Got your second letter while this one was being typed. The points look O.K., except the Miocene looks a little thin. If we had the first 15 feet of cuttings you might change your mind.

You have a fascinating study going and I'd like to work on it sometime. Right now I've got to submit my annual diagram or Joe would have my head if I delayed much longer. I will report, in the text of our report that new information may change the age boundaries of some of the formations, and also the thicknesses. However, the aquifer, will for all practical purposes, remain the same, etc.

Personally I believe there is much less Ocala than we have been accepting. In the area west of the Savannah area we may find the answer. Also north in Jasper and Hampton County. I have what I believe to be the electric log of Well 30, the Kress Well that you reviewed for Georgia in 1946. This would be a good one to redo. It is nearly 1400' deep.

Do you want the new well from the Post Office in Savannah? It is 695' deep.

Layne-Atlantic just deepened Union-Bag 1 to 975' from 650'. It is supposed to be a big secret. They won't give me the cuttings. If you have any pull with Brashears of Liggett and Brashears maybe we can get the cuttings if you want them. Of course, I didn't tell you this!

-Ellis

219 Kelvin Place
Ithaca, N.Y.
March 16, 1959.

Dear Ellis,

Just a note to let you know how things are going here.

Saturday I began serious work on the Daufuskie test, preparatory to locating and picking out the large forams from the "Orbitoid Zone," the same thing as already done for the Hilton Head test hole.

Have gotten down to depth of 215' in the Daufuskie test, so-far. The top of the Cooper Marl (?) Equivalent in this well is at 190', which compares with 180' in the Hilton Head test. The formational tops appear to summarize, down to 215' as follows:

Pliocene - Recent(Undifferentiated)	0 - 86'
Miocene, undifferentiated	86 - 96'
Oligocene, undifferentiated	96 - 215+
" Cooper Marl Equivalent°	190 - 215+

Regarding this white limestone facies, which I have called, Cooper Marl(?) Equivalent, there still seems to be considerable question as to its correct geologic age. The small forams in this facies appear to be Cooper Marl and therefore Oligocene in age. However, there are elements - large forams, such as Operculinoides and Discocyclina - which are Upper Eocene in age. The question here is whether or not these large forams are, or are not, indigenous to this facies. This problem will have to be resolved in the course of my study now being carried on here in Ithaca. I have already informed Professor Cole(also shown him the large forams) of the existence of this problem and he concurs with the conclusion just stated, that this problem of the age of these large forams must be solved once and for all before we can begin to draw definite conclusions concerning the top of the Ocala in Chatham County and adjacent parts of South Carolina. For the time being, therefore, I see no reason against your using the top of this white limestone facies, with the abundant bryozoan remains, as the top of the Ocala in your cross sections, structure contour maps etc. This point was the one I settled on during your recent visit to Atlanta, hence you know what I am talking about here.

Moreover, the disposition of these large forams occurring in what appears to be strata of Oligocene age(Cooper Marl Equivalent) has a direct bearing on the stratigraphic problem in the Savannah River Valley, on my Shell Bluff paper, and all the rest, not the least of which is the true geologic age of the Cooper Marl, itself. If I can prove that these large forams occurring in this facies are indigenous to these sediments then we can regard this facies as Upper Eocene(Ocala) in age, not to mention the fact, that we can then regard the Cooper Marl as also Upper Eocene in age. This down-dip evidence would also prove that my small forams at Shell Bluff are also Upper Eocene in age, as originally stated but disagreed with by P & S Branch in Washington. So, as you can see, more is in this problem than meets the eye. I am beginning to believe that we are now on the trail of some dinamite that will blast a few of the die-hards in Washington right out of their boots. Great stuff, eh?

° May turn out to be, on the basis of the large forams, Upper Eocene in age.

In the meantime I shall keep you informed of results obtained at this end of the line. Have just about made up my mind to come over here and work several nights a week until I get your wells looked-over, so that your work can go forward to completion. My sectioning chores occupy all of the regular week's work, hence anything extra must be done at some other time. My time is really so short here that the most must be made of this opportunity regardless of what it costs, if you see what I mean.

The weather, during the past week end and to-day, has taken on more of a spring look, though it is still quite cold when compared with weather down your way. I am surprised at the way I have become acclimated to this wintry weather, which I had dreaded considerably though I hadn't said much about it in Atlanta. Don't get discouraged about this whole thing because I now think just the opposite is in prospect. These large forams are going to give us the answers we have ~~been~~ so sorely needed all these years. Regards to everyone,

Steve

S. M. Herrick.

am sending a copy to Joe Callahan

File

Additional notes about the cuttings and cores from U.S.G.S. Test Well #3, BFT #604
Beaufuskie Island, Beaufort County, S. C.

1. There are no samples from the surface to 42.5'.
2. The cores or pieces of cores are in cloth sacks. The cable tool cuttings and reamings are in kraft paper envelopes.
3. Note the overlap and duplication in the cored sequences (see enclosed list). The hole was cored to 6", but reamed to 8". Where there was little recovery by coring the reamed cuttings were recovered and represent (I hope) the intervals marked on the envelope. The top of each piece of core is marked with either a number, a "U", or an "X". In some cases I used an arrow on the side of the core pointing to the top, with or without a number on the bottom. The number had meaning only to me, but the location of the number and/or the direction of the arrow is enough to tell up from down. The only reason I marked the top is in the event someone wants to grind a thin section. The markings are generally red pencil or red crayon, but lead pencil was also used.
4. In all cases the cable tool cuttings were collected in cloth sacks. When collected the samples were rather soupy or more like waffle batter. When dry they become quite hard. I did not take the trouble to pulverize each sack, so any solid piece does not represent the natural formation except as noted below.
5. At certain intervals (listed below) I recovered and washed larger pieces of the well cuttings. They generally appear as white flatted, sub-round fragments of spongy limestone or white, sticky clayy, marl (when wet) or white macro-fossil fragments. Opposed to this the recemented cuttings usually break into blocky sub-angular to angular fragments. If there is any concern as to which are natural and which are not, I suggest wetting the questionable fragments. The recemented cutting will collapse, the spongy limestone will not, nor will the marl and certainly not the macro-fossil fragments. Again, the natural pieces appear whiter when wet.

List of sample intervals which include washed fragments:

315 - 320	610 - 615
320 - 325	615 - 620
550 - 555	620 - 625
565 - 572	625 - 630
581 - 587	630 - 635
595 - 601	635 - 640
601 - 605	640 - 645
605 - 610	

Of course, it is possible that there may be natural fragments of hard limestone or marl in the other intervals, however, the intervals noted above are the only intervals where I made a special effort to seperate them.

6. In the zone from 610 to 645 the dried samples were extremely hard to break. This suggests a change of some sort in the cementing characteristics; possibly a clay binder or more clay. Note the change at 645 on the electric log.

File
Test Well #3
BFT-304

Notes on the cutting & cores from U. S. G. S. Test Well #3, BFT 304, Beaufuskie Island, Beaufort County, S. C.

42.5-66	-	Three samples from bottom, middle & top of 8' recovery in 23' sequence.
66 - 86	-	One sample from 3' recovery in 20' sequence.
86 - 106	-	One sample from 3' recovery in 20' sequence.
96 - 106	-	Cutting washed from bottom of hole immediately before coring from 106' to 126'.
126	-	Sample of cuttings washed from 126' - Here 20' of drill stem was added and cored to 146. Assume no recovery from 106 to 126.
132 - 135	-	Hardest drilling so far.
135 - 140	-	Measured cable - 140' OK.
135 - 144	-	Reamed cuttings washed out of hole.
146 - 166	-	One sample from lower part of 2' recovered in 20' sequence.
166 - 186	-	One sample from lower part of 3' recovery in 20' sequence.
166 - 186	-	Pieces of core from upper part of 3' recovery in 20' sequence.
186 - 196	-	Piece of core from middle of 1' recovery in 10' sequence.
270 - 275	-	Cutting represents reamings and may be contaminated.
275 - 286	-	Cutting represents reamings and may be contaminated.
365 - 386	-	One sample from lower part of 2' recovery in 21' sequence.
365 - 386	-	One sample from upper part of 2' recovery in 21' sequence.
386 - 406	-	Piece of core approximately 1' from bottom of 4' recovery in 20' sequence.
386 - 406	-	Paper envelope - Uppermost part of 4' recovery in 20' sequence. May represent 386 - 400'.
506 - 526 (520)	-	Reamed cutting bailed from hole at 520'.
506 - 526 (520 - 525)	-	Reamed cutting bailed from hole.
645 - 650	-	Reaming and bailed samples in 646 - 666 - 20' sequence.

Ellis Donsky
BFT 304

Location: Daufuskie Isl., Beaufort Co., S.C. Well No.: 333 566
Owner: No. 3 USGS Test Hole Elev.: + ~~20'~~ 13
Driller: M. M. Gray Well Drlg. Co.
Drilled: 1958
Logged by: J. H. Herrick *changed to compare with Bull 70*

	Thickness (feet)	Depth (feet)
No Samples	42	42
IN *Miocene* ~~PLIOCENE TO RECENT~~(UNDIFFERENTIATED):		
Sand: fine to medium-grained, subangular grains, sparsely phosphatic, interbedded ~~with scattered stringers of~~ clay; dark-gray to dark-green, somewhat indurated, blocky, silty, micaceous, carbonaceous, fossiliferous, ~~carrying~~ (macro-shells at certain levels)	41	83
~~PLIOCENE~~(UNDIFFERENTIATED):		
Sand: medium-grained, subrounded ~~grains~~, phosphatic	3	86
Clay: yellowish-green, blocky, tough, sandy	10	96
OLIGOCENE(UNDIFFERENTIATED):		
Limestone: light-gray, massive, saccharoidal, very porous°, sandy, sparsely phosphatic, fossiliferous, carrying casts and molds of mega-fossils	10	106
No Samples	11	117
Limestone: cream-colored, nodular, saccharoidal, somewhat soft & powdery at certain horizons, very sandy, sparsely phosphatic, fossiliferous, ~~carrying~~ (casts and molds of mega-fossils, echinoid & bryozoan remains, and some Foraminifera) — Rotalia mexicana var., Pyrgo sp., Quinqueloculina sp., Dictyoconus°° sp. at 117 - 122'.	18	135
Limestone: cream-colored to light-gray, massive, somewhat calcitized & nodular, fossiliferous(as above) — Operculinoides sp. at 135 - 140'.	55	190
UPPER EOCENE:		
JACKSON GROUP:		
CLAIBORNE SERIES:		
Limestone: white, somewhat crystalline & calcitized, fossiliferous, ~~carrying~~ (some macro-shells, abundant bryozoan remains, some Ostracodes, ~~and frequent~~ Foraminifera) — Cypsina globula, Eponides cocoaensis, Eponides jacksonensis, Discorbis aculata, Nonion planatum, Cancris sp., Planularia sp., Siphonina jacksonensis, Globorotalia cocoaensis, Guttulina irregularis, Cibicides americanus, Cibicides	70	260

° Cavities represent former mega-fossils subsequently dissolved by Ground Water.
°° Re-worked(?) Fossil of Eocene age.

GGS 566

	Thickness (feet)	Depth (feet)
mississippiensis at 190 - 196'. Operculinoides floridensis, Discocyclina nassauensis at 196 - 200'. Linqulina sp. at 200 - 205'.		
Limestone: light-gray, rather massive, much calcitized & crystalline, somewhat nodular, fossiliferous(as above)	45	305
Limestone: cream-colored, much calciti ed, gramular, fossiliferous, ~~carrying abundant large~~(Foraminifera at certain levels)	255 ~~395~~	560 ~~700~~
Orthophragmina citrensis at 345 - 350'. Operculinoides cf. vanderstoki common at 426 - 431'. Lepidocyclina sp., Operculinoides sp. at 645 - 650'.		

~~MIDDLE EOCENE(TOP NOT DETERMINED)~~: Lisbon Formation

CLAIBORNE GROUP(~~UNDIFFERENTIATED~~):

Limestone: as above, but more massive and calcitized, somewhat sandy, fossiliferous at certain levels (mega foss., bryozoan remains & foram. 140 - 700

Limestone: white, massive, much calcitized, somewhat granular(in texture), coarsely glauconitic, sparsely fossiliferous, ~~carrying~~(macro-shells at certain levels)	5	705
Marl: yellowish-green, interbedded with scattered, thin tongues of limestone; as above	41	746

SUMMARY:

No Samples	42	42
In ~~Pliocene to Recent~~, Miocene (undifferentiated)	41 54	83 96
~~Miocene, undifferentiated~~	~~79~~	~~175~~ ~~96~~
Oligocene, "	94	190
Upper Eocene(Ocala limestone)	370 ~~510~~	560 ~~700~~
In Middle Eocene, ~~undifferentiated(top not determined)~~ (Lisbon Formation)	46/86	746+

POTENTIAL WATER-BEARING ZONES:

Limestone	395	530

REMARKS:

The interval, 530 - 700', may represent Late Middle Eocene, i.e. Gosport Equivalent. Accordingly, at 645 - 650 feet a species of Lepidocyclina was identified as possibly Lepid. ariana, a Middle Eocene Lepidocyclina. However, more specimens are needed before a definite ~~specific~~ specific identification of this species may be made.

File

S. M. Herrick; Ithaca, N. Y. March 19, 1959

E. Donsky; Savannah, Ga.

Stratigraphy in the Savannah Area

Someone once told me that paleontologists couldn't be trusted! I was just putting the finishing touches on my masterpiece when I received your latest log.

If you promise not to change Test Well #2 again I'll promise to get you bigger and better well cuttings. Of course, this is the dilemma that I place myself in since the more wells we log the greater the possibility of changes and refinement in the stratigraphy.

Harlan and I looked over the new log and we broke out all our electric logs. If you now believe that the Hilton Head well is reliable, I can go ahead and revise my fence diagram and send it to Joe the end of this week. We believe we can now correlate the electric logs across Chatham County and also from Parris Island #2 to Jelks-Roger #1 in Liberty County.

However, I want to make the following observations and ask a few questions:

1. You now have the top of the Cooper Marl in the Oligocene about 180' - 185', but your previous log has Oligocene up to 135'. I assume the Cooper will be basal Oligocene. What age do you suspect the material to be from 135 - 185'? According to MacNeil (P.P. 243-B, 1952, p. 28, list of fossils) some of the formams that you've listed at 140' - 144' are also Cooper!

   I have an old old log where you've picked Suwanee from 138' - 152'. This zone was also reported in the interim report by you and Bob (1955) although you did not call it Suwanee. Maybe we best call the upper Oligocene, the Miocene, Pliocene, and Recent "undifferentiated" until we know more about it.

2. Have you reviewed the Parris Island #2 well? I have very little in the way of a good log. I have a brief paleo-log down to 550 and the summaries by you, an oil company geologist, and E. R. Applin. I do have your latest pick for the Castle Hayne at 510'. I'll run that into the top of the Gosport at 545' in the Hilton Head Test Well. How about the Lisbon and Tallahatta? I have Claiborne from 605 to 1070 in P.I. #2 and a memo from you indicating possible Tallahatta from 1014' to 1070' based on Cibicides blanpeidi. Is this still O.K.? I've made a summary of the wells and listed to depth to the formation, group, or series bottoms that I'm going to use.

   Again, Harlan and I have picked depths on all our electric logs based on the new Hilton Head revision. We think we can trace points on the electric log pretty well all over the place. We've made a few assumptions:

File

a. The regional dip in the Savannah area is roughly SSW.
b. The strike is nearly east-west, so that the bottom of the limestone, (again, based on our observations of electric logs) and some of the other formations are fairly level in eastwest sections.
c. This also anticipates your remark that the wells back from the coast may not need drastic changes as those near the coast.

I'm behind in my report and it is overdue, so I've simply got to call a halt somewhere.

The fact that the principal artesian aquifer may be composed of 4 or 5 limestones of various age is not really important. Our main purpose is to delineate the aquifer geographically and this we think we've done based on well cuttings, permeability test, pumping test and quality analyses. There may be other conditions that will come to light when we have more chemical analyses of wells over a longer period of time. It is possible that we can expect or observe certain kinds of water in specific formations, but this will have to wait until the limits of each formation is more accurately determined.

I've sent a copy of a radiation log of the Hilton Head Test Well. I don't know if you've ever seen it. Note the change around 290 and 550, looks like your 290 to 545 for the Ocala. Apparently, the glauconitic zones are highly (relatively) radioactive. However, the glauconitic limestone may not be limited to one age. If you have the time would you look again and see just where the Gosport (545-730') became glauconitic. The radioactivity log indicates another change at about 650'. Is this the "coarsely glauconitic at depth" that you refer to on the log? Radioactivity logging may be another tool that we can use in the Savannah area, or elsewhere in the Coastal Plain. Please return the radiation log when you're finished with it.

Ellis