M. D. Allison
CONSULTING GEOLOGIST
CPG 3190

BUS: (817) 665-3090
RES: (817) 665-1050

HERITAGE PLAZA
715 E. CALIFORNIA
P.O. BOX 256
GAINESVILLE, TEXAS 76240

October 17, 1987

COMPANY:	Standard Oil Production Co.
WELL:	Weyerhaeuser # 1-22
LOCATION:	800' FNL & 2300' FEL of section 22, T5S, R24E, McCurtain County Oklahoma. Approximately 6.5 miles northwest of Broken Bow
ELEVATION:	G.L. 625, D.F. 656, K.B. 658
TOTAL DEPTH:	18,987'
COMMENCED	4-9-87
COMPLETED:	7-29-87
STATUS:	D & A
NOTE:	Geosearch Logging Inc., P.O. Box 3697, Edmond, Oklahoma 73083 provided a mud logging trailer and evaluated the well from surface to T.D.
DRILLING CONTRACTOR:	Noble Drilling Rig #T-133

GEOLOGIC EVALUATION: Surface to T.D.

SHOWS OF OIL: None, other than gas on mud logging instrument.

LOGS RUN:

100-3000'	Dual Induction, Litho-Density/Neutron/ NGT, Sonic Waveforms, Dipmeter.
3000-13,400'	Sonic.
8300-14,300'	Dipmeter.
3000-17,086'	Dual Induction, Litho-Density/Neutron/ NGT, Sonic, Dipmeter.
16,800-18,987'	Dual Induction, Litho-Density/Neutron.

CORE INTERVALS:

CORE #1 12,137-49' Recovered 9' of sandy micaceous meta-dolomite with numerous stylolites.

CORE #2 12,149-209' Recovered 60' consisting of 34' of sandy micaceous marble cut by numerous stylolites and 26' of sandy micaceous meta-dolomite cut by numerous stylolites.

CORE #3 14,252-301' Recovered 49' of slightly sandy and micaceous meta-dolomite cut by numerous fractures and stylolites.

CORE #4 17,089-106' Recovered 17' of graphitic sandy micaceous meta-dolomite and sandy graphitic dolomitic phyllite.

DRILL STEM TEST:

Test Interval: 13,756-14,250'

Test String, Bottom to Top: 5 drill collars, DST test assembly, 9 collars, 5" drill pipe to surface. Pipe filled with 3600' water cushion.

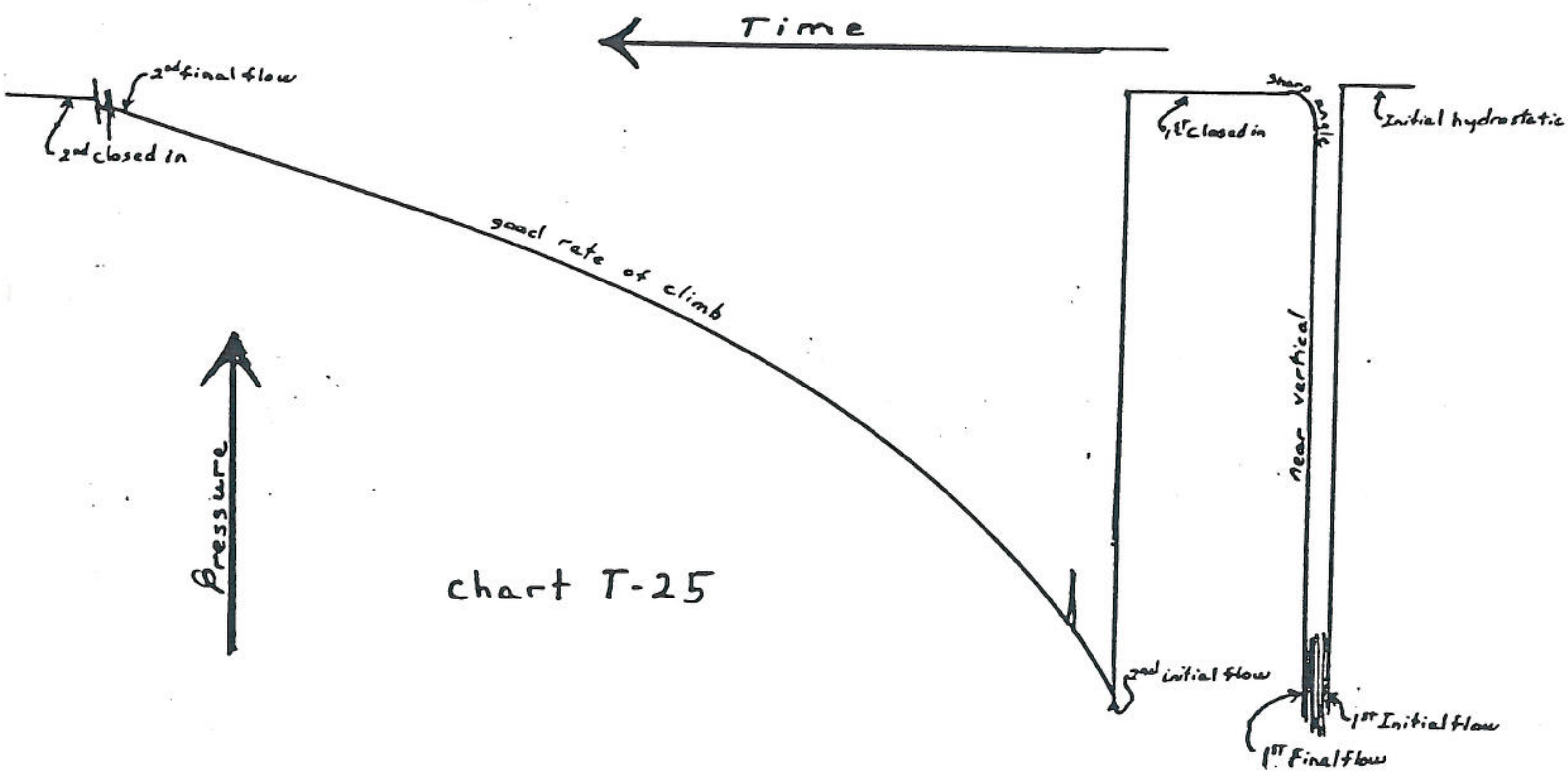
Flow Period: 5 minutes open, 1 hour closed, 5 hours 25 minutes open, 1 hour closed.

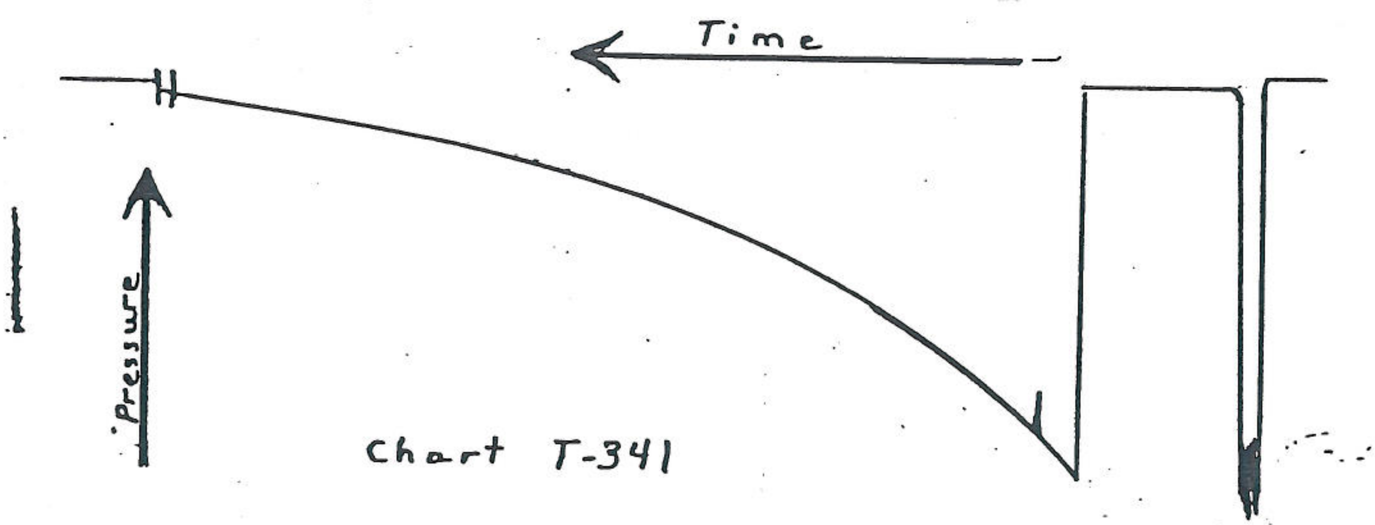
<u>Recovery:</u> 13,331' total fluid - 3600' water cushion and 9731' of heavily gas cut salt water. In this fluid was also 1 bbl ammonia and 60 gal diesel.

<u>Pressure Charts:</u>

<u>Upper chart:</u> Depth 13,723', Temp. 212, IHyMP 6203, 1st IF 1922, 1st FF 1922, 1st CI 6179, 2nd IF 1922, 2nd FF 6049, 2nd CI 6179, FHyMP 6203.
<u>Middle chart:</u> Depth 13,729', Temp. 212, IHyMP 6198, 1st IF 1919, 1st FF 1919, 1st CI 6115, 2nd IF 1919, 2nd FF 6046,2nd CI 6173, FHyMP 6198.
<u>Lower chart:</u> Depth 13,766', Temp. 212, IHyMP 6322, 1st IF 1924, 1st FF 1924, 1st CI 6230, 2nd IF 1924, 2nd FF 6047, 2nd CI 6175, FHyMP 6322.

REPRESENTATIVE EXAMPLES OF TWO OF THE THREE PRESSURE GRAPHS
DST #1





FORMATION TOPS:

	Depth	Datum
Ordovician Crystal Mountain Sand	0	658'
Cambrian Collier Shale	176'	482'
Ordovician Womble fm.	5150'	-4492'
Cambrian(?) Arbuckle Group	11,750'	-11,092'
Ordovician Womble fm.	12,870'	-12,212'
Ordovician Arbuckle Group		
West Spring Creek(?)	13,396'	-12,738'
Kindblade(?)	13,700'	-13,042'
Cool Creek(?)	14,332	-13,674'
Cambrian(?) Arbuckle	15,040'	-14,382'
T.D.	18,987'	-18,329'

GENERAL STATEMENT:

Between April 9, and July 29, 1987, Standard Oil Production Company, formerly Sohio, drilled the Weyerhaeuser # 1-22, section 22, T5S, R24E, McCurtain County, Oklahoma. This well was drilled along the crest of the Benton-Broken Bow uplift, which is the core of the Ouachita Mountains in Southeastern Oklahoma. This well was drilled to a total depth of 18,987', encountered no commercial quantities of hydrocarbons, and was plugged and abandoned.

As is commonly understood, the Ouachita Mountains are the remnants of a late Paleozoic thrust sheet complex. The Ouachita facies sediments, upper Cambrian to Pennsylvanian, were deposited in a basin to the south, which during late Mississippian to early Permian time was closed and the deposited sediments were shoved out of the basin to the north as a complex series of thrust sheets. The thrusted Ouachita facies sediments overrode a foreland facies of shelf deposits.

The Weyerhaeuser # 1-22 was spudded in the Ordovician Crystal Mountain Sandstone and at approximately 176' drilled into the Cambrian Collier formation. A Cambrian Collier or pre-Collier section was recognized between 176' and 5,150'. At 5,150' a thrust within the Ouachita facies complex was encountered and the Ordovician Womble formation was penetrated. The Womble formation was observed from 5150-11,750', at which point the main thrust between the Ouachita facies thrust complex and the overridden foreland facies was encountered.

At 11,750' the foreland facies was determined to be a Cambrian(?) Arbuckle section. The Cambrian(?) Arbuckle was found to be from 11,750-12,870', at which point a basement fault was crossed and the lower portion of the Ordovician Womble was repeated. This repeated Womble section was recognized from 12,870-13,396', at which point the main Ouachita facies to foreland facies thrust was repeated and an Ordovician Arbuckle section was found.

Below this thrust the Arbuckle is believed to be West Spring Creek(?), Kindblade(?) and Cool Creek(?), followed by Cambrian(?) Arbuckle. The Cambrian(?) Arbuckle is located between 15,040' and T.D. at 18,987'. The Cambrian rhyolite flows or Precambrian granites recognized in the Arbuckle Mountains of Southcentral Oklahoma were not encountered.

All rocks encountered in this well are considered to be green-schist facies metamorphics representative of low to moderate temperature and high directed pressures. This is true for both the Ouachita facies and foreland facies sediments. Considerable recrystallization was recognized. All rocks encountered were originally carbonaceous shales, impure sandstones, limestones and dolomites which have been altered to graphitic phyllite and schist, schistose quartzites, marbles and meta-dolomite.

Due to the metamorphic forces which acted on these rocks, all original porosity was destroyed and any hydrocarbon present prior to thrusting and metamorphism was also nearly completely destroyed. In contrast to this dismal picture, a very good reservoir does currently exist in this location. Apparently, a post metamorphic tectonic event has extensively fractured these rocks. Add to this the propensity for stylolite development within the Arbuckle Group and a very good reservoir of fracture and stylolite porosity has been created. As was seen during the DST of the Kindblade(?) section at 13,756-14,250' a flowing pressure of 1922 psi increasing to 6049 psi was observed. A total of 13,331' of fluid was recovered, liking only approximately 400' of flowing to surface. This Arbuckle section is therefore, even though it has undergone extensive metamorphic alteration, still a very good reservoir.

If a source can be found which is in juxtaposition to the Arbuckle, one can very confidently expect that a usable reservoir should exist. In the location of the Weyerhaeuser # 1-22 this is not expected, but due to the great thickness and regional extent of the Arbuckle Group, if one could move closer to the leading edge of the thrust sheet where less metamorphism has been recognized a greater chance of success should exist.

THIN SECTION EVALUATION:

TS-1	90-100'	Dense limestone and igneous intrusive; possibly diabase sill.
TS-2	160-70'	Fine grained very siliceous quartzite and dolomitic quartzite. Trace pyrite.
TS-3	180-90'	Fine to medium crystalline very sandy marble. Sand consist of fine to medium angular quartz grains. Trace pyrite.
TS-4	250-60'	Fine grained sandy marble. Sand grains are primarily fine angular grains. Trace calcareous quartzite.
TS-5	350-60'	Fine grained very siliceous quartzite, dolomitic quartzite and graphitic phyllite with chalcedony fracture filling. Trace coarse crystalline sandy marble.
TS-6	400-10'	Fine crystalline sandy marble, slightly sandy dolomitic marble and very fine to fine grained angular quartzite.
TS-7	480-90'	Fine grained quartz in very siliceous quartzite and slightly calcareous sandy fine grained meta-dolomite.
TS-8	560-70'	Fine grained quartz in fine crystalline marble.
TS-9	650-60'	Finely siliceous graphitic micaceous phyllite and sandy fine crystalline meta-dolomite.
TS-10	780-90'	Sandy fine grained marble and poorly sorted very fine to fine grained calcareous slightly argillaceous quartzites.
TS-11	800-10'	Very argillaceous slightly calcareous and micaceous quartzite and sandy dolomitic marble.
TS-12	960-70'	Argillaceous calcareous poorly sorted quartzite.
TS-13	1,130-40'	Thin quartzite partings in micaceous graphitic phyllite.

TS-14	1,400-10'	Very fine grained quartzite and coarse quartz containing chlorite crystals.
TS-15	1,520-30'	Very fine grained slightly dolomitic quartzite and graphitic siliceous phyllite.
TS-16	1,820-30'	Fine grained well sorted slightly calcareous quartzite and graphitic phyllite.
TS-17	1,860-70'	Very fine grained quartzite and dolomitic slightly calcareous quartzite.
TS-18	1,960-70'	Calcareous dolomitic quartzite.
TS-19	2,020-30'	Same as TS-18.
TS-20	2,060-70'	Fine to medium grained quartzite.
TS-21	2,090-00'	Argillaceous calcareous dolomitic quartzite, coarse grained quartz with fine crystalline chlorite, and black graphitic fractured phyllite.
TS-22	2,200-10'	Calcareous dolomitic very fine grained quartzite and siliceous phyllite.
TS-23	2,310-20	Very fine grain sand in aphanitic to very fine grained meta-dolomite, graphitic phyllite, and calcareous dolomitic quartzite.
TS-24	2,400-10'	Very fine grained sand in very sandy marble.
TS-25	2,410-20'	Sandy slightly calcareous fine grained meta-dolomite.
TS-26	2,440-50'	Very fine angular slightly calcareous quartzite, sandy marble and siliceous phyllite.
TS-27	2,530-40'	Sandy calcareous meta-dolomite, sandy dolomitic marble, Micaceous marble and calcareous dolomitic quartzite.
TS-28	2,630-40'	Very fine grained calcareous dolomitic quartzite, and sandy marble.
TS-29	2,720-30'	Calcareous dolomitic slightly micaceous quartzite, fine crystalline slightly sandy marble.

TS-30	2,770-80'	Very fine grained quartzite and siliceous phyllite.
TS-31	2,830-40'	Bimodal very fine and coarse quartz grain calcareous quartzite, calcareous dolomitic fine grained quartzite and interbedded phyllite and quartzite.
TS-32	2,880-90'	Calcareous phyllite, sandy marble and calcareous sandy meta-dolomite.
TS-33	2,920-30'	Sandy fine crystalline marble and calcareous sandy meta-dolomite with thin quartzite partings.
TS-34	3,030-40'	Argillaceous fine grained quartzite and foliated graphitic phyllite and mica quartz schist.
TS-35	3,210-20'	Fine grained well sorted argillaceous quartzite and graphitic phyllite.
TS-36	3,330-40'	Graphitic micaceous phyllite with thin quartzite partings, fine grained dolomitic quartzite, and very fine to aphanitic slightly sandy meta-dolomite.
TS-37	3,520-30'	Dolomitic calcareous slightly micaceous quartzite and black graphitic phyllite.
TS-38	3,590-00'	Argillaceous calcareous quartzite, bimodal very fine and medium grained quartzite. Coarse quartz containing fine crystalline chlorite.
TS-39	3,610-20'	Bimodal to poorly sorted calcareous quartzite, medium quartz in medium crystalline marble.
TS-40	3,770-80'	Same as TS-39.
TS-41	3,890-00'	Very fine and medium bimodal calcareous dolomitic quartzite.
TS-42	3,980-90'	Very fine grained calcareous quartzite.
TS-43	4,160-70'	Calcareous quartzite and fractured graphitic phyllite. Fracture lined by chalcedony and center of crystalline calcite.

TS-44	4,200-10'	Very argillaceous micaceous quartzite and siliceous micaceous graphitic phyllite.
TS-45	4,270-80'	Micaceous dolomitic calcareous quartzite.
TS-46	4,320-30'	Sandy micaceous graphite marble and argillaceous micaceous poorly sorted quartzite.
TS-47	4,410-20'	Same as TS-46.
TS-48	4,490-00'	Sandy marble and sandy graphitic phyllite.
TS-49	4,520-30'	Argillaceous very sandy marble exhibiting stress lineation.
TS-50	4,580-90'	Argillaceous slightly micaceous very sandy marble containing very thin quartzite partings.
TS-51	4,650-60'	Sandy marble, argillaceous calcareous quartzite and sandy micaceous phyllite.
TS-52	4,700-10'	Argillaceous calcareous quartzite.
TS-53	4,850-60'	Micaceous quartzite with distinct stress lineation. Very fine to medium very poorly sorted pyrite calcareous quartzite. Trace amounts of albite.
TS-54	4,890-00'	Calcareous dolomitic quartzite, sandy micaceous graphitic phyllite, calcareous chert, and sandy medium crystalline marble. Stylolite.
TS-55	4,980-90'	Calcareous micaceous fine grained quartzite and sandy micaceous phyllite.
TS-56	5,050-60'	Calcareous very micaceous quartzite and graphitic quartzite and sandy micaceous graphitic phyllite.
TS-57	5,180-90'	Very argillaceous micaceous quartzite, micaceous chlorite schist, and chlorite sand crystals in quartz. Stylolite.
TS-58	5,260-70'	Angular poorly sorted micaceous quartzite. Pyrite.

TS-59	5,290-00'	Very sandy micaceous phyllite and very siliceous micaceous quartzite.
TS-60	5,330-40'	Very siliceous poorly sorted angular quartzite. Quartzite distinctly bimodal.
TS-61	5,430-40'	Pyrite rich sandy micaceous phyllite, distinctly bimodal poorly sorted finely micaceous graphitic quartzite.
TS-62	5,480-90'	Calcareous poorly sorted micaceous quartzite.
TS-63	5,550-60'	Sandy very micaceous marble(?), sandy graphitic phyllite, calcareous micaceous quartzite, and chlorite quartz quartzite.
TS-64	5,630-40'	Very fine to fine poorly sorted quartzite and bimodal quartzite. Chlorite crystals in quartz and trace albite.
TS-65	5,790-00'	Fine grained quartz in chert.
TS-66	6,070-80'	Very siliceous quartzite and slightly sandy chert.
TS-67	6,150-60'	Poorly sorted micaceous quartzite and chert. Trace very fine grained chlorite.
TS-68	6,280-90'	Very poorly sorted slightly calcareous micaceous quartzite and bimodal quartzite. Trace albite. Chert and graphitic phyllite.
TS-69	6,330-40'	Poorly sorted micaceous quartzite and micaceous siliceous phyllite.
TS-70	6,540-50'	Very poorly sorted micaceous quartzite and sandy mica schist. Trace pyrite.
TS-71	6,680-90'	Same as TS-70.
TS-72	6,840-50'	Very poorly sorted micaceous quartzite, sandy mica schist, and chlorite quartzite.
TS-73	6,950-60'	Quartzite as above and pyritic siliceous phyllite.

TS-74	6,990-00'	Quartzite and poorly sorted slightly bimodal calcareous micaceous pyritic quartzite, and micaceous phyllite.
TS-75	7,100-10'	Very chloritic coarse quartz grains, chloritic sand, and quartzite.
TS-76	7,300-10'	Bimodal poorly sorted quartzite.
TS-77	7,420-30'	Bimodal quartzite.
TS-78	7,640-50'	Poorly sorted very pyritic quartzite.
TS-79	7,660-70'	Fine to very fine grained quartzite. Trace coarse quartz with chlorite crystals.
TS-80	7,700-10'	Very poorly sorted micaceous, albite, pyrite quartzite. Trace stylolite(?).
TS-81	7,770-80'	Chlorite mica schist.
TS-82	7,850-60'	Very poorly sorted bimodal micaceous pyrite quartzite and quartz micaceous phyllite.
TS-83	7,880-90'	Very poorly sorted micaceous pyrite quartzite. Trace albite.
TS-84	7,940-50'	Bimodal micaceous poorly sorted quartzite, calcareous quartzite and coarse sandy marble.
TS-85	7,950-60'	Micaceous albite pyrite very poorly sorted bimodal quartzite, schistose quartzite and sandy phyllite.
TS-86	8,140-50'	Very metamorphosed micaceous pyrite chlorite crystal quartzite and chlorite crystal marble.
TS-87	8,210-20'	Micaceous chlorite pyrite albite schistose quartzite and chlorite sand.
TS-88	8,220-30'	Same as TS-87.
TS-89	8,250-60'	Same as TS-87.
TS-90	8,500-10'	Micaceous pyrite albite schistose quartzite.
TS-91	8,680-90'	Same as TS-90.

TS-92	8,780-90'	Poorly sorted schistose quartzite as above with chlorite crystals in coarse quartz grains.
TS-93	8,830-40'	Same as TS-90.
TS-94	8,900-10'	Same as TS-90.
TS-95	9,040-50'	Chlorite quartzite, schistose quartzite as above and mica schist.
TS-96	9,120-30'	Schistose quartzite and mica schist as above.
TS-97	9,280-90'	Same as TS-96.
TS-98	10,770-80'	Bimodal poorly sorted slightly calcareous quartzite.
TS-99	10,950-60'	Very sandy mica schist and schistose poorly sorted quartzite.
TS-100	10,960-70'	Sandy micaceous schist and slightly calcareous schistose quartzite.
TS-101	11,070-80'	Very poorly sorted micaceous slightly calcareous schistose quartzite and sandy mica schist/phyllite. Trace pyrite.
TS-102	11,160-70'	Same as TS-101.
TS-103	11,190-00'	Same as TS-101.
TS-104	11,290-00'	Same as TS-101.
TS-105	11,330-40'	Same as TS-101 with addition of chlorite schist.
TS-106	11,520-30'	Schistose quartzite as above.
TS-107	11,540-50'	Poorly sorted micaceous slightly calcareous graphitic schistose quartzite and sandy graphitic phyllite.
TS-108	11,660-70'	Poorly sorted schistose quartzite and very sandy meta-dolomite.
TS-109	11,720-30'	Schistose quartzite as above, sandy dolomitic marble and calcareous meta-dolomite.

TS-110	11,770-80'	Very fine to fine crystalline meta-dolomite and sandy graphitic meta-dolomite.
TS-111	11,830-40'	Very fine to fine trace medium crystalline slightly calcareous meta-dolomite. Trace dolomitic marble. Trace chert. Clay filled stylolite.
TS-112	11,870-80'	Very fine to fine crystalline pelletal meta-dolomite. Clay filled stylolite.
TS-113	11,900-10'	Same as TS-112.
TS-114	11,940-50'	Slightly sandy very fine to fine crystalline meta-dolomite.
TS-115	11,980-90'	Same as TS-114 with slight intercrystalline porosity.
TS-116	12,020-30'	Meta-dolomite as above and stress lineated quartzite with thin graphitic partings. Medium crystalline sandy marble.
TS-117	12,060-70'	Same as TS-116.
TS-118	12,100-10'	Meta-dolomite and fine grained well sorted quartzite.
TS-119	12,120-28'	Very fine to fine crystalline slightly calcareous and sandy meta-dolomite and quartzite. Trace stylolite.

NOTE: Core #1 & 2 12,137-12,209'. Core description under separate heading.

TS-120	12,210-20'	Fine to very fine crystalline pelletal meta-dolomite, sandy argillaceous siliceous meta-dolomite, and medium crystalline slightly sandy marble.
TS-121	12,250-60'	Very fine to fine crystalline meta-dolomite with fine grained chert grains.
TS-122	12,320-30'	Aphanitic to fine crystalline slightly argillaceous meta-dolomite. Trace chert grains.
TS-123	12,360-70'	Fine crystalline pelletal meta-dolomite, very siliceous and slightly micaceous marble.

TS-124	12,420-30'	Fine crystalline to aphanitic pelletal meta-dolomite and graphitic slightly siliceous and calcareous phyllite.
TS-125	12,470-80'	Same as TS-124. Trace stylolites.
TS-126	12,510-20'	Aphanitic to fine crystalline siliceous meta-dolomite with thin quartzite and siliceous partings. Argillaceous fine chert grain fine crystalline marble.
TS-127	12,580-90'	Aphanitic to fine crystalline slightly calcareous and argillaceous meta-dolomite with fine quartz and chert grains.
TS-128	12,600-10'	Fine crystalline argillaceous sandy meta-dolomite, sandy cherty marble, and micaceous calcareous schistose dolomitic quartzite.
TS-129	12,650-60'	Same as TS-128.
TS-130	12,700-10'	Fine crystalline quartz and chert grain meta-dolomite and siliceous meta-dolomite slightly micaceous. Dolomite quartzite and dolomitic coarse quartz grain conglomerate (?).
TS-131	12,760-70'	Fine to very fine slightly sandy and calcareous meta-dolomite. Vermicular chlorite in coarse quartz grain.
TS-132	12,820-30'	Fine crystalline meta-dolomite.
TS-133	12,840-50'	Fine to very fine crystalline meta-dolomite containing very fine crystalline speckled calcite.
TS-134	12,900-10'	Fine grain quartzite, micaceous graphitic schist and chlorite schist.
TS-135	12,930-40'	Fine crystalline slightly calcareous meta-dolomite, poorly sorted slightly micaceous quartzite and micaceous graphitic schist.
TS-136	13,080-90'	Slightly calcareous micaceous graphitic schist and quartzite.
TS-137	13,140-50'	Micaceous schistose quartzite and micaceous graphitic schist.

TS-138	13,190-00'	Micaceous schistose dolomitic quartzite and fine crystalline meta-dolomite.
TS-139	13,370-80'	Calcareous micaceous schistose quartzite. Trace tourmaline.
TS-140	13,400-10'	Schistose quartzite and fine crystalline meta-dolomite.
TS-141	13,430-40'	Calcareous quartz and chert grain meta-dolomite, siliceous meta-dolomite, and chert and quartz grain fine crystalline marble.
TS-142	13,480-90'	Fine crystalline slightly sandy and calcareous pelletal meta-dolomite.
TS-143	13,520-30'	Fine crystalline slightly sandy meta-dolomite with very fine speckled calcites, calcareous quartz, chert, mica, tourmaline phlogopite quartzite.
TS-144	13,560-70'	Meta-dolomite and in TS-143 with thin clay filled stylolites.
TS-145	13,620-30'	Meta-dolomite containing fine grained chert and a trace of medium quartz. Slightly argillaceous.
TS-146	13,670-80'	Meta-dolomite as in TS-145 and quartz and chert grain rich marble. Trace stylolite.
TS-147	13,700-10'	Fine crystalline chert grain meta-dolomite with very ragged crystal boundaries between the dolomite crystals.
TS-148	13,780-90'	Same as TS-147 and siliceous meta-dolomite.
TS-149	13,840-50'	Fine crystalline chert grain meta-dolomite with ragged contacts, micaceous meta-dolomite and calcareous chert and quartz grain quartzite.
TS-150	13,890-00	Same as TS-149.
TS-151	13,900-10	Very fine to medium crystalline meta-dolomite as above.
TS-152	13,940-50'	Same as TS-151.

TS-153	14,000-10'	Same as TS-151.
TS-154	14,030-40'	Same as TS-151 with numerous clay filled stylolites.
TS-155	14,090-00'	Same as TS-154.
TS-156	14,140-50'	Very fine to medium crystalline meta-dolomite with very ragged contacts. Trace quartz grain and slightly argillaceous stylolite.
TS-157	14,170-80'	Same as TS-156 but finely calcareous throughout.
TS-158	14,210-20'	Same as TS-157 and very siliceous meta-dolomite.
NOTE:	Core #3 14,252-14,301'	Core description under separate heading.
TS-159	14,300-10'	Very fine to medium crystalline slightly sandy and calcareous meta-dolomite.
TS-160	14,350-60'	Meta-dolomite as above with a few thin quartzite partings.
TS-161	14,400-10'	Very fine crystalline slightly calcareous sandy meta-dolomite.
TS-162	14,430-40'	Very fine crystalline calcareous meta-dolomite and very sandy calcareous meta-dolomite.
TS-163	14,480-90'	Very fine to fine crystalline calcareous meta-dolomite and very sandy micaceous schistose meta-dolomite.
TS-164	14,520-30'	Sandy meta-dolomite and dolomitic calcareous poorly sorted quartzite. The quartz grains in the quartzite are very fractured.
TS-165	14,560-70'	Same as TS-164 except quartzite and meta-dolomite are micaceous.
TS-166	14,600-10'	Same as TS-165 and siliceous slightly sandy micaceous phyllite.
TS-167	14,660-70'	Same as TS-165.

TS-168	14,700-10'	Very fine to fine crystalline slightly calcareous sandy pyrite micaceous meta-dolomite.
TS-169	14,770-80'	Same as TS-168 with increase in metamorphic grade in meta-dolomite.
TS-170	14,790-00'	Sandy meta-dolomite and dolomitic quartzite.
TS-171	14,830-40'	Fine to very fine crystalline slightly calcareous sandy pelletal meta-dolomite. Non-micaceous.
TS-172	14,880-90'	Aphanitic to fine crystalline slightly pyritic and calcareous sandy meta-dolomite.
TS-173	15,030-40'	Same as TS-172.
TS-174	15,080-90'	Aphanitic to fine crystalline argillaceous slightly pyritic calcareous sandy pelletal meta-dolomite. Considerable graphitic clay stylolites.
TS-175	15,100-10'	Micaceous graphitic phyllite with thin sand partings. Aphanitic to fine crystalline slightly calcareous and pyritic meta-dolomite.
TS-176	15,140-50'	Aphanitic to fine crystalline slightly calcareous pyritic sandy pelletal meta-dolomite and argillaceous meta-dolomite.
TS-177	15,170-80'	Calcareous and sandy meta-dolomite and very argillaceous meta-dolomite, trace sandy marble.
TS-178	15,190-00'	Aphanitic to medium calcareous sandy meta-dolomite and argillaceous meta-dolomite. Sandy fine to medium crystalline marble.
TS-179	15,220-30'	Very fine to fine crystalline micaceous sandy meta-dolomite and fine crystalline sandy marble and very argillaceous marble.
TS-180	15,250-60'	Fine to medium crystalline sandy marble, dolomitic marble, and fine crystalline sandy slightly calcareous meta-dolomite.

TS-181	15,310-20'	Aphanitic to fine crystalline sandy slightly calcareous meta-dolomite, sandy marble and pyrite sandy micaceous phyllite.
TS-182	15,480-90'	Same as TS-181.
TS-183	15,530-40'	Aphanitic to fine crystalline argillaceous cherty sandy meta-dolomite and dolomitic marble.
TS-184	15,790-00'	Very sandy argillaceous micaceous meta-dolomite, fractured graphitic micaceous phyllite, and very fine crystalline dolomitic chert. Detrital orthoclase grains.
TS-185	16,060-70'	Sandy meta-dolomite and graphitic phyllite, trace dolomitic chert. Detrital orthoclase grains.
TS-186	16,150-60'	Calcareous graphitic phyllite and very calcareous quartzite.
TS-187	16,310-20'	Slightly sandy, graphitic and calcareous mica-phyllite and aphanitic slightly calcareous meta-dolomite.
TS-188	16,410-20'	Very micaceous quartzite, dolomitic marble, finely sandy marble, and mica schist(?).
TS-189	16,480-90'	Medium crystalline very fine sandy marble, cherty marble and calcareous aphanitic to very fine crystalline meta-dolomite.
TS-190	16,510-20'	Fine crystalline dolomitic marble, sandy micaceous pyrite aphanitic to fine crystalline calcareous meta-dolomite with thin calcareous quartzite partings.
TS-191	16,560-70'	Sandy marble, micaceous quartzite and sandy mica schist, and aphanitic calcareous meta-dolomite. Trace coarse quartz with tourmaline crystals.
TS-192	16,720-30'	Fine to medium crystalline finely sandy marble, very fine meta-dolomite and calcareous tourmaline rich chert, and fractured siliceous graphitic phyllite.

TS-193	16,920-30'	Slightly sandy aphanitic finely calcareous meta-dolomite, cherty dolomitic sandy marble, medium crystalline marble cut by a dolomite and clay filled stylolite, calcareous pyritic micaceous chert.
TS-194	17,020-30'	Graphitic slightly calcareous slate, sandy fine crystalline marble, argillaceous graphitic quartzite and aphanitic sandy meta-dolomite. Stylolite.
TS-195	17,060-70'	Same as TS-194 without quartzite.
TS-196	17,080-90'	Sandy aphanitic meta-dolomite, sandy graphitic slate.

NOTE: Core #4 17,089-17,106'. Core description under separate heading

TS-197	17150-60'	Calcareous sandy very fine crystalline meta-dolomite; fine and coarse grain sand in coarse crystalline meta-dolomite; calcareous sandy phyllite, calcareous sandy micaceous marble and sericitic quartzite. Trace phlogopite and tourmaline.
TS-198	17,210-20'	Sandy calcareous sericitic phyllite and calcareous graphitic very argillaceous meta-dolomite.
TS-199	17,250-60'	Sericitic dolomitic slightly calcareous graphitic quartzite and sandy sericitic graphitic phyllite.
TS-200	17,300-10'	Very fine crystalline sandy calcareous meta-dolomite, slightly sandy crystalline marble, very calcareous quartzite and slightly micaceous quartzite. Stylolite.
TS-201	17,380-90'	Meta-dolomite, phyllite and quartzite as above and sandy calcareous pyritic phlogopite tourmaline chlorite schist.
TS-202	17,430-40'	Sandy calcareous slightly micaceous meta-dolomite, calcareous dolomitic sandy phyllite, and calcareous graphitic quartzite. Very thin bedding.

TS-203	17,490-00'	Very thin bedded micaceous calcareous phyllite, finely sandy very fine crystalline meta-dolomite, quartzite and graphitic fine crystalline marble.
TS-204	17,590-00'	Meta-dolomite as above and sandy micaceous fine crystalline graphitic marble.
TS-205	17,900-10'	Crystalline marble cut by graphitic stylolite, calcareous very graphitic pelletal meta-dolomite; and micaceous graphitic quartzite.
TS-206	17,950-60'	Graphitic meta-dolomite and graphitic marble as above.
TS-207	18,010-20'	Same as TS-206.
TS-208	18,140-50'	Same as TS-206.
TS-209	18,350-60'	Same as TS-206.
TS-210	18,400-10'	Very fine crystalline calcareous meta-dolomite, graphitic dolomitic marble, and sandy calcareous meta-dolomite.
TS-211	18,580-90'	Slightly sandy calcareous very fine crystalline meta-dolomite, graphitic meta-dolomite, and finely dolomitic fine crystalline marble.
TS-212	18,680-90'	Finely dolomitic fine crystalline and very fine crystalline to aphanitic calcareous meta-dolomite. Trace quartzite.
TS-213	18,930-40'	Calcareous sandy very fine to aphanitic meta-dolomite, fine crystalline marble, and dolomitic sandy marble.

CORE THIN SECTION EVALUATION:

TS-C1-1	12,137'	Very fine crystalline meta-dolomite with thin quartz and mica partings.
TS-C2-1	12,151'	Micaceous very fine grain meta-dolomite.
TS-C2-2	12,152'	Fine crystalline sandy marble cut by numerous thin clay (graphite) and quartz filled stylolites. Trace pyrite.
TS-C2-3	12,153'	Very sandy and graphitic fine crystalline marble with thin clay and quartz filled stylolites. Trace pyrite.
TS-C2-4	12,155'	Fine crystalline slightly sandy marble cross cut by thin mica filled stylolite partings and intermittent quartzite partings. Trace pyrite.
TS-C2-5	12,163'	Fine crystalline slightly sandy marble crosscut by numerous mica and clay (graphite) filled stylolites. Numerous thin quartzite partings. Trace pyrite.
TS-C2-6	12,165'	Marble as above crosscut by thin graphitic very thin bedded graphitic slate partings. Trace pyrite.
TS-C2-7	12,167'	Argillaceous very sandy and siliceous finely micaceous marble. Trace pyrite.
TS-C2-8	12,171'	Fine crystalline slightly sandy marble with a few thin sand grain and mica partings.
TS-C2-9	12,171.8'	Sandy fine crystalline marble cut by very siliceous phlogopite tourmaline mica schist.
TS-C2-10	12,183'	Dolomitic fine crystalline sandy pelletal marble.
TS-C2-11	12,185.1'	Very fine crystalline sandy and cherty slightly calcareous and micaceous meta-dolomite.

TS-C2-12	12,186'	Very fine crystalline sandy meta-dolomite and very thin bedded interbedded mica and dolomite stylolite zone.
TS-C2-13	12,190'	Very fine crystalline meta-dolomite crosscut by extensive stylolite/ fracture system filled with mica, quartz, and calcite.
TS-C2-14	12,193'	Very fine crystalline meta-dolomite cut by mica, quartz and calcite filled stylolites.
TS-C2-15	12,200'	Very fine crystalline very argillaceous finely micaceous meta-dolomite.
TS-C2-16	12,202.5'	Same as TS-C2-14 with greater amount of clay/mica filled stylolites.
TS-C2-17	12,206'	Very fine crystalline slightly argillaceous meta-dolomite crosscut by numerous thin clay/mica filled stylolites.
TS-C2-18	12,209'	Very fine crystalline slightly sandy and calcareous meta-dolomite cut by a thick mica and dolomite filled stylolite.
TS-C3-1	14,255'	Slightly sandy crystalline meta-dolomite with extensive graphite filled stylolites.
TS-C3-2	14,259.5'	Fine crystalline slightly calcareous meta-dolomite containing very small graphite flakes.
TS-C3-3	14,263'	Very fine crystalline slightly sandy meta-dolomite and fine crystalline finely calcareous and sandy slightly argillaceous meta-dolomite. Crystal boundaries very ragged.
TS-C3-4	14,265'	Crystalline slightly sandy meta-dolomite crosscut by very thin dolomite filled stylolites. Quartz filled vein.
TS-C3-5	14,266'	Very fine crystalline meta-dolomite with extensive graphite filled stylolites; very fine to aphanitic slightly argillaceous meta-dolomite

		with thin quartzite concentrations; slightly sandy sericitic meta-dolomite; and sandy pyrite sericitic phyllite.
TS-C3-6	14,270.8'	Very fine crystalline finely calcareous slightly sandy meta-dolomite.
TS-C3-7	14,274'	Same as TS-C3-6.
TS-C3-8	14,276'	Same as TS-C3-6 and very sandy slightly graphitic sericitic phyllite.
TS-C3-9	14,280'	Very fine and medium crystalline slightly calcareous and sandy meta-dolomite.
TS-C3-10	14,282.5'	Very fine pelletal (?) slightly sandy, calcareous, and sericitic meta-dolomite. Graphite filled stylolites.
TS-C3-11	14,284'	Aphanitic finely calcareous fractured meta-dolomite. Thin quartz grain and calcite partings or thin fracture filling.
TS-C3-12	14,285'	Same as TS-C3-11.
TS-C3-13	14,289'	Same as TS-C3-11.
TS-C3-14	14,296'	Very graphitic sericitic dolomitic pyritic quartzite.
TS-C3-15	14,298'	Very fine crystalline meta-dolomite crosscut by numerous parallel quartz, calcite and sericite filled fractures.
TS-C3-16	14,299'	Very fine crystalline meta-dolomite grading into very sandy sericitic pyritic graphitic meta-dolomite.
TS-C3-17	14,300'	Very fine crystalline meta-dolomite and sandy meta-dolomite.
TS-C4-1	17,090.5'	Very sandy and graphitic meta-dolomite and phyllite. Thin sand grain partings.
TS-C4-2	17,092'	Very sandy graphitic meta-dolomite with numerous mica laths. Trace detrital orthoclase.

TS-C4-3	17,094'	Sandy graphitic dolomitic phyllite with numerous mica laths. Very thin calcite partings and calcite replacement of quartz(?).
TS-C4-4	17,098'	Sandy, slightly calcareous micaceous, graphitic, dolomitic phyllite. Thin bedded.
TS-C4-5	17,103'	Graphitic, sandy, micaceous phyllite as above.
TS-C4-6	17,105'	Very sandy, micaceous, graphitic calcareous meta-dolomite.

GEOLOGICAL EVALUATION

Introduction

The Standard Oil Production Company, Weyerhaeuser # 1-22, sec. 22, T5S, R24E, McCurtain County, Oklahoma is probably the most geologically significant well ever drilled along the 1300 mile Ouachita foldbelt. What makes this well unique is a combination of where the well was drilled, what formations were penetrated and the tectonic events which had occurred.

The Weyerhaeuser # 1-22, was drilled along the crest of the Benton-Broken Bow uplift, spudding in the Ordovician Crystal Mountain Sandstone and quickly penetrating into the Cambrian Collier formation, the oldest Ouachita facies formation observed in the Ouachita Mountains (Fig. 1). This well is located on the "type section" for Ouachita facies deposits in Oklahoma and is in one of the most heavily studied portions of the Ouachita foldbelt. The significance is that the Ouachita facies rocks penetrated by this well should therefore be readily recognizable by comparison with the outcrop samples. Any new unidentified intervals would therefore, in all probability, be new or previously unrecognized formations. This is important because Honess (1923) or Miser and Purdue (1929) were only able to recognize approximately 200' of Collier and at no time were they able to determine its base or identify what is below.

It has long been known that the Ouachita facies rocks represent a large thrust sheet which was moved north by major tectonic forces. This thrust sheet in Arkansas and Southeastern Oklahoma was thrust over a foreland facies of lower to middle Paleozoic rocks. In that this well was drilled through the main thrust and into the overridden foreland facies helps to understand the tectonics of the region and to give some understanding of the magnitude of this middle Paleozoic tectonic event.

Lastly, as one moves east of the Arbuckle Mountain exposures, which is the type section for the foreland facies rocks this sequence quickly passes under the leading edge of the Ouachita foldbelt. In that very few wells have been drilled through the Ouachita thrust sheet into the foreland facies, a general ignorance exists about what depositional or stratigraphic changes may have occurred as one proceeds to the east-southeast. It has been hypothesized by some, that the depositional basin for the Ouachita facies rocks was in an east-southeast direction from the Arbuckle Mountains outcrop (Fig. 2). In that a sequence of approximately 7000' of foreland facies, lower Paleozoic, rocks were penetrated, a better understanding of this depositional transition from the foreland facies depositional environment into the Ouachita facies depositional environment has been made possible.

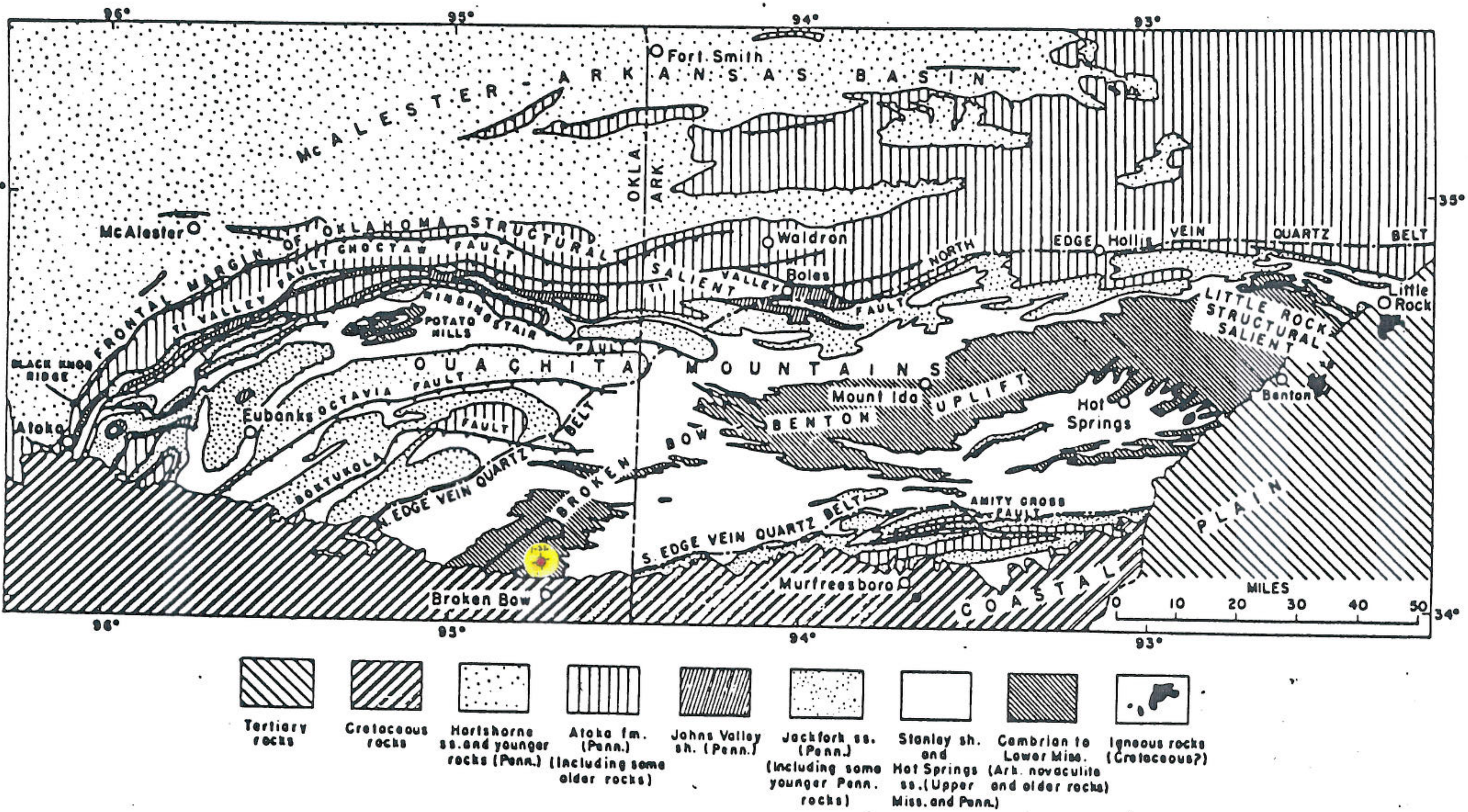


Figure 1: Location of the Standard Oil Production Company, Weyerhaeuser #1-22. The Broken Bow - Benton uplift, also refered to as the Choctaw Anticlinorium, is the core area of the Ouachita Mountains. From Bush, et al (1977, p. 59).

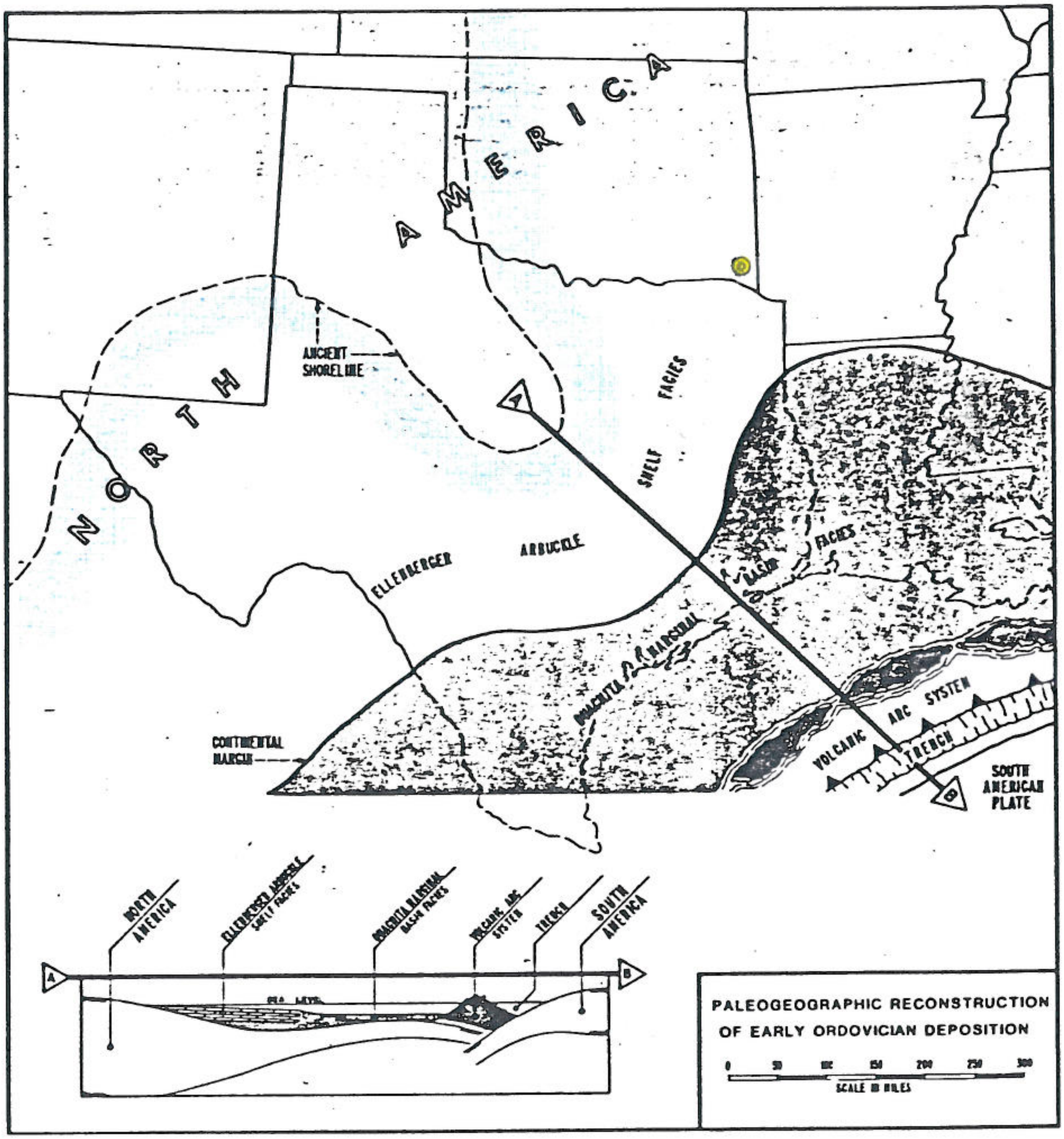


Figure 2: Location of Standard Oil Production Co., Weyerhaeuser #1-22 in Respects to a Reconstruction of Early Ordovician Depositional Regions (Walper, 1982).

Sample Study

Numerous lithologic changes were observed in the drilling of the Weyerhaeuser 1-22. These changes were found to be as follows:

0-180'	Medium grained iron stained sandstone with medium to course grained quartzite at the base (Pl. 1-5).
180-1050'	Dark gray to black graphitic phyllite schist and gray, black, trace brown marble and meta-dolomite. Marble gray and white mottled below 550'. Marble and meta-dolomite at times very sandy (Pl. 6-20).
1050-2020'	Dark gray to black graphitic phyllite and argillaceous fine grained quartzite (Pl. 21-29).
2020-2400'	Dark gray to black graphitic phyllite, light gray fine crystalline marble. Trace quartzite (Pl. 30-35).
2400-3000'	Fine grained quartzite, dark gray to black graphitic phyllite and light gray fine crystalline marble and very sandy marble (Pl. 36-47).
3000-3520'	Dark gray to black graphitic phyllite with some quartzite partings (Pl. 48-53).
3520-4700'	Gray fine to coarse poorly sorted graphitic calcareous quartzite and dark gray to black graphitic phyllite (Pl. 56-70).
4700-5150'	Light to dark gray marble, sandy marble graphitic phyllite, and micaceous schist (Pl. 71-77).
5150-11,750'	Light to medium gray phyllite, sandy mica schist, sandy phyllite and poorly sorted argillaceous micaceous quartzite. Quartzite frequently exhibiting a bimodal grain size. Chlorite sand and chlorite schist frequently observed as well as chlorite crystals in quartz veins. Pyrite and chalcopyrite(?) and to a lesser extent albite (Pl. 78-135 & possibly 54-55).
11,750-12,870'	Light to medium gray slightly sandy meta-dolomite with intermittent partings of fine grained graphitic quartzite and black phyllite (Pl. 136-162).
12,870-13,396'	Very poorly sorted micaceous quartzite, light gray to black phyllite, and mica schist. Trace amounts of chlorite schist and chlorite crystals. Quartzite bimodal in part. Pyrite and chalcopyrite (Pl. 163-171).

13,396-13,700' Light to medium gray, fine trace medium crystalline slightly sandy meta-dolomite with infrequent clay filled stylolites (Pl. 172-179).

13,700-14,330' Light gray fine to medium crystalline meta-dolomite with slight amounts of quartz and chert grains (Pl. 180-189).

14,330-15,040' Cream to light gray slightly calcareous very sandy slightly micaceous meta-dolomite and fine grained dolomitic quartzite (Pl. 190-205).

15,040-15,480' Black to dark grey phyllite, cream to light gray fine crystalline calcareous meta-dolomite and sandy meta-dolomite. Trace sandy fine to medium crystalline marble (Pl. 206-217).

15,480-16,420' Black to dark gray granular to slickensided waxy foliated phyllite and calcareous quartzite. Trace amounts of meta-dolomite and marble (Pl. 218-226).

16,420-16,950' Phyllite and calcareous quartzite as above and gray to tan fine crystalline marble and trace amounts of meta-dolomite. Trace tourmaline (Pl. 227-236).

16,950-17,300' Dark gray to black phyllite and fine grained graphitic quartzite, trace marble and meta-dolomite. Increase in sericite, phlogopite, biotite schist (Pl. 237-242).

17,300-18,020' Graphitic calcareous fine grained quartzite, tan to light gray marble and phyllite. Phlogopite and sericite common with trace amounts of chlorite and tourmaline (Pl. 243-252).

18,020-18,987' Light to dark gray very dolomitic phyllite, tan fine crystalline graphitic marble and graphitic quartzite with an increase in slightly graphitic marble and meta-dolomite below 18,600 (Pl. 252-261).

GEOLOGICAL SEQUENCE PENETRATED

In attempting to identify the various rock units penetrated the most difficult problem to over come was the amount of metamorphic alteration observed. With very rare exceptions all samples observed were greenschist facies metamorphics. Also, either due to non-preservation or destruction no recognizable fossil evidence was observed.

Taking into consideration the above mentioned difficulties, the following formation tops have been recognized in the Weyerhaeuser # 1-22:

0-176'	Ordovician Crystal Mountain Sandstone
176-5150'	Cambrian Collier Formation
5150-11,750'	Ordovician Womble Formation
11,750-12,870'	Cambrian(?) Arbuckle Group
12,870-13,396'	Ordovician Womble Formation
13,396-13,700'	Ordovician Arbuckle West Spring Creek Formation(?)
13,700-14,332'	Ordovician Arbuckle Kindblade Formation(?)
14,332-15,040'	Ordovician Arbuckle Cool Creek Formation(?)
15,040-18,987'	Cambrian(?) Arbuckle Group

The Crystal Mountain Sandstone, Collier formation and Womble formation are Ouachita facies sediments while the Arbuckle Group is of the foreland facies. A model has been prepared which portrays these formations and presents the tectonic conditions which are believed to have created this linear sequence (Fig. 3).

The well, according to mapping by Honess (1923, pl. 1), was spudded in the Crystal Mountain Sandstone in close proximity to the contact with the underlying Collier Formation. The base of Crystal Mountain and top of Collier is approximately at 176'(KB). The interval below the Crystal Mountain Sandstone closely resembles the Collier as described by Honess. It consists of graphitic phyllites, graphitic dolomitic calcareous quartzites, graphitic sandy dolomitic marbles and calcareous meta-dolomites (Pl. 6-77). The Collier and pre-Collier(?) were found to be from 176-5150'. The Crystal Mountain and Collier interval from 0-5150' represent a thrust sheet which has been thrust over an Ordovician Womble section.

The interval from 5150 to 11,750' is a very uniform interval consisting of chloritic slightly feldspathic micaceous quartzites, light gray sandy phyllites and mica schists (Pl. 78-135). Numerous quartz veins containing vermicular chlorite were also observed (Pl. 78,88,90,91,103,106 & 124). This interval contains very strong similarities to the Womble formation with the exception of identifiable graptolite fossils.

At 11,750' the main thrust between the overlying Ouachita facies thrust sheet and the overridden foreland facies was observed. The foreland facies below the thrust is an Arbuckle sequence of very fine to fine crystalline meta-dolomite, sandy meta-dolomite, phyllite and quartzite (Pl. 136-162). This interval strongly resembles the

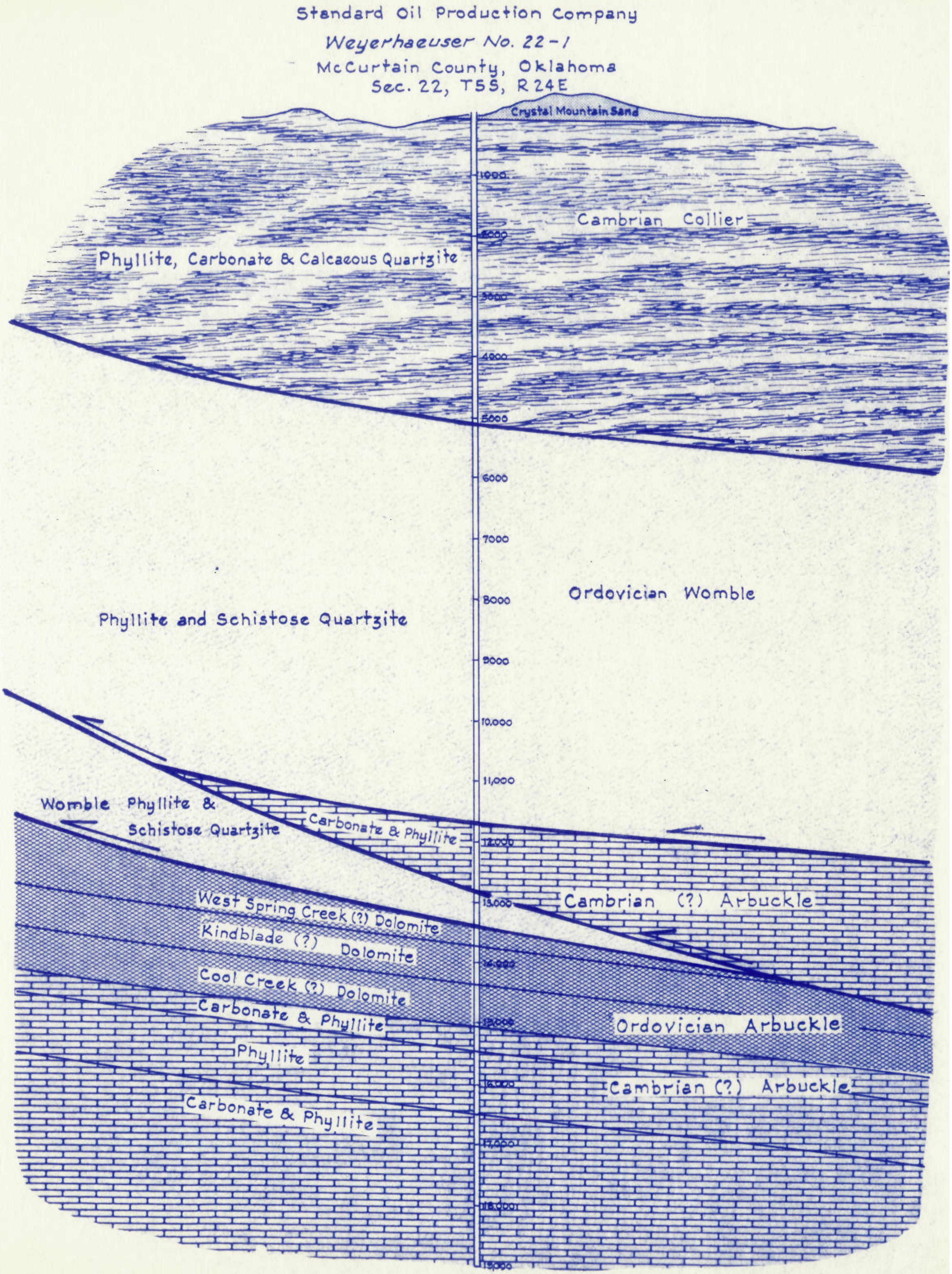

Standard Oil Production Company
Weyerhaeuser No. 22-1
McCurtain County, Oklahoma
Sec. 22, T5S, R24E
Crystal Mountain Sand
Cambrian Collier
Phyllite, Carbonate & Calcaeous Quartzite
Ordovician Womble
Phyllite and Schistose Quartzite
Womble Phyllite &
Schistose Quartzite
Carbonate & Phyllite
Cambrian (?) Arbuckle
West Spring Creek (?) Dolomite
Kindblade (?) Dolomite
Cool Creek (?) Dolomite
Carbonate & Phyllite
Ordovician Arbuckle
Phyllite
Cambrian (?) Arbuckle
Carbonate & Phyllite
1000
2000
3000
4000
5000
6000
7000
8000
9000
10,000
11,000
12,000
13,000
14,000
15,000
16,000
17,000
18,000
19,000

Figure 3:

subsurface Arbuckle of Grayson County, Texas, and the Arbuckle Mountain outcrop of south central Oklahoma, with the exception of the presence of the shale fraction. This Arbuckle section is of apparent Cambrian age. The reason for this interpretation will be more readily explained during the discussion of the interval below 15,040'.

At 12,870' a reverse fault was encountered and a repeat section of Womble was recognized. Petrographically and lithologically this interval of the Womble most closely resembles the lower portion of the Womble interval which was observed between 11,000 and 11,700'. This repeated Womble interval was noted from 12,870-13,396' (Pl. 163-171).

At 13,396' the main thrust from Ouachita facies to foreland facies was repeated and once again an Arbuckle interval was observed. This Arbuckle interval is interpreted to be Ordovician West Spring Creek(?). The West Spring Creek(?) is from 13,396-13,700' (Pl. 172-179). Below the West Spring Creek(?)is the Kindblade(?) formation from 13,700-14,332. The Kindblade(?) is very fine to fine crystalline meta-dolomite and sandy cherty meta-dolomite (Pl. 180-189). The primary lithologic change from the interval above is a coarser and more bimodal crystal size, decrease in quartz and chert grain, the very ragged crystal boundaries which were not previously recognized, and a general harder or more resistant nature of the rock. Below the Kindblade(?) is found a cream to tan calcareous very sandy meta-dolomite which is believed to be the Cool Creek(?) formation. The Cool Creek(?) occurred from 14,332-15,040' (Pl. 190-205).

In work by Ham (1955) the following was observed: 1). The West Spring Creek is generally a thin bedded fine crystalline dolomite and thin sandstones in the upper half. The lower half consists of thick bedded limestone or dolomite and thin sandstone lenses with chert. 2). The Kindblade is the least sandy and cherty of the Ordovician Arbuckle formations. 3). The Cool Creek formation is the most sandy, cherty and siliceous of all the Arbuckle formations. What was not stated by Ham (1955), but needs elaborating, is that in Southern Oklahoma the entire Ordovician portion of the Arbuckle section is very uniform throughout. Unless one has a large enough section to evaluate, or usable fossils are recognized, it becomes very difficult to tell exactly where one is in the section.

In comparing the interval from 13,396 to 15,040' the same general trend was recognized and is the primary reason for these conjectures. To date no fossils have been recognized which might assist in correlation.

Below 15,040' a very argillaceous interval was observed. From 15,040-15,480' the lithology is sandy argillaceous meta-dolomite, phyllite, sandy marble and quartzite. Between 15,480 and 18,150' is phyllite, quartzite, meta-dolomite and marble. The 18,150 to 18,987'(TD) zone is dolomitic phyllite, sandy marble and meta-dolomite with a decrease in phyllite and quartzite with depth. Below

18,600' phyllite has dropped out and below 18,750' quartzite has dropped out (Pl. 206-261).

Correlation of Ouachita Facies

In attempting to correlate the various Ouachita facies formations found in the Weyerhaeuser # 1-22, with the adjacent outcrop sections several similarities were recognized. According to Honess (1923, pl. 1) this well was spudded in the Ordovician Crystal Mountain sandstone. Honess (1923) described the Crystal Mountain sandstone as fine to medium grained carbonaceous, siliceous, graphitic quartzites resting on a 14' basal limestone, quartz, chert, sandstone, and shale pebble conglomerate. The quartz grains frequently exhibit quartz over growths which create a sutured contact between the quartz grains. Partial carbonate replacement occurs very frequently and may constitute 50% of the rock. The first 180' of the Weyerhaeuser # 1-22, was found to conform very closely to the Crystal Mountain, as described by Honess. In viewing thin sections from this interval (Pl. 2-6) strong similarities were observed in comparison with micro-photographs from Honess (1923, pl. 7 & 8). The basal conglomerate was not recognized, but due to the thin nature of the conglomerate and the general nature of cuttings, it would not be unrealistic that it was not recognized even though it does exist.

Below the Crystal Mountain, as interpreted by Honess (1923), should be the Collier shales and limestones. Honess described this formation as "blue-black slates and soft unctuous shales." These shales are interbedded with thin limestones and limestone - sandstone conglomerates. The top of the formation consists of 25-30' of dark gray limestone. The entire sequence is cut by numerous quartz and calcite veins. Honess also found that the entire sequence was subjected to strong regional metamorphism exhibited by pronounced twisting, shearing, and creation of a strong schistose appearance.

In McCurtain County Honess was not able to locate a complete section of Collier. Only 200' of section was recognized and the base of the formation was covered.

In the Weyerhaeuser # 1-22, a section exactly as described by Honess (1923) was not recognized. What was found was a section that was fairly uniform from 180-5150'. This section was found, from a gross view, to consist of black sandy graphitic calcareous to dolomitic micaceous phyllite and schist, graphitic quartzite, graphitic calcareous or dolomitic quartzites, graphitic sandy micaceous marble, and graphitic sandy micaceous meta-dolomite. The entire sequence was dark gray to black and exhibited considerable shearing contortion and recrystallization to metamorphic minerals. A sequence similar to this was located between 0 and 6,900' in the Viersen and Cochran, Weyerhaeuser # 25-1, located approximately 4 1/2 miles southwest of the Weyerhaeuser # 1-22 (Denison, et al 1977).

This interval from 180-5150' in the # 1-22 appears to be a highly disturbed faulted, folded and metamorphosed zone. The primary difference in this sequence and the Collier, as described by Honess (1923), is not as much a factor of absence as of addition. The sequence penetrated is far more complex than described by Honess. Honess presented an example of shear folding which is similar to PLATE 49 in the # 1-22, sheared graphitic shale with intruded quartz similar to PLATE 27, 33, 38 and 42 in the # 1-22, and replacement limestone similar to PLATE 6, 23, 25, 28 and 31.

Due to the strong similarities it is believed that the interval from 180-5150' is a Cambrian Collier or pre-Collier sequence. The equivalent sequence in the Viersen and Cochran was also interpreted to be a probable Collier sequence (Denison, et al, 1977).

Between 5,150 and 11,750' is the most readily recognizable formation from the Ouachita facies within this well. This interval was found to be a very uniform sequence of schistose quartzites consisting of bimodal quartz grains, albite, chlorite, sericite and lesser amounts of rutile needles. This interval was very uniform for the entire 6,600' penetrated with the greatest fluctuation noted being a transition from schistose quartzites to sand schist. This formation contained numerous thin intervals of chlorite crystal sand and quartz veins with vermicular chlorite.

This interval is without a doubt an Ordovician Womble section. In Honess' description of the Womble in McCurtain County he described and photographed a vermicular chlorite that is identical to examples from the # 1-22 (Pl. 78,88 & 90). Honess found the basic lithology of the Womble to be irregular grains of quartz and minor amounts of plagioclase in a very reorganized siliceous chlorite, sericite schistose matrix. Examples of this are found in great amounts in the # 1-22 (Pl. 80,83,86,89,110,114,130,134 and others). In addition to this interval a repeated section of Womble was found between 12,870 and 13,396' (Pl. 163-171).

Within the Ouachita facies sediments there is no formation as uniform and consistent over the entire exposure as the Womble, until one reaches the Mississippian/Pennsylvanian Stanley-Jackfork flysch sequence. Also, the Womble is at least 1000' thick and with considerable folding and faulting is frequently expanded to an apparent thickness of several thousand feet. This is apparently the case in this well, where 6600' of Womble is observed in this section.

Correlation of the Foreland Facies

According to Walper (1982), Briggs and Roeder (1975), Denison (1975), and Arbenz (1984) the final movement of the Ouachita facies thrust plate was between late Pennsylvanian and early Permian time. Therefore the youngest age rock to be expected under the thrust would be Pennsylvanian. As one moves further back from the leading edge of the thrust the overridden rocks would be expected to be older.

The closest well to the Weyerhaeuser # 1-22 which drilled through the basal Ouachita facies thrust into the foreland facies is the Hassie Hunt, Neely # 1, in Lamar County, Texas; southwest of the # 1-22. The Neely # 1 is also along the strike of the Broken Bow - Benton uplift. As interpreted by Denison (1975) and this author the Neely # 1 encountered below the Ouachita facies thrust an Ordovician Viola to Cambrian Arbuckle and possibly Cambrian Timbered Hills, section. The following sequence was recognized in the Neely # 1:

Viola fm.	12,800'	Fine crystalline fractured fossiliferous limestone and dolomitic siliceous chert (Pl. 371-372).
Simpson Group	12,924'	Fossiliferous medium crystalline marble. Crinoid and a trace Ostracoda. Slightly sandy throughout (Pl. 373-376).
Arbuckle Group,	14,130'	Fine to aphanitic meta-dolomite, sandy meta-dolomite, and aphanitic to fine crystalline slightly to moderately sandy marble. This interval is cut by numerous stylolites and is distinctly nonfossiliferous. Pelletal in part (Pl. 377-384).
Cambrian(?) Arbuckle	18,070'	Fine crystal meta-dolomite, graphitic dolomite, sandy sericite schist, graphitic phyllite, and graphitic micaceous quartzite (Pl. 385-389)

In comparing the foreland sequence in the Weyerhaeuser # 1-22 with the Hunt, Neely # 1 the only correlation found was with the Arbuckle and Cambrian(?) Arbuckle sequence. As stated above, the Viola and Simpson sections were nearly exclusively marble, were frequently fossiliferous and no meta-dolomites of any consequence were observed. Of interest at this juncture is that the Neely # 1 exhibits the same general intensity of metamorphism as the Weyerhaeuser # 1-22; Therefore it should exhibit the same properties as the Hunt, Neely # 1. By comparing the microphotographs of the Neely # 1 (Pl. 371-376) it is evident that no correlation is possible with the Viola or Simpson sections.

In attempting to correlate the Arbuckle Group from the Neely # 1 with the Weyerhaeuser # 1-22 the following similarities have been recognized:

Neely # 1 (PLATES)	Weyerhaeuser # 1-22 (PLATES)
377	190, 196, 202, 204
378	177, 179, 183, 189, 192, 203
379	No strong correlation-332
380	380
381	299 (if dolomitized)
382	188, 191, 192
383	276, 277, 270
384	No strong correlation
385	226, 241, 242
386	139, 140, 143, 145, 155
387	222
388	146, 157
389	144, 148

For correlation purposes various examples of the Ordovician Arbuckle from Grayson County, Texas have been presented for comparison with the Neely # 1 as well as the Weyerhaeuser # 1-22 (Pl. 390-406). Some key points for recognition of the Arbuckle which seem to hold up, whether metamorphosed or not, are:

1). Pelletal throughout section (Pl. 140, 145, 150, 175, 182, 218, 386, 399).
2). Sand grains floating in carbonate matrix (Pl. 196, 202, 259, 377, 390).
3). Change of crystal size along distinct boundary (Pl. 139, 211, 392, 396).
4). Large and numerous stylolites throughout entire section (Pl. 140, Core 1-4, 401-406).
5). Thin sand partings in carbonate (Pl. 176, 203, 394).
6). Very uniform lithology throughout entire section.
7). Detrital feldspar in lower Arbuckle (less common but persistent) (Pl. 223, 224).

In comparing the interval 15,040-15,700' in the Weyerhaeuser # 1-22, with the Hassie Hunt, Neely # 1 a sample description/log response similarity was observed. In the Neely #1 at 18,070 a sharp increase in phyllite (without an E-Log response) was observed followed by a dramatic resistivity break at 18,330'. In the Weyerhaeuser # 1-22, the observance of phyllite (without a major E-Log response) occurred at 15,040' with the resistivity break at 15,480'. Denison (1975), in the Neely # 1, interpreted this interval below 18,070' as Cambrian(?) Arbuckle.

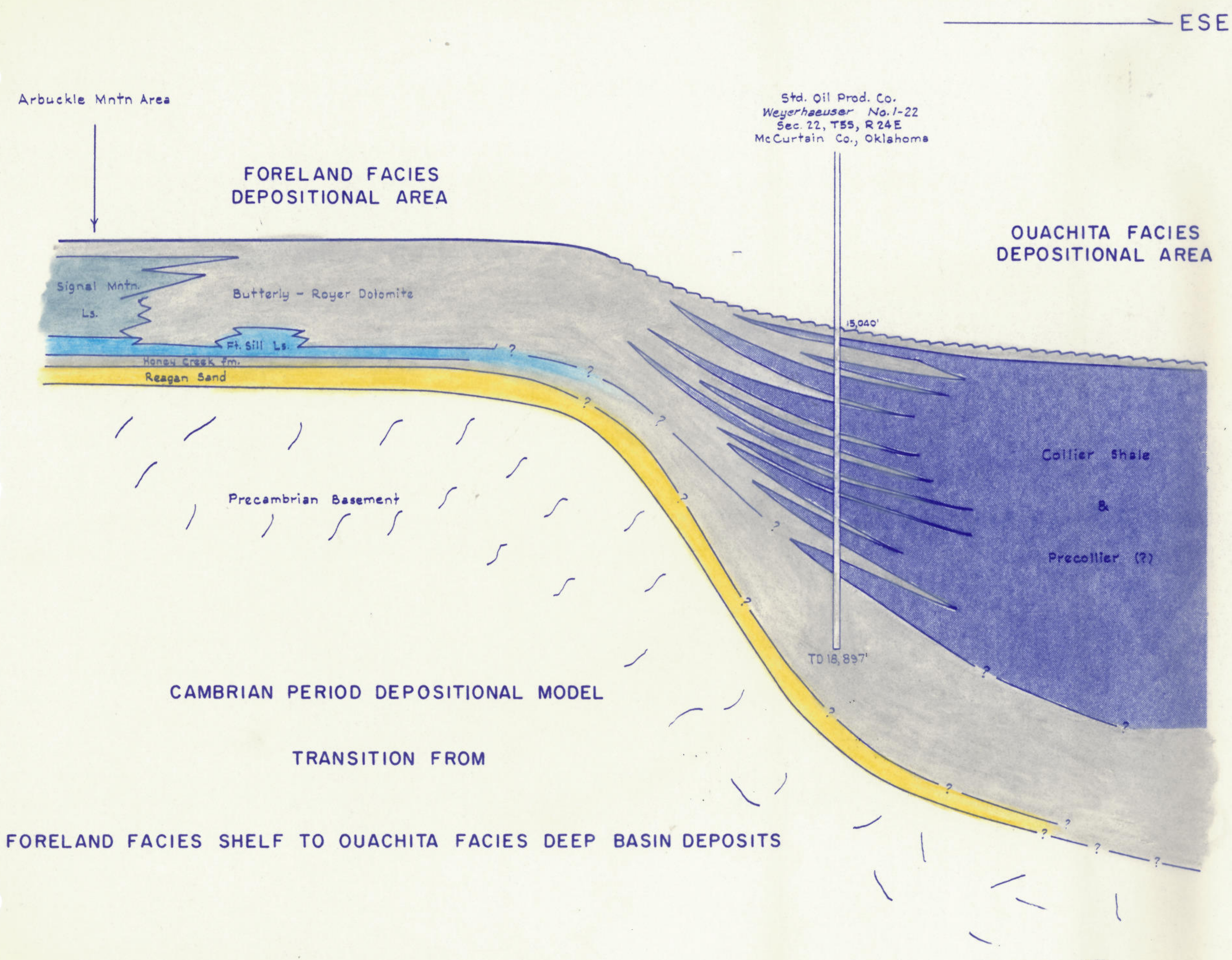
During the drilling of the Weyerhaeuser # 1-22, the interval below 15,040' was originally interpreted, by this author, to be a thrust fault followed by a repeated section of the Ouachita facies Cambrian Collier formation. In comparing samples and thin sections from the Cambrian Collier interval observed between 1000-5000' and the interval below 15,040', very strong similarities were observed and in many cases the samples can not be differentiated. In that the Arbuckle Group is known to transition across the Ordovician-Cambrian contact, and strong correlation of this deep Arbuckle section with the Collier formation exists, it is interpreted that the interval below 15,040' is, in all probability, Cambrian in age. A model has been prepared to explain the transitional relationship which is believed to exist at the location of the Weyerhaeuser # 1-22, as it relates to the foreland facies depositional environment and the Ouachita facies depositional environment during Cambrian time (fig. 4).

In evaluating the outcrop area of the Ozark region of Northeastern Oklahoma and Southern Missouri, the Cambrian section consists of the Lamotte Sandstone at the base, followed in ascending order by the Bonneterre, Davis, Derby-Doerun, Potosi and Eminence formations (McCracken, 1964). In contrast to the Cambrian section of Southern Oklahoma which contains no shales of significance, the Davis formation, in the St. Francois Mountains of Southern Missouri, contain a well developed shale. The Bonneterre through Derby-Doerun is characterized by McCracken (1964) as "a gray, silty, earthy to fine grained, sandy zone throughout." The presence of this argillaceous Cambrian section in Northern Arkansas and Southern Missouri does provide some evidence for the potential of shale deposition in the Cambrian as one moves east of the Arbuckle Mountain outcrops of south central Oklahoma.

In an attempt to determine the thickness of the Cambrian Period deposits in the vicinity of the Weyerhaeuser # 1-22, a comparison has been made with several outcrop sections from the Arbuckle and Ozark Mountains. The thickest section noted is in the Arbuckle Mountains and was determined to be 2100' thick. This Cambrian section is at the Joins Ranch outcrop (sec. 3 & 4, T1S, R1W), and was found to rest unconformably on Cambrian rhyolite and Precambrian granite. At this location the lower 450' consists of the Reagan Sandstone (Ham, 1955). In the Ozark Region the Cambrian section generally varies from 400-1600' thick, with the thickest section in the Francois Mountains of south central Missouri (McCracken, 1964).

If the Cambrian section in this well was topped at 15,040' and no sections are repeated, then nearly 4000' of Cambrian has been penetrated. If the location of the Weyerhaeuser # 1-22, is in a basinward direction from the Joins Ranch outcrop of south central Oklahoma, this increase in thickness would be consistent with what would be expected. What is not known is if the basal Cambrian Reagan Sandstone which was noted in Southern Oklahoma, or the Lamotte Sandstone of Missouri would continue to exist as one transgresses toward the deep basin depositional environment. Therefore, to speculate upon how deep one would have to drill to reach basement would only be conjecture, particularly without having seen a basal sand unit as of T.D.

To further complicate the matter, in the Arbuckle Mountains the ratio of Ordovician to Cambrian deposits for the Pre-Simpson is



CAMBRIAN PERIOD DEPOSITIONAL MODEL

TRANSITION FROM

FORELAND FACIES SHELF TO OUACHITA FACIES DEEP BASIN DEPOSITS

Figure 4:

roughly 70/30. In the Ozark region this ratio for the equivalent section is 80/20. If the interpretation for formation tops is correct, then in this well approximately 1600' of Ordovician was penetrated in comparison with 4000' of Cambrian, which is reversed from what would be expected. Therefore, if the correlations are correct, then a repeated Cambrian section exists or a much greater rate of deposition occurred during Cambrian time as one transgressed toward the deep basin. Due to the above mentioned inconsistencies and the very thick Cambrian section already penetrated, it is hypothesized that the basement igneous deposits could be encountered at any time.

The basement rocks in the Arbuckle Mountains consist of the Cambrian Carlton Rhyolite Group and Precambrian granites (Ham, 1973). The Cambrian Carlton Rhyolite Group has a known drilled thickness of 5000' of Carlton Rhyolite above 1050' of Cambrian basalts and tuffs. The combined Cambrian igneous flows and tuffs are therefore at least 7500' thick (Ham, 1973).

Below these Cambrian igneous extrusions is the Precambrian Blue River Gneiss, Tishomingo Granite, Troy Granite and an unnamed granodiorite (Denison in Ham, 1973). These igneous intrusives have a drilled thickness of nearly 11,000'.

At this point, the most useful tool for speculating the depth to basement would be seismic records from this area. If a basal Cambrian sand exists above the Cambrian rhyolites and tuffs or Precambrian granites it may be recognizable. Also, there may be a possibility that a reflector would exist at the top of Precambrian unconformity. If seismic proves to be of no value, it is the authors opinion that there would be no more than 4000' of additional Cambrian sediments prior to encountering a Cambrian or Precambrian basement.

Primary Tectonic Stages

Earlier a model was presented which represented the geologic section penetrated (Fig. 3). In evaluation of this model one can observe that the primary tectonic elements are a number of thrust faults which are the result of compressive stress forces.

The creation of the geologic sequence would tend to require several periods' of movement, rather than one large movement. This multiple movement hypothesis has been recognized for a number of years. An example of the multiple movement hypothesis was noted in the Collier at 2090-00' (Pl. 32). In this example three different fracture fillings are observed. Apparently with each major tectonic event this fragment was broken and subsequently healed. Interestingly, this fragment was at a different attitude during each movement which created fractures at different orientations.

To create the vertical sequence recognized in the Weyerhaeuser # 1-22 a tectonic sequence consisting of four stages, or pulses, is envisioned (Fig. 5). Stage 1 consisted of thrusting the main

IDEALIZE MODEL OF PRIMARY TECTONIC EVENTS – BENTON/BROKEN BOW UPLIFT SEC. 22, T5S – R24E McCurtain County, Oklahoma

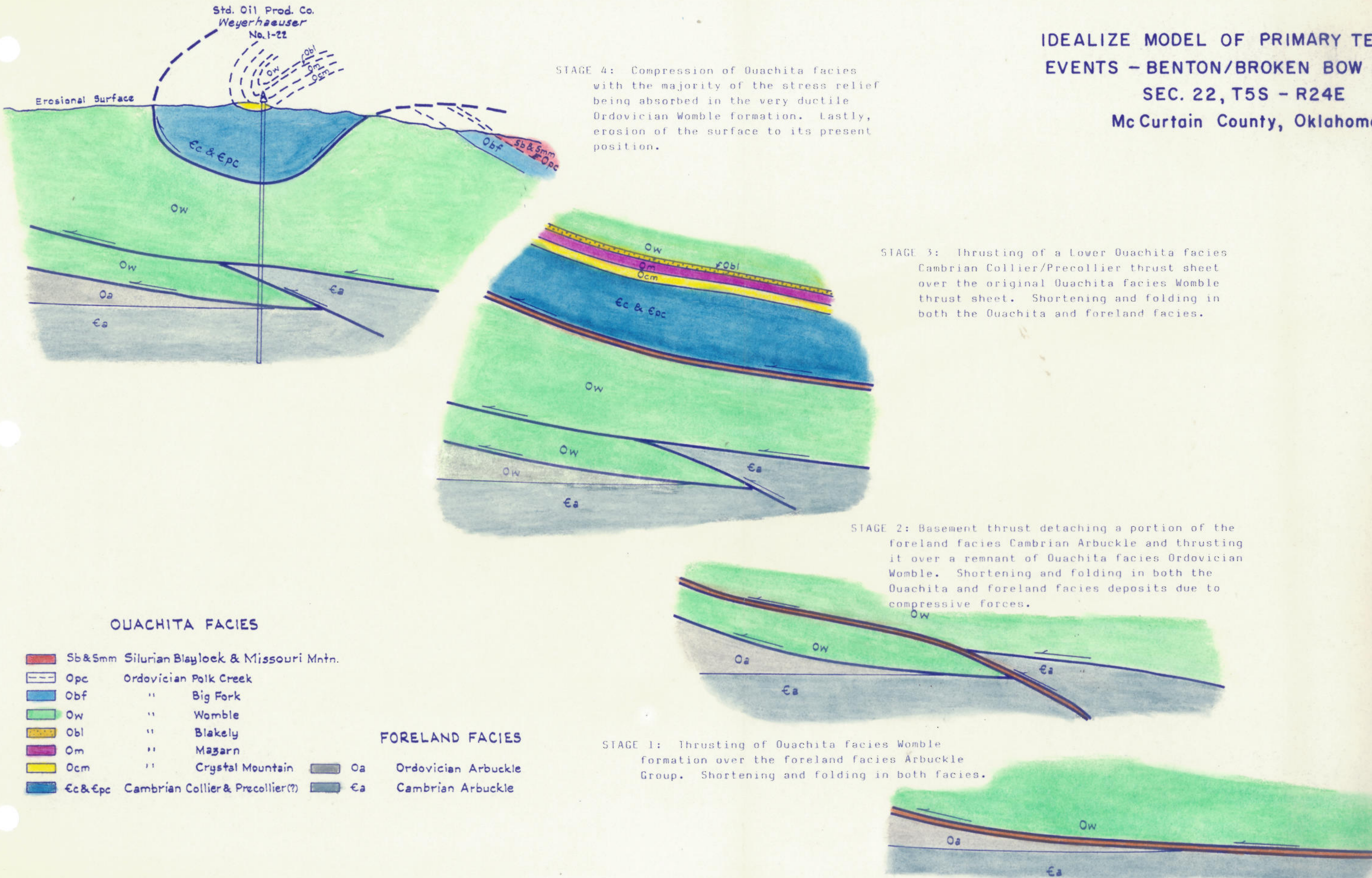


Figure 5:

Ouachita thrust plate over the foreland facies, which in this case is the Ordovician to Cambrian Arbuckle Group. As so often has been recognized in other areas, the most common formation that the Ouachita facies slid upon is the Womble (Flawn in Flawn, et al, 1961). This is apparently because of the high shale content and fluid bedding surfaces within the Womble.

The second stage consists of a basement thrust which detached a portion of the foreland facies and thrust it up and over a Womble interval. This thrust, as has probably happened with extreme frequency, becomes lost within the Womble. A thrust of this nature would shorten the section and create a thickened Womble section, which is commonly observed.

The third stage consists of thrusting a lower Paleozoic Ouachita facies section (pre-Collier, Collier and younger) up and over the thrusted Womble. It would be possible that stage 2 and 3 could have been one simultaneous movement with the stage 3 movement being the force which caused the stage 2 basement thrust.

The fourth stage consists of compression of the system which deformed the stage 3 thrust plane into a large recumbent feature. Lastly, erosion to the present condition of the area occurred.

In the stage four model the thrust fault between the Womble and Collier/pre-Collier, located at 5150' in the # 1-22, is drawn such that it reaches the surface on both sides of the well. In reviewing the surface geology map of this area (Honess, 1923, pl. 1) a NE-SW normal(?) fault is found approximately 3 1/2 miles NW of the # 1-22 (C, sec. 6, T5S, R24E). Also a contact between the Collier and Womble is noted 3/4 mile SE of the well (SE Cor, sec. 22, T5S, R24E). The presence of a normal fault in a strongly compressive tectonic regime is not a very common event, in that a normal fault represents a tensional, rather than compressional, forces. If a compressional, thrust, fault plane could be, due to additional compressive forces, folded into a recumbent attitude then an apparent "normal" fault would exist.

In evaluating the simplistic model presented above, one must realize that folding, fault, and fracturing within each unit has contorted this entire sequence into a very complex system that in most cases is probably to complicated for the mind to comprehend or unravel.

Metamorphism

Flawn in (Flawn, et al, 1961), divided the Ouachita fold belt into two groups. The first is unmetamorphosed, or only slightly metamorphosed, rocks which otherwise exhibit all the normal tectonically deformed features which are normally associated with the Ouachita system. The formations which make up this sequence are normally Womble and younger, and the associated overridden foreland facies deposits are also characteristically unmetamorphosed. This group is normally located in the vicinity of the leading edge of the Ouachita facies thrust sheet. The second group consists of minor to significantly metamorphosed sedimentary rocks which exhibit considerable folding, faulting, shearing, shredding, plastic flow, schistose cleavage, and considerable new mineral growth. Frequently the overridden foreland facies sediments also exhibit metamorphic alteration which is comparable to that that the Ouachita facies sediments have undergone. This zone or belt is normally further back from the leading edge of the thrust sheet, and is frequently referred to as an "interior fold belt". The Broken Bow - Benton uplift is considered to be a part of the interior foldbelt of metamorphosed sediments.

In evaluation of the Hassie Hunt, Neely # 1 (Denison, 1975) and the Viersen and Cochran, Weyerhaeuser # 25-1 (Goldstein, 1975; and Denison, 1977) it was found that both had undergone low to moderate metamorphism with a high shear component and were interpreted to be located in the interior foldbelt of Ouachita facies sediments. Denison (1975) also proved in the Neely # 1 that the metamorphic alteration also extended into the overridden foreland facies.

In evaluation of the Weyerhaeuser # 1-22 the entire well was found to consist of weak to moderate metamorphics which closely resemble the greenschist facies. Some of the metamorphic features observed were extensive folding, flow structures, fracturing, slaty to schistose cleavage, shearing, shredding, and extensive recrystallization.

Spock (1953) defined a type of metamorphism that he referred to as dynamothermal metamorphism. This type of metamorphism is exemplified by strong directed horizontal pressure and moderate to high temperature. In this type one can expect intense folding and it contains nearly all phyllites, schist and many slates, most quartzites and marbles. This type of metamorphism is most commonly associated with major compressional forces, such as thrusting, and rather than being a local phenomenon it is normally associated with regional metamorphic situations. Rocks of the dynamothermal metamorphic type consist of quartzite, marble, phyllite and some schist, with the primary minerals being quartz, chlorite, muscovite and albite of the greenschist facies.

Normal temperature and pressure range for the greenschist facies sediments are 200-400° C and 2000-4000 kg/cm^3 (Spock, 1953). Metamorphism occurs between 200 and 750° C. Above 750° C water facilitates melting of feldspar and quartz, and one would lose the distinction between metamorphic and magmatic.

Within greenschist facies metamorphics certain minerals are more competent than others. Quartz, being competent, is less likely to be altered. Quartz is susceptible to quartz overgrowth and with elevated temperature and pressure to replacement by calcite. Throughout the entire well this quartz overgrowth and calcite replacement was recognized. Less competent than quartz is shale, which is readily recrystallized to graphite sericite and chlorite with commensurate change to the slate - phyllite - schist metamorphic series. Other metamorphic minerals are also present, such as tourmaline, phlogopite, rutile, biotite, pyrite/chalcopyrite and possibly talc. In evaluating the # 1-22, unless one was in close proximity to a fault surface, the grade of metamorphism remained quite uniform.

All limestones, dolomites and sands in the Weyerhaeuser # 1-22 have under gone metamorphism which has destroyed all original porosity. The more argillaceous the rock is the more obvious is the presence of metamorphic alteration. This is not to be construed as meaning that the argillaceous rocks are more intensely metamorphosed.

The effects of metamorphism are also visible on the log response observed. The presence of pyrite/chalcopyrite has driven the resistivity down to approximate 0 ohms in many cases. The destruction of normal bedding surfaces has dramatically altered the dipmeter's usefulness, and the SP tends to be less responsive. In respects to well logs, the problem is that most logs were designed for sedimentary rocks with interpretative theory to match. Metamorphic rocks do not fit this mold. With the addition of numerous unusual mineral suites, the response of some tools can and are dramatically altered.

Reservoir and Source Potential

Denison (1975) observed two consequences of low rank metamorphism in sedimentary rocks. First, due to elevated temperature the organic matter present is frequently altered to elemental carbon, which would end the possibility of a source. Further, any hydrocarbon already generated would be "reduced to methane and carbon residue" (Tissot and Welte, 1978). Metamorphism resulting in greenschist facies sediments would yield a vitrinite reflectance of more than 4%. Secondly, recrystallization is associated with greenschist facies metamorphism. During such conditions original porosity is destroyed by plastic flow, and secondary mineral growth, such as quartz, calcite, dolomite, mica and other minerals. This reduces the possibility of porosity development to fracturing as a general rule, which tends to be very "flashy", hard to predict and hard to interpret.

These rules of reservoir destruction should exist in the Weyerhaeuser # 1-22, in that both the Ouachita facies and foreland facies have both undergone moderate to upper level greenschist metamorphism, except, the foreland facies consists of Arbuckle Group sediments.

The Arbuckle has a strong propensity for pressure solution stylolite development. Apparently, even metamorphism doesn't increase the stability of the calcite and dolomite present to the point that stylolite development is no longer possible. With pressure solution activity and differential solution an extensive fracture system is created. Further, the period of solution along a single stylolite is apparently quite long, which is shown by the large size of some stylocumulate zones. Within the fractured limestones and dolomites are normally dolomite crystals, sand grains and clay residue. What this means is that this unit has had a secondary increase in porosity and permeability by natures own "frac-job".

The potential of such a reservoir, even in these greenschist metamorphics, can be observed by the DST at 13,756-14,250' in the Kindblade(?) section. Flowing pressures increased from 1922# to 6049# and recovery consisted of 13,331' of gas cut saltwater.

Goldstein (1975) in a study of the Viersen and Cochran, Weyerhaeuser # 25-1 determined that due to the metamorphism of the area that one could not expect to find commercial quantities of hydrocarbons due to the destruction of the reservoir porosity and permeability. This may be true for the Ouachita facies, which is what the # 25-1 bottomed in, but not necessarily for the Arbuckle.

The one point that can not be skirted is the destruction of any source that may have existed, and any hydrocarbons in place prior to metamorphism. This is what was observed in the # 1-22 when no visible shows of hydrocarbons were noted, except a few questionable carbon fragments. If the Arbuckle could be located further toward the frontal belt where less metamorphism has occurred the good reservoir qualities of the Arbuckle may prove to be financially significant. Apparently, even rather severe metamorphism can't destroy the potential for development of a usable reservoir within the Arbuckle. Therefore, one should be able to map out features which place the Arbuckle in juxtaposition to a known source, without a major concern of locating a usable reservoir.

M.D. Allison
Consulting Geologist

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