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Preliminary Correlation of the Paleozoic Rocks from test wells in Florida and adjacent parts of Georgia and Alabama

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The following conclusions are based on preliminary studies of the cores, cuttings and fossils recovered from 52 test wells drilled in central and northern Florida and adjacent parts of Georgia and Alabama. Detailed faunal lists are omitted, partly because the studies of the faunas are as yet incomplete, and partly because most of the fossils are types that are more readily correlated with faunas found in South America and Europe than with known faunas elsewhere in the United States. It is believed that the correlations postulated here are essentially correct, but they are preliminary and may be modified slightly in the light of more detailed studies. At the present time these studies indicate:

1. The presence of early Paleozoic rocks beneath central and northern Florida and adjacent portions of Georgia and Alabama that include strata ranging from early Ordovician (late Beekmantown) to Early or possibly Middle Devonian age. The distribution of these rocks is shown on the accompanying map, and the tentative correlations between wells are summarized in Table 1.

2. The total thickness of these rocks has not been accurately determined; if the tentative correlations given here are anywhere near correct, it is certainly not less than 3000 to 3500 feet (the total thickness of the sections cut in the 15 wells from which fossils have been recovered), and, if the correlation between these wells and certain others is correct, the thickness of the Paleozoic section is more probably around 6000 feet, or even more. (see Table 1)

3. The Paleozoic strata are entirely clastic, and appear to have been deposited in shallow water. They consist principally of quartzitic sandstones, sandstones, gray to black noncalcareous micaceous shales, and gray to black noncalcareous nonmicaceous shales. Red sandstones and red and gray shales are found at a few localities.

4. The quartzites, sandstones and micaceous black shales are most abundant in the older part of the section, (Lower Ordovician), black and gray non- or finely micaceous shales predominate in the upper part, with the exception of what are here regarded as the youngest beds. These are composed of red and gray sandstones and shales that are of either fresh-water or terrestrial origin.

5. The Paleozoic strata are essentially flat-lying. The dips observed in most of the cores are less than 10°, in most examples less than 5°. An exception occurs in the Tindel well(#53), where the cores indicate dips up to 30°. However these sediments are believed to be of terrestrial origin (they contain plant fragments), and these steep dips may be due to cross-bedding.

6. The strata are practically unmetamorphosed. This is indicated by the absence of deformation of the fossils, and by the absence of metamorphic structures in the rocks themselves.

7. The source of the sediments is not known. They lie east of the prolongation of the Blue Ridge axis, and bear little resemblance to strata of equivalent age in the Appalachian Valley. They do however bear a strong lithologic resemblance to some of the more highly metamorphosed Paleozoic rocks of the Piedmont province farther north, e.g., the slates at Arvonia and Quantico, Va.

They are quite different from the limestones found farther north in the Piedmont region; i.e., the Frederick and York-Hanover valleys in Maryland and Pennsylvania. In this connection it should be noted that the limestones found in these valleys are of late Cambrian and early Ordovician age and are older than any of the rocks thus far identified from the Florida wells. However it would be unsafe to predict that limestone might be found in Florida if the wells were drilled deeper, for the Frederick and York-Hanover valleys lie in a structural trough close to the Blue Ridge Axis while the Florida area lies much farther east of the axis and in a different structural trough. Furthermore the general nature of the sediments thus far encountered in the Florida area suggests that the occurrence of limestone is most unlikely.

8. Fossils have been found in cuttings and cores from 17 wells (see map), and the age determinations given here are based on these fossils. Only a single faunal zone has been found in each well, hence the order of superposition cannot be definitely established and in some cases is doubtful (see table). The same fauna has been found in two or more wells, in a few instances, thus enabling some very definite correlations to be made between certain widely separated wells. (#42 Cone - #59 Ragland, and #30 Kirkland - #60 Robinson).

Evidence of former life in the form of vertical worm borings has been found in at least 15 wells, and the strata containing them are believed to belong to a single stratigraphic unit which is at least 2000' thick. This correlation is strengthened by the finding of identical fossils associated with the worm borings in at least three wells (#30, Kirkland, #60, Robinson, and #49, Langston), and by the similarity of the lithology of the rocks containing the worm borings in most of the wells in which these borings occur. (See table and note 4).

9. The area underlain by these rocks is roughly triangular in shape, with sides approximately 250 miles long. It is bounded on the northern and southeastern sides by areas underlain by crystalline and volcanic rocks of various types and various degrees of metamorphism. (Applin, U. S. G. S. Circular 91, in press). These are believed to be older than the Paleozoic rocks, and in one well (#23 - H.N.Camp #1) conglomeratic and arkosic sandstone directly overlies metamorphosed igneous rocks.

The western boundary of this triangle lies somewhere off the west coast of Florida in the Gulf of Mexico, and is purely hypothetical. Along this side of the block, sedimentary rocks of Triassic (?) age appear to wedge in locally between the Paleozoic and younger rocks (see map).

10. The apparent triangular shape of the block of Paleozoic rocks is probably an over simplification due to lack of detailed information, for at least two of the lines bounding such a block are at variance with the general trends of Piedmont structure as shown on the Tectonic map of the United States, and with the trend of anomalies on geophysical maps that have been available to us.

The southeastern boundary is fixed within rather narrow limits by the positions of at least 10 wells that are distributed at fairly regular intervals along both sides of the entire line and that penetrated either Paleozoic or crystalline rocks; in one instance both. Moreover the general northeasterly trend of this boundary compares favorably with the regional structural trends in the Piedmont area to the north and northwest, and also with the trends of the geophysical anomalies in Florida. It is therefore regarded as a major structural boundary, probably a fault of considerable displacement. The interpretation based on the presence of a fault is preferred to that of a fold along this line because of the great thickness of some of the Paleozoic rocks penetrated in some wells lying close to this boundary (over 700 feet in the Hernasco well and over 2100 feet in the Foremost Properties well). It is thought that the contact between the Paleozoic rocks and the igneous rocks in the Camp well (#23) is unconformable, and that the fault passes close to the site of the well but not through it.

The northeastern boundary is much less definitely established and is drawn on the basis of some six or seven wells that are arranged in small groups and separated by much wider areas in which no information is available. Furthermore, although this boundary coincides with a minor cross-structure shown on some geophysical maps and with a major thickening of the overlying Mesozoic sediments, it cuts directly across the major tectonic lines and the trends of the major geophysical anomalies. For these reasons it is believed that this boundary is not a natural one, but merely one of convenience, and that it will be drastically modified if and when additional information becomes available.

As noted earlier, the southwestern boundary is an arbitrary line with nothing in the way of well records, tectonic or geophysical evidence to support it.

It is quite possible that the wedge of Paleozoic rocks as here recognized is actually a series of subparallel belts, each with a general northeast trend, and each separated from its neighbors by faults. The distribution of Paleozoic rocks of different ages within the area cannot be easily explained without postulating a certain amount of folding or faulting within the block.

For reasons already given, it is believed that folding has been of only minor importance, and that the problem is best solved by assuming the presence of a number of high angle faults, each more or less parallel to the southeastern boundary, that divide the area into a series of subparallel belts. Some of the faults originally drawn to explain stratigraphic relations were later found to coincide reasonably well with the trends of geophysical anomalies. They are not shown on the present map, pending a more detailed study of the stratigraphic and geophysical data.

The three westernmost wells (Chandler, Kirkland, and Tindel) are separated from the larger group of wells by a broad area in which definite information concerning the presence of Paleozoic rocks directly beneath Cretaceous rocks is not available. Wells along the eastern edge of this area have encountered early Mesozoic sedimentary rocks above the Paleozoic, and it is probable that a wedge of early Mesozoic rocks lies between the Paleozoic and Cretaceous rocks in this belt, thus separating the small western area from the larger area farther east. However the two are closely related to each other lithologically, faunally and structurally and evidently are a part of the same depositional series, although the western area may be, and probably is, a part of another structural block.

11. The age of the faulting appears to be post-Middle (?) Devonian - pre-Lower Cretaceous.

12. Igneous intrusions cutting the Paleozoic sedimentary rocks also fall within the same age limits. Because of their similarity to known Triassic intrusive rocks elsewhere in eastern North America, they are provisionally classed as late Triassic or early Jurassic. (Applin, Paul L., Circular 91, U. S. G. S. 1951)

Table 1

Tentative correlation of the Paleozoic Rocks of Florida - J. Bridge, J. M. Berdan, May 1950

Not for publication - subject to revision

Period or Series	Determined by fossils in the well listed	Wells correlated with this by fossils	Maximum thickness penetrated	Wells correlated with those in Cols. 2 and 3 on the basis of similar lithology.
Middle Devonian	C.W.Tindel #1	(none)	803' (Tindel)	(none)
Late Silurian (Upper) or Lower Devonian (?)*	J.P.Cone #1	J.B. & J.T. Ragland #1 M.W.Sapp #1A(?)	906' (Cone)	(none)
	J.H.Tillis #1 **	Hilliard Turp. Corp. #1 Kie Vining #1(?)	168' (Hilliard)	(none)
Silurian or Upper Ordovician	A.C.Chandler #1	(none)	539' ± (Chandler)	(none)
Middle and/or Upper Ordovician	Superior Pine Products #1	(none)	100' (SPP-1)	(none)
Middle Ordovician, (Black River)	Gibson #2	S.P.P. #3(?) S.P.P. #4(?) Earl Odom #1(?)	753' (Gibson 2)	(none)
Lower Ordovician (Upper Beekmantown)	E.P.Kirkland #1	C.E.Robinson #1 Hazel Langston #1 Alice Musgrove #1 (?)	554' (Kirkland) 2250' (Perpetual Forest ?)	Superior Pine Products #2, Ruth M. Bishop #1, H.L.Hunt #1, P.C.Crapps #1, P.C.Crapps (A)#1, Ronald Sapp #1, Perpetual Forest #1, Alto Adams #1, Williams Bros., #1, R.H. Cato #1, Josie Parker #1, H.T.Parker #1, J.A.Pfifer #1, M.F.Wiggins #1, Foremost Properties #1, Q.I.Roberts #1, H.N.Camp #1, Clark-Ray-Johnson #1, J.T.Goethe #1, Hernasco Corp. #1, W.L.Lawson #1 (?), National Turpentine Corp. #1.
unplaced (If Paleozoic probably Lower Ord.***)	(none)	(none)		W.J.Barlow #1, W.F.Johnson #1, A.B.Russell #1, R.L. Henderson #1, Brooks-Scanlon Blk. 49 #1, Brooks-Scanlon Blk. 37 #1A, E.P.Larsh #1.

NOTES: -

*Period assignments are given in order of probability - the most probable assignment is listed first.

**The relation of the strata in the Cone well to those in the Tillis is uncertain, the latter may be younger than the former, or may represent a shallow, brackish water phase of it.

***The quartzites encountered in the bottoms of some of these wells may be boulders of Paleozoic material contained in a basal conglomerate of Mesozoic age.

Supplementary notes to accompany map

1. No. 51 (Williams Bros.) is in red micaceous shale with traces of worm tubes rather than in gray micaceous shale and quartzite as indicated on the legend. However, it is believed that this red shale may represent a weathered phase of the gray shale and the rock in this well is therefore correlated with the other worm-bored shales. No. 78 (Superior Pine Products No. 4) is also in red micaceous shale and is correlated with other wells cutting Middle Ordovician rocks on the basis of linguloid brachiopods. These wells penetrated 18 and 5 feet of red shale respectively. The bottom core of the Williams Bros. well ended in grayish shale and it is probable that Superior Pine Products No. 4 would also have entered gray shale if it had been drilled deeper into the Paleozoic.

2. No's. 43 (Ruth M. Bishop) and 63 (Gibson No. 4) are in black quartzitic sandstone with worm borings, but are here correlated with the gray quartzitic sandstone and micaceous shale on the basis of the worm borings.

3. Quartzites in No. 56 (Brooks-Scanlon Blk. 49), No. 70 (A. B. Russell) and 101 (Brooks-Scanlon Blk. 37) may be pebbles or boulders of early Paleozoic rock incorporated in Cretaceous or early Mesozoic conglomerates, or may be a Paleozoic formation. There is no information either way, as the maximum penetration of the quartzite in these wells is three feet (in the Russell well). No. 57 (R. L. Henderson) penetrated a boulder zone containing red and yellow quartzite pebbles similar to the quartzites in the wells listed above, and ended in hard white to gray unfossiliferous quartzite of uncertain age. This quartzite is probably early Paleozoic but may possibly be a basal quartzite of Mesozoic age. Other wells which penetrated a similar quartzite are No. 44 (W. F. Johnson), No. 100 (W. J. Barlow), and No. 54 (E. P. Larsh). The latter went through Triassic (?) sedimentary rocks and ended in a white quartzitic sandstone of uncertain age.

4. The reasons for considering the white non-fossiliferous sandstone in wells No. 23 (Camp), 38 (Pfifer), 52 (Hernasco), 68 (Q. I. Roberts) and 103 (National Turpentine) as Paleozoic are: 1) The presence of a white quartzitic sandstone below fossiliferous Paleozoic black shales in cuttings in No. 73 (Chandler), and 2) the presence of a white sandstone overlying hard gray quartzitic sandstone with worm-borings in wells No. 41 (Foremost Properties) and 66 (H. T. Parker). In the Foremost well these non-worm-bored white sandstones range through a vertical interval of at least 1000 feet, but the entire interval was not cored therefore worm-bored zones may have been present. Where samples are represented by cuttings, as in No. 52 (Hernasco) it is impossible to determine the presence or absence of

worm-borings. The above occurrences suggest the presence of a white sandstone unit in stratigraphic sequence between the black shales and the gray quartzitic worm-bored sandstones and micaceous shales of the Robinson and other wells. It may be that the sandstones in the wells listed above (23, 38, 52, 68 and 103) belong in this interval. This cannot be definitely proven, since no Paleozoic sedimentary rocks were found above these sandstones in these wells, and because penetration was not sufficient to prove the existence of worm-bored sandstones beneath them.

In the wells listed in paragraph 3 (notes), a white to gray quartzite or quartzitic sandstone was encountered directly below the Mesozoic sedimentary rocks, but, as it was not penetrated and as it is more highly cemented than the other sandstones, its position is uncertain.

5. No. 73 (Chandler) passed through approximately 539 feet[1] of black shale and ended in white quartzitic sandstone similar to less well-cemented white sandstone in No. 38 (Pfifer), 68 (Q. I. Roberts) and 41 (Foremost Properties). The fossils recovered from the two intervals cored in the Paleozoic are considered by Swartz (Jour. Paleo., vol. 23, no. 3, p. 320, 1949) to be early Silurian or Upper Ordovician in age. The lowest core is over 200 feet above the kick on the Schlumberger log believed to represent the white sandstone. There is a possibility, therefore, that Middle Ordovician faunas may occur in this interval but were not recognizable in the cuttings.

6. Some wells in white sandstone, such as No. 66 (H. T. Parker) and No. 41 (Foremost Properties), have thin local beds of red sandstone and anhydrite. This is not the same as the red and brown sandstone in No. 53 (Tindel).

7. The sandstone in No. 23 (Camp) is arkosic and conglomeratic, especially near the base of that unit. This suggests derivation from a nearby crystalline source. Faint indications of worm borings suggest correlation with the other wells containing worm-bored sandstone.

8. Rocks in well No. 74 (Bennett and Langsdale) are here tentatively correlated with the micaceous shale and quartzitic sandstone series although it is much less micaceous and the worm tubes are parallel to the bedding rather than perpendicular to it. This correlation is uncertain, but is the best possible at present.

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[1] Cuttings badly contaminated and the thickness of the shale has been variously estimated by different geologists. Figure given here is based on our examination of the cuttings.

9. The position of the fauna in wells No. 42 (Cone), 46 (M. W. Sapp 1-A), and 59 (Ragland) relative to that of the fauna in wells No. 67 (Hilliard), 71 (Tillis), and 102 (Kie Vining) is not yet established. The placing of the fauna from well No. 42 (Cone) above the fauna from well No. 67 (Tillis) is based entirely on the general aspect of the faunas and not on precise correlations or stratigraphic superposition. It is therefore subject to change.

10. Well No. 46 (M. W. Sapp 1-A) penetrated only eight feet into black shale which is here correlated with the shale in No. 42 (Cone) on the basis of similar lithology, and occurrence of similar plant spores.