DESCRIPTION OF SELECTED DRILL CORES FROM PALEOZOIC ROCKS, WERTZ OIL FIELD, SOUTH-CENTRAL WYOMING

PART I. WELLS 27 ABC; 46 ABC&E; 42 B; West Wertz 2

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Open-File Report 76-377

1976

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INTRODUCTION

In graphic form, this report describes drill cores from four wells in the Wertz oil field, south-central Wyoming (fig. 1). Wertz 27 ABC well is on the east flank and wells 46 ABC&E, 42 B, and West Wertz 2 are on the west flank of the Wertz anticline. Rocks described are the principal reservoirs for oil in the field, and belong to the Tensleep Sandstone and Amsden Formation of Pennsylvanian age, or to the Darwin Sandstone Member of the Amsden Formation and the Madison Limestone, both of Mississippian age. Table 1 lists the wells, their locations, units described, depths of intervals cored, and persons responsible for the descriptions. This report is the third of a series that describes cores from selected wells in the Lost Soldier, Wertz, Sand Draw, Happy Springs, and Crooks Gap oil fields, Wyoming (Reynolds and others, 1975; Reynolds and Fox, 1976). The text and graphic descriptions have been prepared for open-file release by Mitchell W. Reynolds.

Drill cores described here were provided by Pasco, Inc., Englewood, Colorado, as part of a cooperative program with the U.S. Geological Survey, to study in detail reservoir characteristics in selected producing oil fields of central Wyoming. Careful identification of rock types and successions, stratification types, fractures, mineral cementation, and distribution of oil might aid in predicting kinds, routes, and controls of fluid migration, thereby increasing the efficiency of secondary and tertiary recovery of oil.

Acknowledgments. Pasco, Inc., provided the drill core and financed its slabbing. Thomas F. Manera, Donald R. Holbert, and Ronald D. Brown of

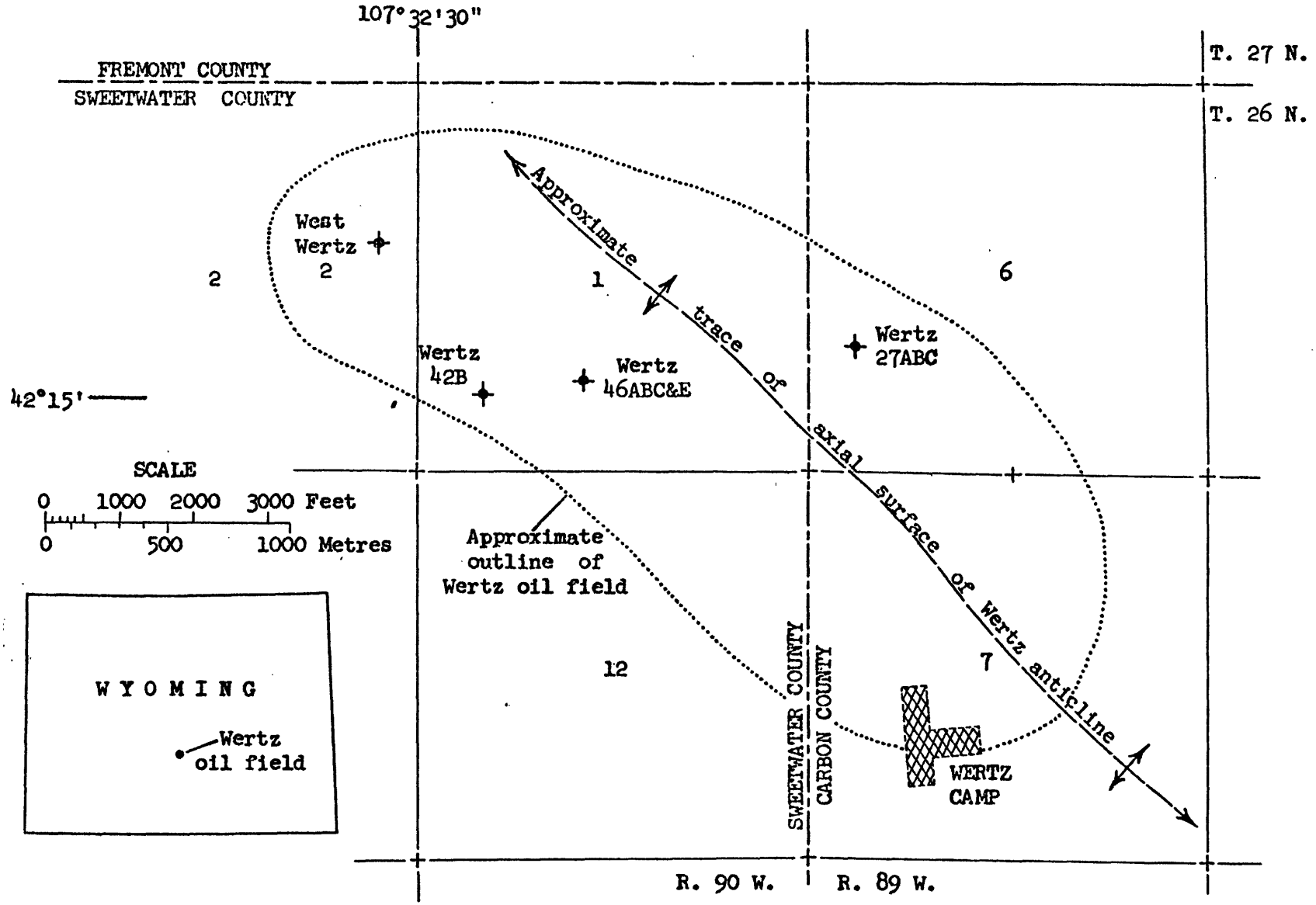

FIGURE 1. — Index map showing location of the Wertz oil field and wells from which drill core is described in this report.

Operator and Well Number	Location and API Well Number	Rock Units Described	Ages of Units	Inclusive Depths Cored (feet)	Studied By
Sinclair Oil and Gas Co. Wertz 27 ABC	SW NW SW sec. 6, T. 26 N., R. 89 W., Carbon County, WY. 49-007-06007	Tensleep Sandstone (part) Amsden Formation (part) Darwin Sandstone Member of Amsden Formation (part) Madison Limestone (part)	Pennsylvanian Pennsylvanian Mississippian Mississippian	6389-6471 6471-6527 6585-6648 6648-6818	Mitchell W. Reynolds Thomas S. Ahlbrandt James E. Fox
Atlantic Richfield Co. Wertz 46 ABC&E	NE SE SW sec. 1, T. 26 N., R. 90 W., Sweetwater Co., WY. 49-037-20335	Tensleep Sandstone (part)	Pennsylvanian	6338-6630	Mitchell W. Reynolds James E. Fox
Sinclair Oil and Gas Co. Wertz 42 B	SE SW SW sec. 1, T. 26 N., R. 90 W., Sweetwater Co., WY. 49-037-06222	Tensleep Sandstone (part) Amsden Formation (part)	Pennsylvanian Pennsylvanian	6769-7162 7185-7221	Mitchell W. Reynolds Thomas S. Ahlbrandt Paul W. Lambert James E. Fox
Sinclair Oil and Gas Co. West Wertz 2	SE NE sec. 2, T. 26 N., R. 90 W., Sweetwater Co., WY. 49-037-06272	Tensleep Sandstone (part)	Pennsylvanian	6926-7209	Mitchell W. Reynolds Thomas S. Ahlbrandt

TABLE 1. — Locations of wells from which cores are described in this report, showing API well numbers, formations with ages, depths of cored intervals, and investigators

Pasco, Inc., provided mechanical logs and some core analyses to the study. C. Keith Fisher, U.S. Geological Survey, facilitated the handling of the core at the U.S. Geological Survey Core Library at Golden, Colorado, where William S. Bruggemeyer and Fred R. Clark transported, arranged, and catalogued the core. Cores described here are available for inspection upon request in advance at the U.S. Geological Survey Core Library, 418 Orchard Street, Golden, Colorado 80401.

METHODS OF STUDY

Drill core examined for this report was slabbed parallel to its long axis, but off-center, to produce slabs about 7.5 cm (3 in.) wide. Most core was not continuous because it had previously been broken and segments had been removed for core analyses, leaving segments 7-29 cm (about 3-11.5 in.) long for the present study. Each segment of slabbed core was inferred to be representative of a full 30-cm (1-ft) interval shown on figures 2-5.

Table 2 summarizes abbreviations used in the graphic descriptions. The abbreviations generally follow those compiled by the A.A.P.G. Committee on Stratigraphic Correlations, as presented by Maher (1964). Tables 3-13 summarize symbols and standards used on the graphic logs and are arranged in their order of occurrence on log headings. Depths shown on the logs are in feet, as generally used by the petroleum industry in the United States. The scale along the edge of the left-hand column is in metres.

Pages of descriptions can be assembled in succession to form con-

tinuous strip logs of the intervals cored.

Examination Procedure. All slabbed core was examined under binocular microscope at magnifications ranging from about 10x to 400x. Spot chemical tests were first made on the slabbed core, then the flat surfaces were moistened with water to increase contrasts and to improve visibility of constituents for microscopic examination. Properties were identified by comparison to published standards (tables 8, 11, 12) or to standards established for this study (tables 3-7, 9, 10). Grain-size and porosity estimates were made through the binocular microscope by comparison to commercially available standards.

Identification of mineral grains and cement types was made visually through the microscope or by using mechanical or chemical tests. To distinguish calcite from dolomite, 0.1 N hydrochloric acid, calibrated first for reaction on carbonate rocks of known composition, was applied to the rock surface. Estimates of the kind and quantity of carbonate cement present were made by judging the relative speed and vigor of effervescence of the minerals in the dilute acid. Color identifications were made by comparison to the "Rock-Color Chart," published by the Geological Society of America (1963).

To test for the presence of oil where saturation was not evident, rock chips were placed in 111-trichloroethane solvent. After standing briefly, the solution was examined under long- and short-wave ultraviolet light for the intensity or absence of fluorescence resulting from the presence or absence of oil. Table 3 shows the symbols used in the graphic descriptions for estimates of different quantities of

oil saturation.

SUPPLEMENTARY DATA

Mechanical and geophysical logs, including induction electrical and laterologs, sonic, gamma ray-neutron, and caliper, were available for the wells described here. However, core depths have not been adjusted to match depths on the logs. Results of core analyses were available for some wells, and this information was incorporated graphically (tables 3 and 5) on the descriptions in the columns for oil shows and porosity (figs. 2-5).

LIMITATIONS OF THE STUDY

Study of the cores described here has been limited to visual inspection under binocular microscope. No thin sections were prepared to confirm identification of clasts, mineral cements, or fabrics; and no X-radiographs or X-ray analyses were made to study sedimentary structures or clay minerals. Because most cores were not continuous, the stratigraphic record of some breaks in sedimentation may not have been preserved.

Directional surveys for the drill holes were not incorporated into the present data. If a hole deviates significantly from a vertical orientation, values for the dip of stratification, cross stratification, or fractures measured on slabbed core may not be true values. Dips recorded on the logs were measured from an imaginary line perpendicular to the core edge; that imaginary line is assumed to be hori-

zontal. From drill-hole-direction information for several wells, we established that dips of algal laminae observed and measured on the core approximate the structural dip in a hole within 4 to 10 degrees. Orientations of the cores either were not recorded at the drill site or were not marked on the cores, and so directions of dip of strata or cross-strata and fractures, or strikes of these elements are generally unresolved.

Visual estimation of porosity is difficult, and estimates differ among observers. Application of the quantitative classification for porosity shown on table 5 to the core descriptions of figures 2-5 is somewhat unequal and is approximate.

Depositional environments were interpreted from rock types, bedding and sedimentary structures, stratification sequences, and, rarely, fossils observed. The general absence of faunal control in the rocks precludes precise correlation of inferred depositional sequences, but approximate correlation of some characteristic sequences is possible. Investigators together examined the cores after describing them to standardize interpretations of depositional environments. Nevertheless, differences of interpretation persist for some intervals, and the senior author is ultimately responsible for the interpretations shown.

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TABLE 2. – Abbreviations for words used in descriptions of drill cores
(Modified from Maher, 1964)

About	abt	Carbonaceous	carb
Above	abv	Cavernous	cav
Abundant	abnt	Caving	cvg
Acicular	acic	Cement, cemented	cmt
Agglomerate	aglm	Center, centered	cntr
Aggregate	agg	Cephalopod	Ceph
Algae, algal	Alg	Chalcedony	chal
Altered, altering	alt	Chalk, chalky	chk
Amorphous	amor	Chert	cht
Amount	amt	Cherty	chty
And	&	Chitin, chitinous	chit
Angular, angle	ang	Chlorite,chloritic	chl
Anhedral	anhed	Clastic	clas
Anhydrite, anhydritic	anhy	Clay, clayey	cly
Aphanocrystalline	aphoxl	Claystone	clyst
Apparent	apr	Clean	cln
Appears	aprs	Clear	clr
Approximate, approximately	aprox	Cluster	cls
Aragonite	arag	Coarse, coarsely	c
Arenaceous	aren	Cobble	cbl
Argillaceous	arg	Color, colored	col
Arkose, arkosic	ark	Common	com
Asphalt, asphaltic	asph	Compact	cpct
At	@	Concentric	cncn
Average	av	Conchoidal	conch
Band, banded	bnd	Concretion, concretionary	conc
Barite, baritic	bar	Conglomerate	cgl
Basalt	bas	Conodont	Cono
Bed	bd	Contact	ctc
Bedded	bdd	Contorted	cntrt
Bedding	bdg	Coquina	coq
Bentonite, bentonitic	bent	Covered	cov
Biotite	biot	Crenulated	cren
Bioturbated	bioturb	Crevice	crev
Bitumen, bituminous	bit	Crinkled	crnk
Black	blk	Crinoid, crinoidal	Crin
Block, blocky	blky	Crossbedded	xbd
Blue, bluish	bl	Crossbedding	xbdg
Botryoidal	btry	Cross-laminated	xlam
Boulder	bldr	Cross-stratified	xstrat
Brachiopod	Brac	Cryptocrystalline	crpxl
Breccia, brecciated	brec	Cryptograined	crpgr
Bright	bri	Crystal, crystalline	xl
Brittle	brit	Cuttings	ctgs
Brown	brn	Dark	dk
Bryozoa	Bry	Dead	dd
Calcite, Calcareous	Calc	Debris	deb

TABLE 2.—Abbreviations for words used in descriptions of drill cores — Continued

Decrease, decreasing	decr	Friable	fri
Dendritic	dend	Frosted	fros
Dense	dns	Fusulinid	Fus
Determine	dtrm	Gabbro	gab
Detrital, detritus	dtrl	Gastropod	Gast
Diameter	dia	Glassy	gl
Difference	dif	Glauconite, glauconitic	glauc
Disseminated	dism	Gloss, glossy	glos
Dolocast, dolocastic	dolc	Gneiss	gns
Dolomite, dolomitic	dol	Good	g
Dolomold, dolomoldic	dolmd	Grade, grades, graded	grd
Dolostone	dolst	Grading	grdg
Druse, drusy	drsy	Grain, grained	gr
Earthy	rthy	Granite	grnt
Echinoid	Ech	Granular	gran
Elliptical	elip	Granule	grnl
Elongate	elg	Graptolite	Grap
Embedded	embd	Gravel	gvl
Enlarged	enl	Gray	gy
Equivalent	equiv	Graywacke	gywke
Euhedral	euhed	Greasy	gsy
Evaporitic	evap	Green	gn
Expose, exposed, exposure	exp	Gritty	grty
Extrusive, extrusive	extr	Gypsum, gypsiferous	gyp
Faceted	fac	Hackly	hky
Faint	fnt	Hard	hd
Fair	fr	Heavy	hvy
Fault	flt	Hematite, hematitic	hem
Fauna	fau	Hexagonal	hex
Feldspar, feldspathic	fld	High	hi
Ferruginous	Fe	Horizontal	hztl
Fibrous	fib	Hydrocarbon	hydc
Figured	fig	Igneous	ig
Fine, finely	f	Imbedded	imbd
Fissile	fis	Impression	imp
Flaggy	flgy	Inclusion, includes	incl
Flake	flk	Increase, increasing	incr
Flaky	flky	Indistinct	indst
Flat, flattened	flat	Indurated	ind
Floating	fltg	Interbedded	intbd
Fluorescence	flor	Intercalated	intcl
Foliated	fol	Intercrystalline	intxl
Foraminifera	Foram	Interfingered	intfr
Formation	fm	Intergranular	intrgr
Fossil, fossiliferous	fos	Intergrown	intgwn
Fracture, fractured	frac	Interlaminated	intlam
Fragment, fragmental	frag	Interstitial	intstl
Fresh	frs	Interval	intv

TABLE 2. — Abbreviations for words used in descriptions of drill cores — Continued

Intraformational	intfm	Minimum	min
Intrusion, intrusive	intr	Minor	mnr
Invertebrate	invrtb	Minute	mnut
Iron	Fe	Moderate	mod
Ironstone	Fest	Mollusca	Mol
Irregular	ireg	Mottled, mottling	mot
Irridescent	irid	Mudstone	mdst
Jasper, jasperoid	jasp	Muscovite	musc
Jointed	jtd	Nacreous	nac
Joints	jts	No, non-	n.
Kaolin	kao	Nodule, nodular	nod
Laminated	lam	Normal	nor
Large, larger	lrg	Numerous	num
Lavender	lav	Object	obj
Leached	lchd	Ochre	och
Ledge	ldg	Odor	od
Lenticular, lentil	len	Oil	o
Light, lighter	lt	Oil sand	o. sd
Lignite, lignitic	lig	Oil stain	o. stn
Limestone	ls	Olive	olv
Limonite, limonitic	lmn	Oolicast, oolicastic	ooc
Limy	lmy	Oolite, oolitic	ool
Lithic, lithology	lith	Oomold, oomoldic	oom
Little	ltl	Opaque	op
Local	loc	Orange	orng
Long	lg	Organic	org
Loose	lse	Orthoclase	orth
Lower	low	Ostracode	Ost
Lumpy	lmpy	Oxidized	ox
Luster	lstr	Part, partly	pt
Magnetite or magnetic	magn	Parting	ptg
Marlstone	mrlst	Pearl, pearly	prly
Maroon	mar	Pebble	pbl
Massive	mas	Pebbly	pbly
Material, matter	mat	Pelecypod	Plcy
Matrix	mtx	Pellet, pelletal	pel
Maximum	max	Permeability	perm
Median	mdn	Petroleum, petroliferous	pet
Medium	m	Phosphate, phosphatic	phos
Member	mbr	Pink	pk
Metamorphic	meta	Pin-point	p-p
Mica, micaceous	mica	Pisolite, pisolitic	piso
Microcrystalline	micxl	Pitted	pit
Microfossil (-iferous)	micfos	Plagioclase	plag
Micrograined	micgr	Plant fossils	pl fos
Micro-micaceous	mic-mica	Plastic	plas
Middle	mid	Platy	plty
Mineral, mineralized	mnrl	Polish, polished	pol

TABLE 2. — Abbreviation for words used in descriptions of drill cores — Continued

Poor, poorly	p	Siderite, sideritic	sid
Porcelaneous	porc	Silica, siliceous	sil
Porosity, porous	por	Silky	slky
Possible, possibility	pos	Silt	slt
Predominate, predominantly	pred	Siltstone	sltst
Preserved, preservation	pres	Silty	slty
Primary	prim	Size	sz
Prism, prismatic	pris	Slabby	slab
Probable, probably	prob	Slickensides, slickensided	sks
Prominent, prominently	prom	Slight, slightly	sl
Pseudo-	psdo	Slump, slumped	slmp
Purple	purp	Small	s
Pyrite, pyritized	py	Smooth	sm
Pyrobitumen	pyrbit	Soft	sft
Pyroclastic	pyrclas	Solution	sol
Quartz	qtz	Sort	srt
Quartzite	qtzt	Sorted	srtd
Quartzitic	qtzc	Sorting	srtg
Quartzose	qtzs	Speck, speckled	spec
Radiate, radiating	rad	Sphalerite	sphal
Range, ranging	rng	Spherules	sph
Rare	rr	Spicule, spicular	spic
Regular	reg	Splintery	splty
Relict	rel	Sponge	Spg
Remains, remnant	rmn	Spore	Spr
Replace, replacing (-ment)	repl	Spot, spotted, spotty	sp
Residue, residual	resd	Stain, stained, staining	stn
Resinous	rsns	Stippled	stip
Reverse	rev	Stone	st
Rhomb, rhombic	rhmb	Strata, stratified,-cation	strat
Rock	rk	Streak	str
Round, rounded	rd	Striated	stri
Rubbly	rbly	Stringer	strg
Sample	spl	Stromatoporoid	Strom
Sand	sd	Structure	struc
Sandstone	ss	Stylolite	styl
Sandy	sdy	Subangular	sbang
Saturated, saturation	sat	Subhedral	sbhed
Scale, scales	sc	Subrounded	sbrd
Scarce	scs	Sucrose	suc
Scattered	scat	Sulphur	S
Schist	sch	Surface	surf
Scolecodonts	Scol	Tabular	tab
Secondary	sec	Texture	tex
Sediment, sedimentary	sed	Thick	tk
Selenite	sel	Thin	tn
Shadow	shad	Throughout	thru
Shale	sh	Tight, tightly	tt
Shaly	shy		

TABLE 2. — Abbreviations for words used in descriptions of drill cores — Continued

Trace	tr
Translucent	trnsl
Transparent	trnsp
Trilobite	Trilo
Tripoli, tripolitic	trip
Tubular	tub
Tuffaceous	tuf
Unconformity	unconf
Unconsolidated	uncons
Upper	up
Variable	var
Varicolored	vcol
Variegated	vgt
Varved	vrvd
Vein	vn
Vertebrate	vrtb
Vertical	vtcl
Very	v
Vesicular	ves
Vitreous	vit
Volcanic, volcanics	volc
Vug, vuggy, vugular	vug
Water	wtr
Wavy	wvy
Waxy	wxy
Weather, weathered	wthr, wthrd
Well	w
White	wh
With	w/
Without	w/o
Yellow	y
Zone	zn

TABLE 3. — Symbols used for shows of oil in descriptions of well cores

o	Trace of oil in cut with 111-trichloroethane solvent
◐	Spotty, but significant show of oil in interval
●	Good cut of oil, commonly with streaming, in interval
▮	Extensive oil saturation throughout interval

TABLE 4. — Symbols and abbreviations used for fractures in descriptions of well cores

\	Single planar or nearly planar fracture in core segment
\\	A few planar or nearly planar fractures in core segment
\\\\	Common planar or nearly planar fratures in core segment
	Abundant planar or nearly planar fractures in core segment
	Common curved anastomosing fractures
op	Open fracture
h	Healed fracture
oh or hop	Open and healed fractures in same interval
\75°	Fracture(s) dip 75° with respect to an imaginary line normal to core edge
\25-57°	Several fractures with dips ranging from 25-57° with respect to an imaginary line normal to core edge

TABLE 5. – Abbreviations and symbols for porosity types and quantities used in descriptions of drill cores

Abbreviations

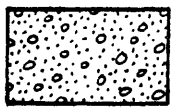
intrgr	intergranular
intrxl	intercrystalline
frac	fracture
frac;intrgr	fracture and intergranular
vug	vuggy
moldic	moldic
dolmd	dolomoldic

Intervals for graph on log heading "Visual Porosity Estimate"

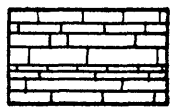
Interval	Approximate Value
None	0 to < 1 percent
Poor	1 to 10 percent
Good	10 to 20 percent
Excellent	>20 percent

(Visual estimates and recording estimates may vary somewhat among investigators)

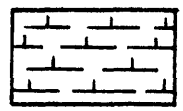
TABLE 6. —Symbols for general rock types and selected minerals used in graphic descriptions of drill cores



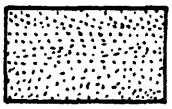
Conglomerate



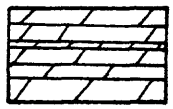
Limestone



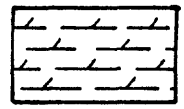
Calcareous



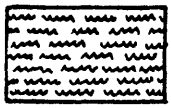
Sandstone



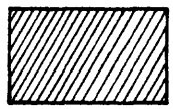
Dolostone



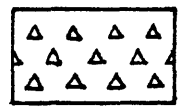
Dolomitic



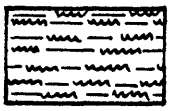
Siltstone



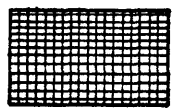
Gypsum



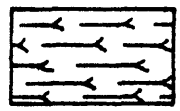
Chert



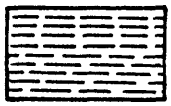
Mudstone



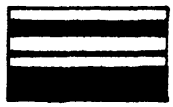
Salt



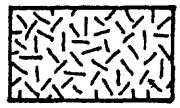
Tuff, tuffaceous, bentonite (-ic)



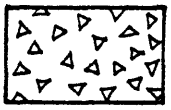
Claystone



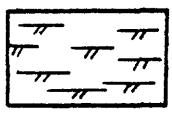
Coal



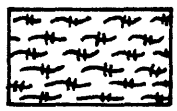
Granite



Breccia



Anhydritic



Schist, schistose

Anhydrite nodule

Chert nodule

G

Glauconite

TABLE 7. – Abbreviations for colors used in descriptions of drill cores

Black	blk
Blue, bluish	bl
Brilliant	blt
Brown, brownish	brn
Clear	clr
Color, colored	col
Colorless	clss
Dark	dk
Dusky	dsk
Gray, grayish	gy
Green, greenish	gn
Lavender	lav
Light, lighter	lt
Maroon	mar
Medium	m
Ochre	och
Olive	olv
Orange	orng
Pale	p
Pink	pk
Red	r
Purple	purp
Tan	t
Varicolored	vcol
Variegated	vgt
Very	v
White	wh
Yellow, yellowish	y

Names and numbers (for example 10YR6/2) for colors used in descriptions of drill cores are from Rock-Color Chart (Geological Society of America, 1963)

TABLE 8. – Grain-size scales for detrital and carbonate rocks

WENTWORTH SCALE FOR GRAIN SIZE OF DETRITAL ROCKS

Sediment Name	Size Limits (metric)	Approximate English (common) Equivalents
Clay	<1/256 mm	<0.00015 in.
Silt	1/256– 1/16 mm	0.00015– 0.002 in.
Very fine sand	1/16– 1/8 mm	0.002 – 0.005 in.
Fine sand	1/8– 1/4 mm	0.005 – 0.01 in.
Medium sand	1/4– 1/2 mm	0.01 – 0.02 in.
Coarse sand	1/2– 1 mm	0.02 – 0.04 in.
Very coarse sand	1 – 2 mm	0.04 – 0.08 in.
Granule gravel	2 – 4 mm	0.08 – 0.15 in.
Fine pebble gravel	4 – 8 mm	0.15 – 0.3 in.
Medium pebble gravel	8 – 16 mm	0.3 – 0.6 in.
Coarse pebble gravel	16 – 32 mm	0.6 – 1.2 in.
Very coarse pebble gravel	32 – 64 mm	1.2 – 2.5 in.
Cobble gravel	64 –256 mm	2.5 –10 in.
Boulder gravel	>256 mm	>10 in.

■◦ or ◦■◦ denotes range in grain size in interval on log, with maximum at heavy bar

TABLE 8. — Grain-size scales for detrital and carbonate rocks — Continued

GRAIN-SIZE SCALE FOR CARBONATE ROCKS

(From Folk, 1968, p. 162)

Quantitative ranges modified from Wentworth size scale
Terms for transported constituents modified from Grabau

	Transported Constituents	Authigenic Constituents	
64 mm	Very Coarse calcirudite	(7) Extremely coarsely crystalline	
16 mm	Coarse calcirudite		
4 mm	Medium calcirudite		4 mm
1 mm	Fine calcirudite	(6) Very coarsely crystalline	1 mm
0.5 mm	Coarse calcarenite	(5) Coarsely crystalline	
0.25 mm	Medium calcarenite		0.25 mm
0.125 mm	Fine Calcarenite	(4) Medium crystalline	
0.062 mm	Very fine calcarenite		0.062 mm
0.031 mm	Coarse Calcilutite	(3) Finely crystalline	
0.016 mm	Medium calcilutite		0.016 mm
0.008 mm	Fine Calcilutite	(2) Very finely crystalline	
0.004 mm	Very fine calcilutite		0.004 mm
0.002 mm		(1) Aphanocrystalline	
0.001 mm			0.001 mm

TABLE 9. — Abbreviations and symbols for bedding and sedimentary structures used in descriptions of drill cores. (Compiled for this study by scientists of the U.S. Geological Survey)

THICKNESS OF BEDDING

Abbreviation	Thickness and splitting description	Scale	
		cm	in.
vtk	very thickly bedded; massive	>100	>40
tk	thickly bedded; blocky	30 - 100	12 - 40
av	average bedded; slabby	10 - 30	4 - 12
tn	thinly bedded; flaggy	3 - 10	1.2 - 4
vtn	very thinly bedded	1 - 3	0.4 - 1.2
l	laminated; platy, shaly	0.3- 1	0.12 - 0.4
tnl	thinly laminated; papery, fissile	<0.3	<0.12
h	homogeneous; massive		

CROSSBEDDING

10° General crossbedding; 10° angle of inclination, south

Abbreviation	Scale	Thickness of bed sets
s	small scale	< 5 cm
m	medium scale	5cm - 2 m
l	large scale	2 m - 8 m
vl	very large scale	> 8 m
t	tabular	
wp	wedge planar	

Abbreviation	Symbol	Type of bedding
ad		antidune
tr		trough (festoon)
cu		convex upward
hb		herringbone
cc		centroclinal

TABLE 9. – Abbreviations and symbols for bedding and sedimentary structures used on descriptions of drill cores. – Continued

GRADED BEDDING

Abbreviation	Symbol	Type of grading
ngrd		normal (becoming finer upward)
rgrd		reverse (coarsening upward)
cgrd		cyclic (within a bed)

LAMINATIONS

Abbreviation	Symbol	Type of lamination
mxlam		microcross-lamination
e‖		even parallel
w‖		wavy parallel
de‖		discontinuous even parallel
dw‖		discontinuous wavy parallel
c‖		curved parallel
dc‖		discontinuous curved parallel
en‖		even nonparallel
den‖		discontinuous even nonparallel
wn‖		wavy nonparallel
dwn‖		discontinuous wavy nonparallel
conv		convolute

CLAST ORIENTATION

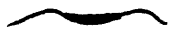
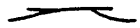
Abbreviation	Symbol	Type of orientation
imbr		imbricated
hztl		horizontal
vert		vertical
obq		oblique

RIPPLES

Abbreviation	Symbol	Type of ripple
gen		general
asym		asymmetric
sym		symmetric

TABLE 9. – Abbreviations and symbols for bedding and sedimentary structures used on descriptions of drill cores. – Continued

RIPPLES (Contd)

Abbreviation	Symbol	Type of ripple
clbg		climbing
fsr		flaser
tncd		truncated

BEDDING PLANE MARKINGS

 sole marking

 surface markings

Abbreviations	Symbol	Type of marking
bsh		brush
b		burrow (see trace fossils)
cst		cast
bp		bubble pit
grv		groove
gp		gas pit
h		hail
mld		mold
mc		mud cracks
rp		rain print
stri		striae
slt		salt casts
wvs		wave and swash
om		other

TABLE 9. – Abbreviations and symbols for bedding and sedimentary structures used on descriptions of drill cores. – Continued

DEFORMED BEDDING

Symbol	Type of deformed bedding
	small scale fault
	fracture
	slickenside
	slump
	load cast
	flute cast
	burrow (mottled or churned sediment)
	flame or wisp
	dish
	contorted
BP	ball and pillow
pn	pseudonodules
	dikes and wedges I ice sh shale ss sandstone
	boudinage
	cone-in-cone
	shatter cone
	pull apart
	brecciation

TABLE 9. — Abbreviations and symbols for bedding and sedimentary structures used on descriptions of drill cores — Continued

MISCELLANEOUS STRUCTURES

Symbol	Type of structure
	concretion
	scour and fill
	stylolite
	geopetal fill
	nodules
	veinlets
	solution features
	geode
	faceted grain
	clasts c carbonate sh shale ss sandstone ru rip-up i igneous mt metamorphic o other
	balls ac armored clay md mud sw sandstone whirl
	pattern cone
	oolite
	pisolite
	oncolite

TABLE 10. – Symbols and abbreviations for biologic constituents observed in drill cores. (Compiled for this study by scientists of the U.S. Geological Survey)

	Algae, framework (green and red)
	Algae, nonframework (blue-green)
	Belemnite
	Bone and teeth
	Brachiopod
	Bryozoa
	Cephalopod (ammonite, nautiloid)
	Charophyte
	Conodont
	Coral
	Crinoid or Blastoid
	Decapod Crustacean
	Echinoid, stelleroid, or asteroid
	Foraminifera
	Gastropod
	Insect
	Ostracode
	Pelecypod
	Plant remains
	Scaphopod
	Sponge spicules
	Spores and pollen
	Stromatoporoid
	Tracks, type unspecified
	Trails, type unspecified
	Trilobite
	Worm tube, calcareous

TABLE 10. – Symbols and abbreviations for biologic constituents observed in drill cores.– Continued

SYMBOLS FOR SELECTED TRACE FOSSILS

	Ophiomorpha
	Thalassinoides
	Arenicolites
	Diplocraterion and Rhizocorallium
	Chondrites
	Asterosoma, form rod-shaped burrows
	Siphonites
	Teichichnus
	Arthrophycus
	Asterosoma, form helicoid funnel
	Nondescript horizontal tracks, trails, and burrows
	Nondescript vertical burrows
	Zoophycus

TABLE 10. – Symbols and abbreviations for biologic constituents observed in drill cores. – Continued

(Terminology from Scott, 1970)

PRESERVATION

OR	Original material
RE	Replaced or recrystallized material

DISPERSION

U	Uniform
R	Random
C	Clumped

DENSITY

FD	Few -- less than 10 percent fossils per unit area
SD	Some -- 10-50 percent fossils per unit area
MD	Many -- more than 50 percent fossils per unit area

ORIENTATION

Long axis of fossil or commissural plane of fossil

Pl	Parallel to bedding	CU	Convex up
Pd	Perpendicular to bedding	CD	Convex down
Ob	Oblique to bedding		

DISSOCIATION OF HARD PARTS

A%	Percent articulated
D%	Percent disarticulated
L%	Percent left valve
R%	Percent right valve

FRAGMENTATION OF REMAINS

MF	Many -- greater than 30 percent broken fragments
SF	Some -- less than 30 percent broken fragments

SIZE SORTING OF ABUNDANT SPECIES

WS	Well sorted -- equal-sized specimens of each species
MS	Moderately sorted -- some specimens of different sizes
PS	Poorly sorted -- wide range in size of specimens

FAUNAL COMPOSITION

HM	Homogeneous -- species preserved together preferring same habitat
HT	Heterogeneous -- species preserved together and suggestive of different habitat

MODE OF ORIGIN

IP	In-place assemblage
DN	Disturbed-neighborhood assemblage
T	Transported assemblage
	Mixed (prefix above categories with "M" if faunal composition is heterogeneous

TABLE 10. — Symbols and abbreviations for biologic constituents observed in drill cores — Continued

ABBREVIATIONS FOR PRESERVATION AND ORIENTATION OF FOSSILS

(From Fox, 1971, p. 155)

ABBREVIATIONS

A	articulated valves
BR	branching
C	contact between fossil and matrix
CA	calcite
CL	closed valves
D	disarticulated valves
FR	fragmented
I	inner surface of shell
L	lift valve
M	external mold
O	outer surface of shell
OP	open valves
OR	original material
R	right valve
RE	replaced or recrystallized shell material
S	sediment fill
ST	stacked shells
ni	no information
rand	random
clump	clumped

EXAMPLE OF USE

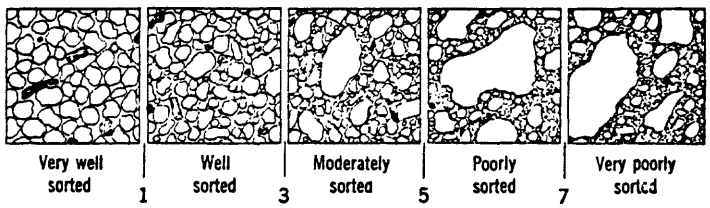
Faunal element	Preservation
Corbula sp.	CL-A; OR; I-C-S

Interpretation: Corbula sp. shells are closed, articulated, and composed of original shell material; the inner surface of the shell is in contact with a matrix of sediment.

TABLE 11. – Charts for estimating degrees of sorting as seen in two dimensions and degrees of roundness of detrital grains (From Compton, 1962, p. 214-215)

DEGREES OF SORTING AS SEEN IN TWO DIMENSIONS

Abbreviations on core descriptions vw w m p vp



Terms for degrees of sorting. The numbers indicate the number of size-classes included by the great bulk (80 percent) of the material. The drawings represent sandstones as seen with a hand lens. Silt and clay-size materials are shown diagrammatically by the fine stipple.

DEGREES OF ROUNDNESS OF DETRITAL GRAINS

Abbreviations on core Descriptions v ang ang sbang sbrd rd w rd

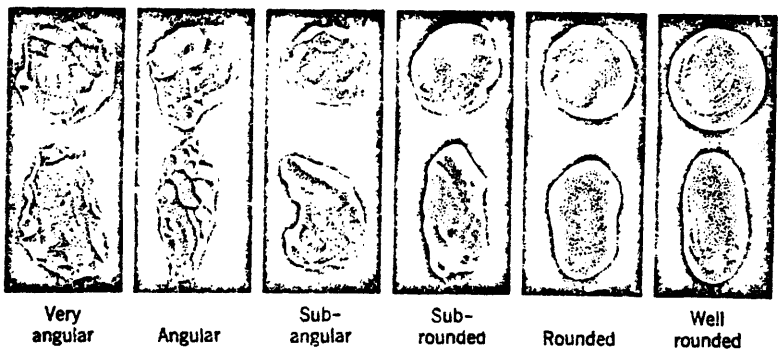


TABLE 12. – Chart for visual estimation of percentage composition (Prepared by R. D. Terry and G. V. Chilingar, 1955, Jour. Sed. Petrology, v. 25, no. 3, p. 229-234, and reproduced here from Compton, 1962. p. 332-333.)

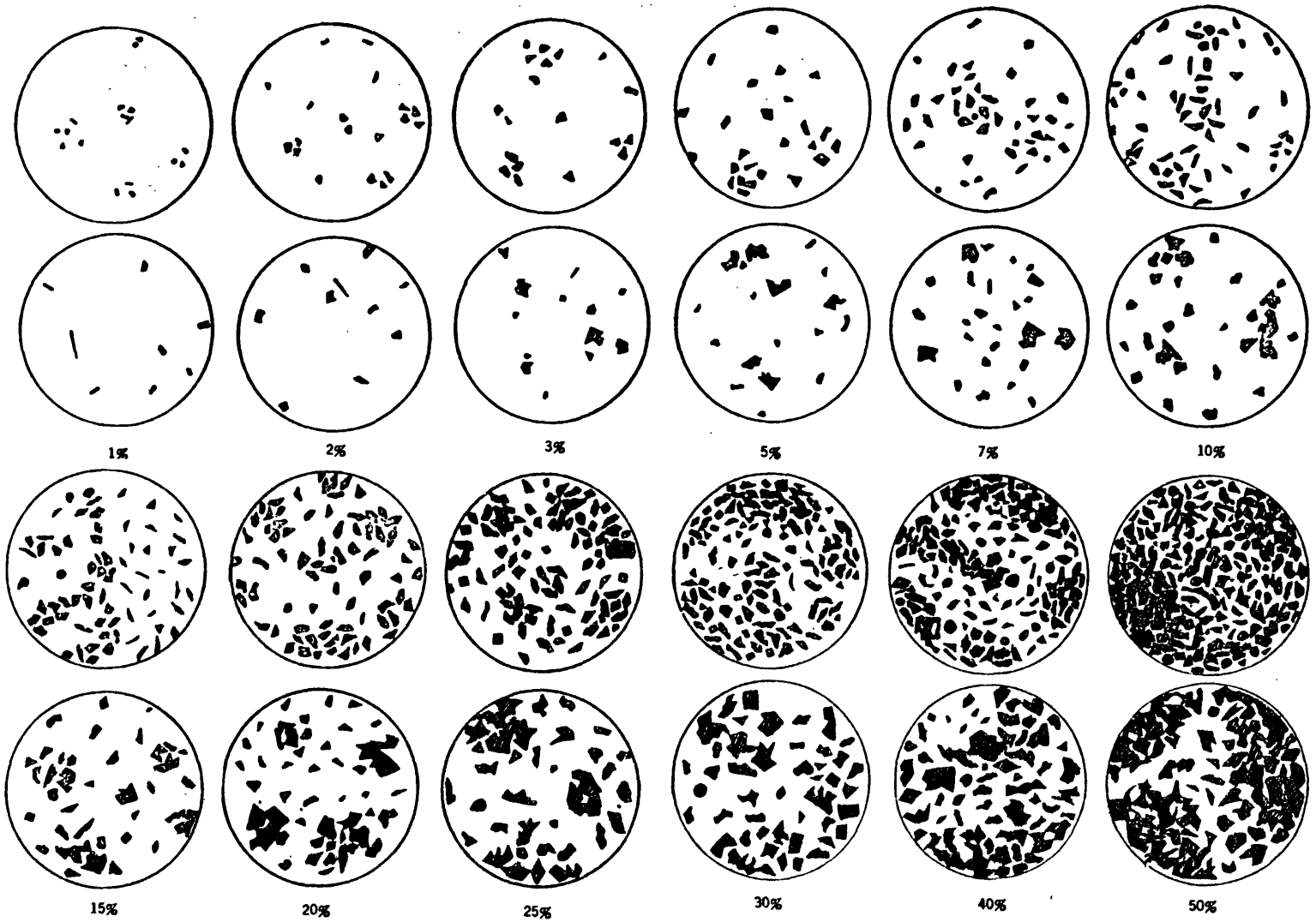
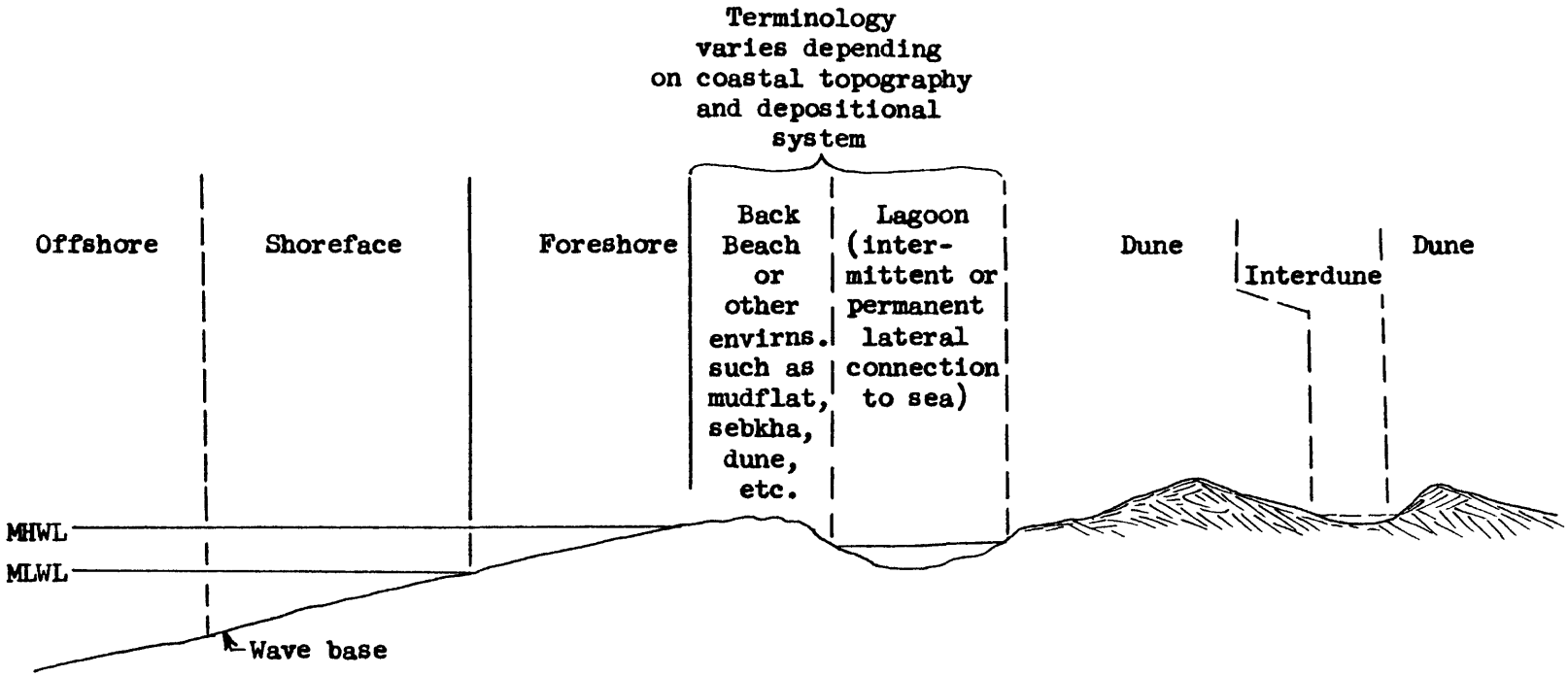
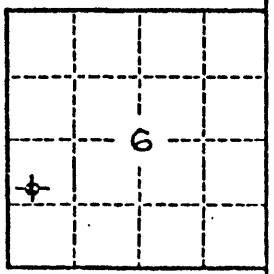


TABLE 13. — Nomenclature used for inferred environments of deposition of terrigenous clastic sedimentary rocks described from drill cores in this report



LOCATION SW.NW.SW. Sec. 6 T. 26 N. R. 89 W.
1670 ft. N. / S. line 630 ft. E. / W. line
STATE WYOMING COUNTY CARBON
U.S.G.S. CORE LIBRARY NUMBER A300 API WELL NUMBER 49-007-06007
COMPANY NAME SINCLAIR OIL AND GAS COMPANY
LEASE NAME WERTZ 27 ABC
AREA / FIELD WERTZ OIL FIELD



ELEVATION KB ft m
GL 6921 ft 2111 m
TOTAL DEPTH 6365 ft 1941 m
Redrill 7055 2152 m
FORMATION AT SURFACE
STEELE SHALE
OLDEST FORMATION PENETRATED
CAMBRIAN ROCKS, UNDIVIDED
FORMATION AT TOTAL DEPTH
CAMBRIAN ROCKS UNDIVIDED
COMMENCED
6/11/62
COMPLETED
11/6/62
CASING (size; depth)
13 3/8" @ 451 w/300; 7" @ 6000 w/700

PRODUCING FORMATION(S)
DARWIN SANDSTONE MEMBER OF AMSDEN FORMATION

PRODUCING INTERVALS AND PRODUCTION DATA
6568-6634 ft gross; perF; IPP 64 BOPD

FORMATIONS CORED AND INTERVALS
TENSLEEP SANDSTONE (part) 6389-6471 ft
AMSDEN FORMATION (part) 6471-6527 ft
DARWIN SANDSTONE MEMBER OF AMSDEN FM. 6585-6648
MADISON LIMESTONE (part) 6648-6818 ft.

MECHANICAL/GEOPHYSICAL LOGS AVAILABLE; DEPTHS RUN
LATEROLOG
MICROLOG WITH CALIPER
GAMMA RAY-NEUTRON LOG
COMPENSATED DENSITY LOG
LOG DEPTH FROM GL

REMARKS
DESCRIPTION FROM SLABBED CORE, 7-30 cm segments per 30 cm depth

STUDIED BY: J.E. FOX 6389-6527; 6730-6755
T.S. AHLBRANDT 6585-6730 M.W. REYNOLDS 6755-6818 DATE January, 1975

LOCATION SW.NW.SW. Sec. 6 T. 26 N. R. 89 W.
STATE WYOMING COUNTY CARBON
COMPANY AND LEASE NAME SINCLAIR OIL & GAS CO., WERTZ 27 ABC
U.S.G.S. CORE LIBRARY NUMBER A300 API WELL NUMBER 49-007-06007

FIGURE 2. – Description of drill core from Sinclair Oil and Gas Company Wertz 27 ABC well

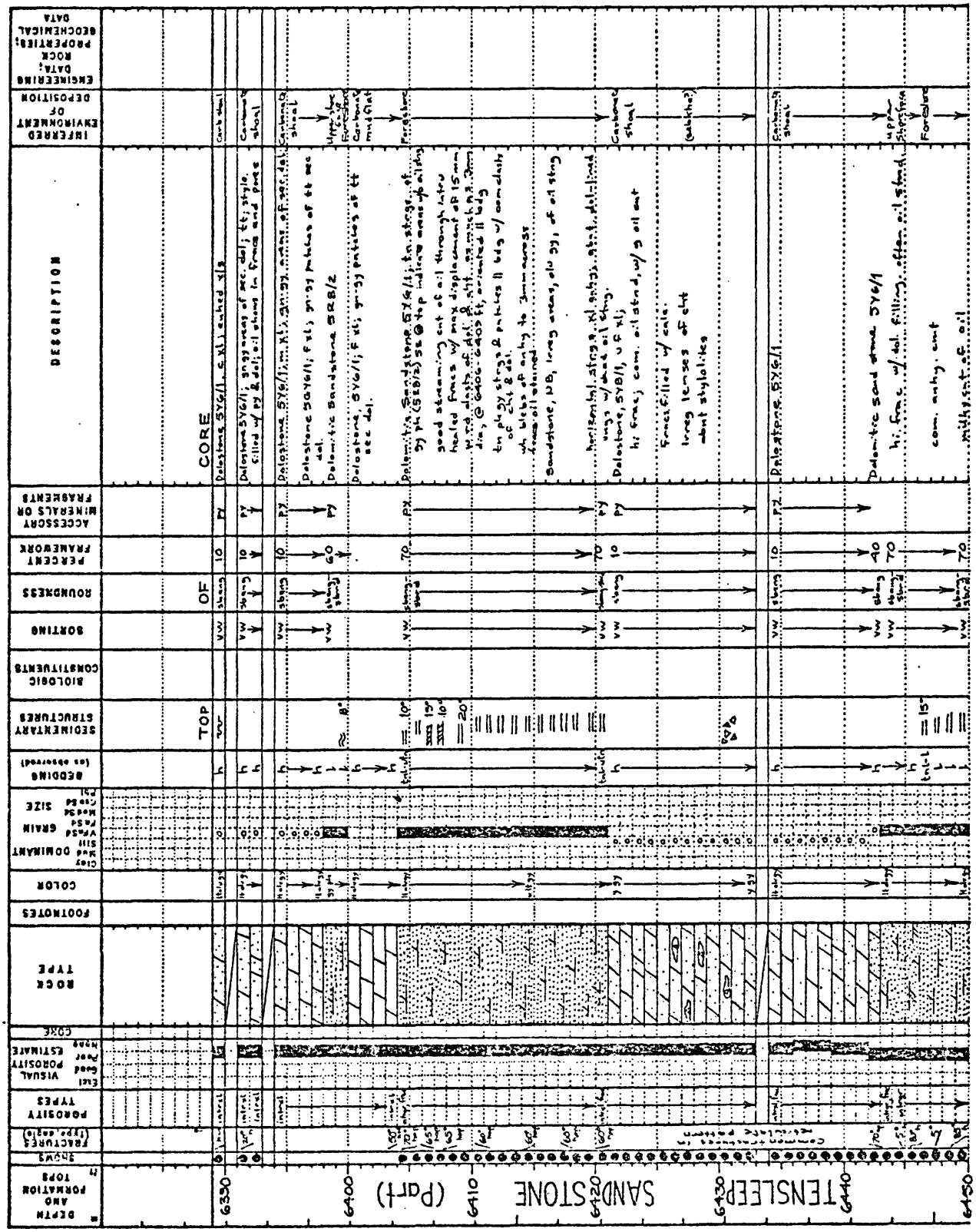


FIGURE 2. -- Description of drill core from Sinclair Oil and Gas Company Wertz 27 ABC well -- Continued

LOCATION SW NW SW Sec. 6 T. 26 N. R. 89 W.
STATE WYOMING COUNTY CARBON
U.S.G.S. CORE LIBRARY NUMBER A300 API WELL NUMBER 49-007-06007

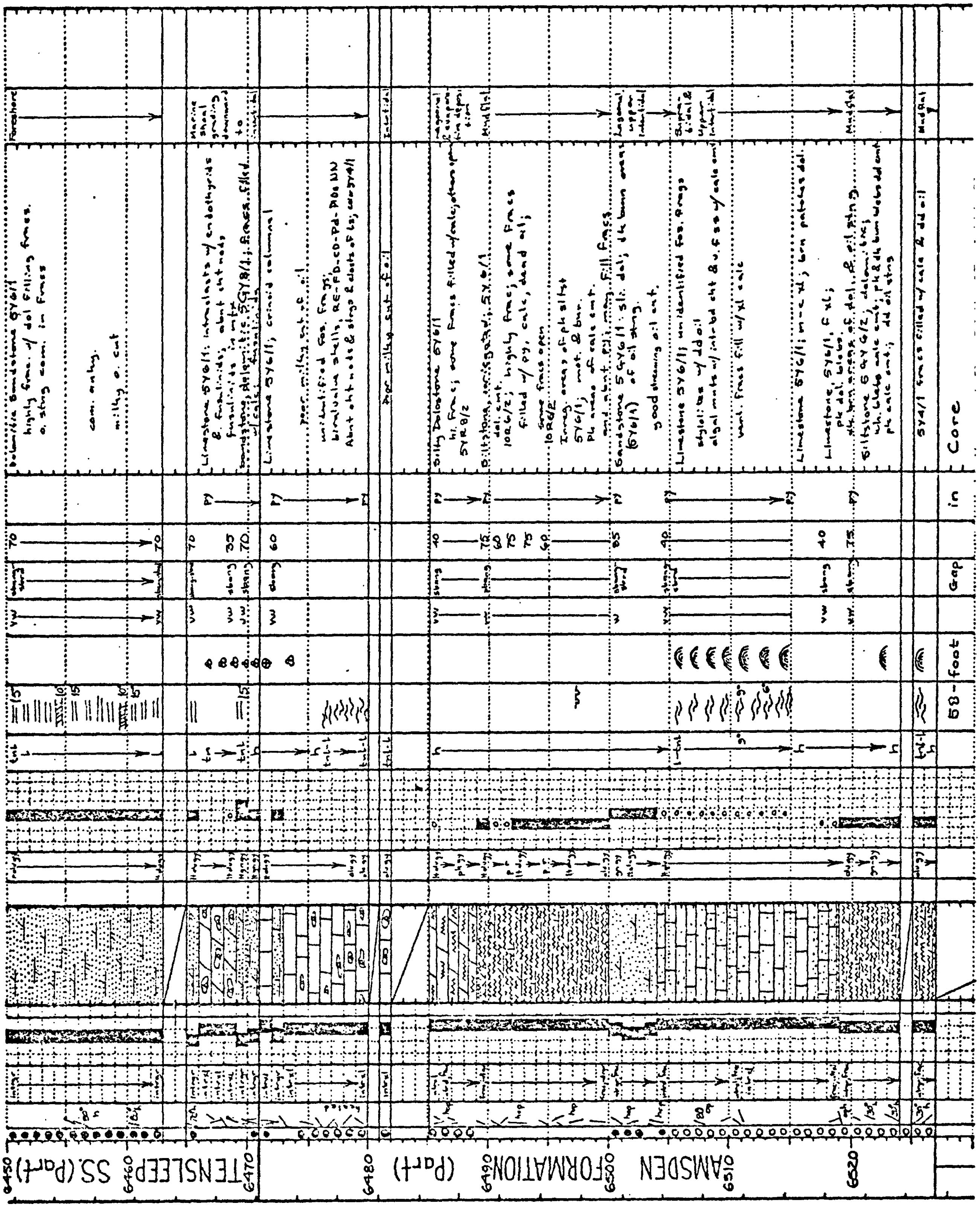


FIGURE 2. — Description of drill core from Sinclair Oil and Gas Company Wertz 27 ABC well — Continued

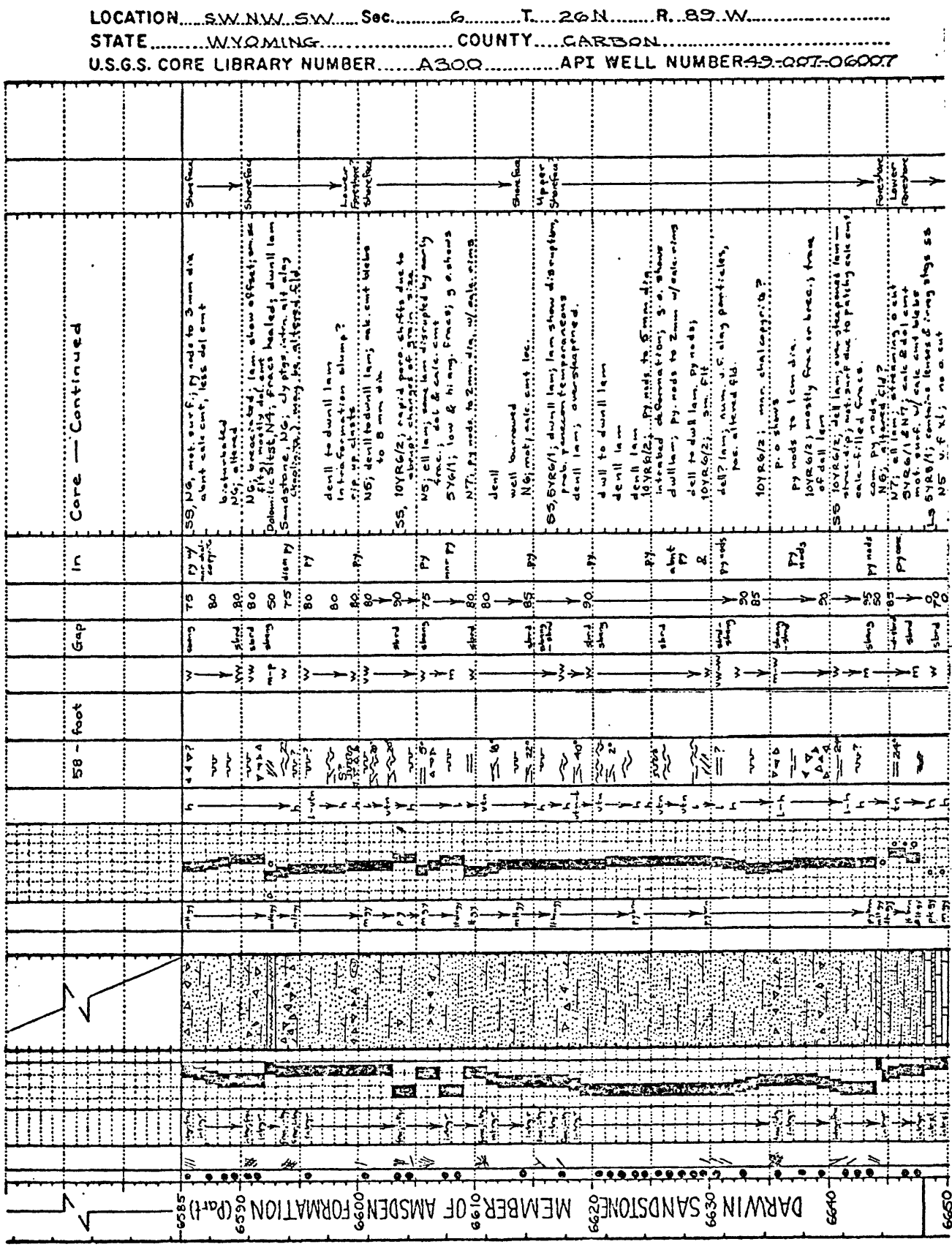


FIGURE 2. — Description of drill core from Sinclair Oil and Gas Company Wertz 27 ABC well — Continued

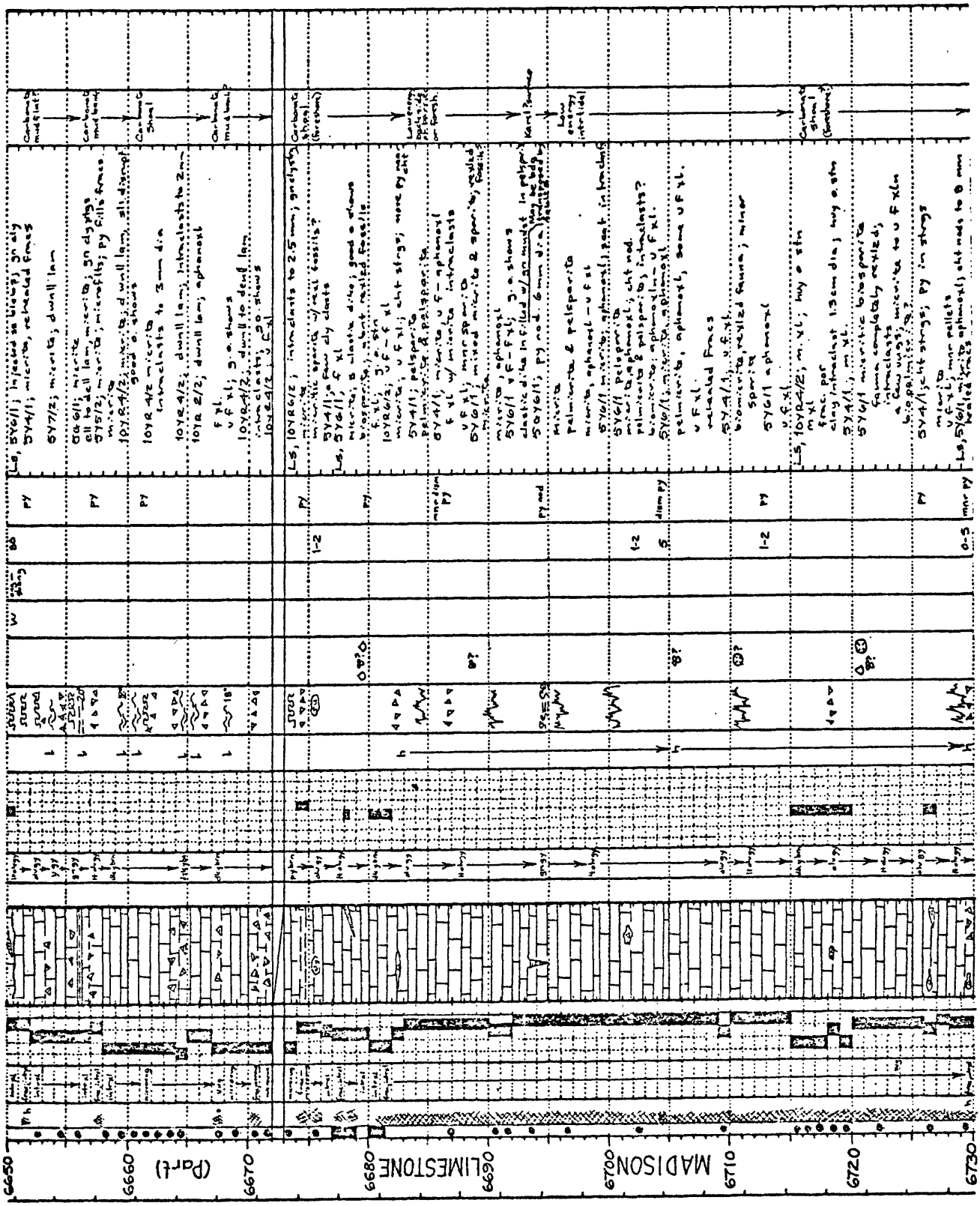


FIGURE 2. — Description of drill core from Sinclair Oil and Gas Company Wertz 27 ABC well — Continued

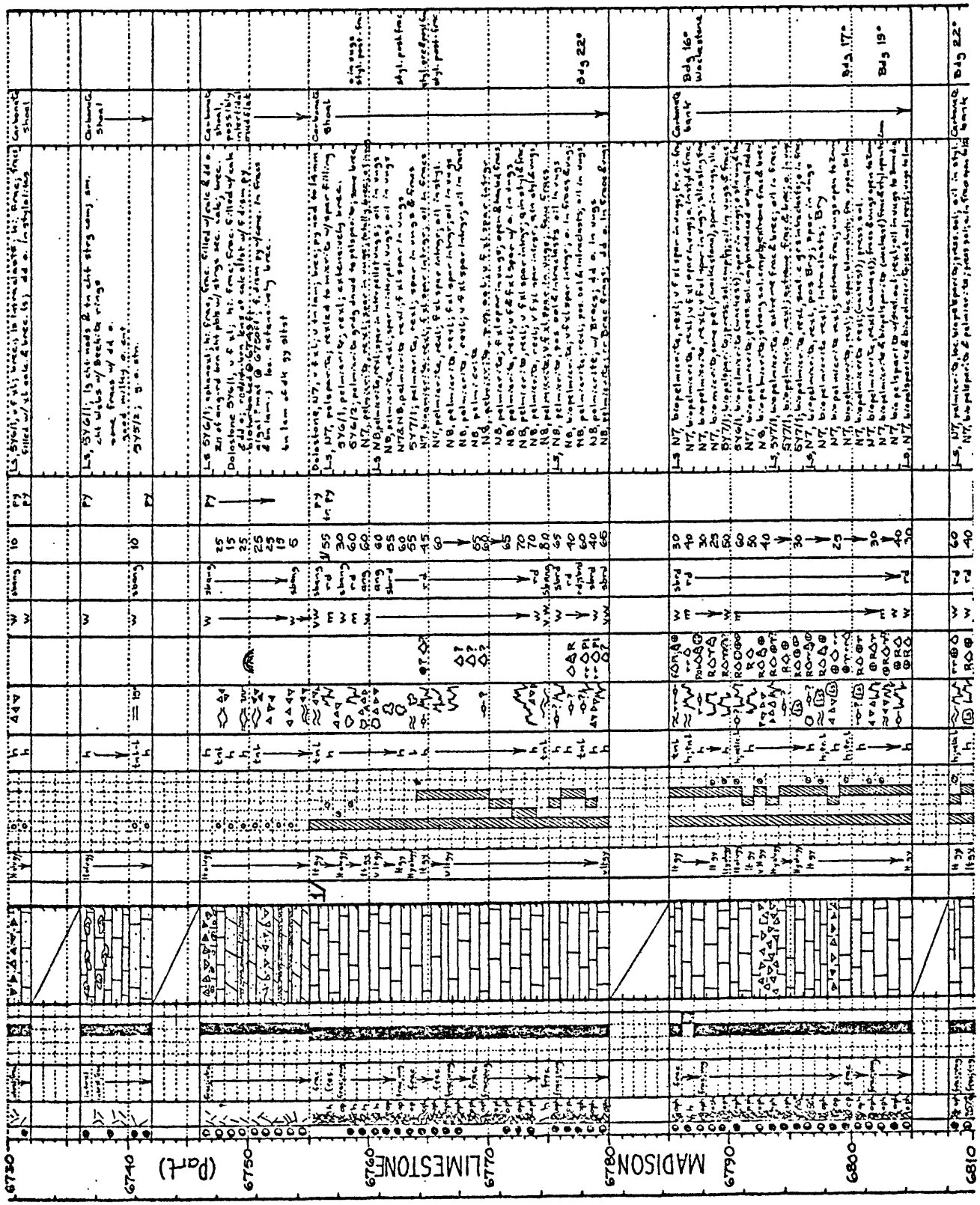


FIGURE 2. — Description of drill core from Sinclair Oil and Gas Company Wertz 27 ABC well — Continued

LOCATION SW NW SW Sec. 6 T. 26 N. R. 89 W.
STATE WYOMING COUNTY CARBON
U.S.G.S. CORE LIBRARY NUMBER A300 API WELL NUMBER 49-007-06007

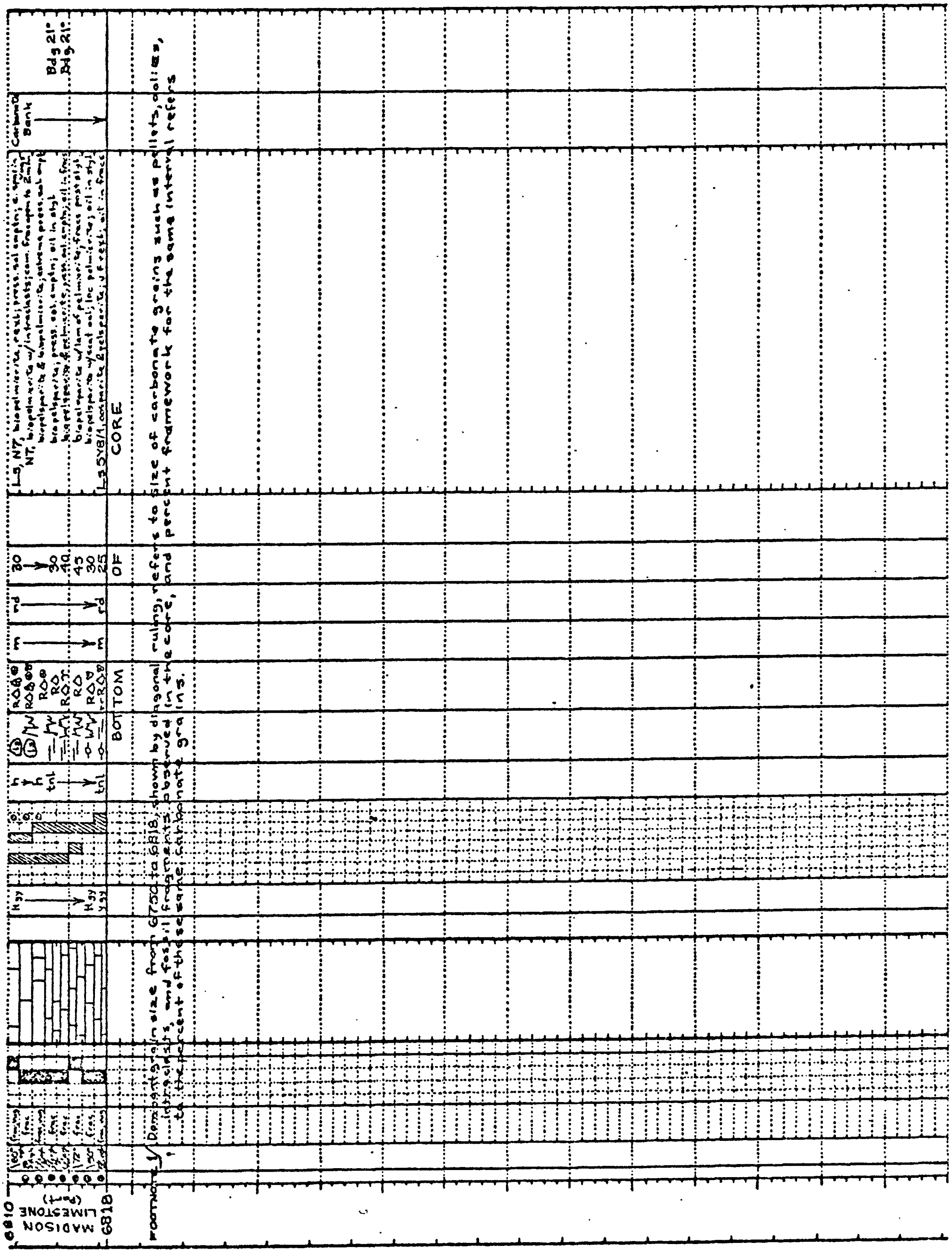
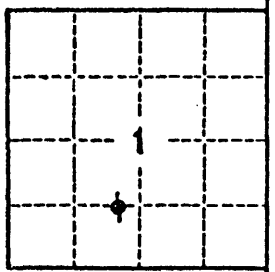


FIGURE 2. — Description of drill core from Sinclair Oil and Gas Company Wertz 27 ABC well — Continued

LOCATION NE SE SW Sec 1 T 26 N, R 90 W
1220 ft N / S line 2288 ft E / W line
STATE WYOMING COUNTY SWEETWATER
U.S.G.S. CORE LIBRARY NUMBER A248 API WELL NUMBER 49-037-20335

COMPANY NAME ATLANTIC RICHFIELD COMPANY
LEASE NAME WERTZ 46 ABC&E
AREA / FIELD WERTZ OIL FIELD

ELEVATION KB 6952 ft 2120 m
GL 6940 ft 2117 m
TOTAL DEPTH 6872 ft 2096 m



FORMATION AT SURFACE
QUATERNARY PEDIMENT GRAVEL, ON STEELE SHALE
OLDEST FORMATION PENETRATED
AMSDEN FORMATION
FORMATION AT TOTAL DEPTH
AMSDEN FORMATION
COMMENCED
5/18/72
COMPLETED
7/25/72
CASING (size; depth)
10 3/4" @ 596 w/250; 7" @ 6872 w/400

PRODUCING FORMATION(S)
TENSLEEP SANDSTONE
PRODUCING INTERVALS AND PRODUCTION DATA
6467-6611 Gross; Perf; 329 BOPD
FORMATIONS CORED AND INTERVALS
TENSLEEP SANDSTONE 6338-6630 ft

MECHANICAL/GEOPHYSICAL LOGS AVAILABLE; DEPTHS RUN
DUAL INDUCTION — LATEROLOG
BOREHOLE- COMPENSATED SONICLOG—GAMMA RAY
PROXIMITY- MICROLOG

REMARKS
Description from slabbed core

STUDIED BY J.E. FOX 6400-6540 ft T.S. AHLBRANDT 6338-6400 ft M.W. REYNOLDS 6540-6630 ft DATE DECEMBER 1974

LOCATION NE SE SW Sec 1 T 26 N R 90 W
STATE WYOMING COUNTY SWEETWATER
COMPANY AND LEASE NAME ATLANTIC RICHFIELD COMPANY, WERTZ 46 ABC&E
U.S.G.S. CORE LIBRARY NUMBER A248 API WELL NUMBER 49-037-20335

FIGURE 3. — Description of drill core from Atlantic Richfield Company Wertz 46 ABC&E well

LOCATION NE.SE.SW Sec. 1 T. 26N. R. 90W.
STATE WYOMING COUNTY SWEETWATER
U.S.G.S. CORE LIBRARY NUMBER A248 API WELL NUMBER 49-037-20335

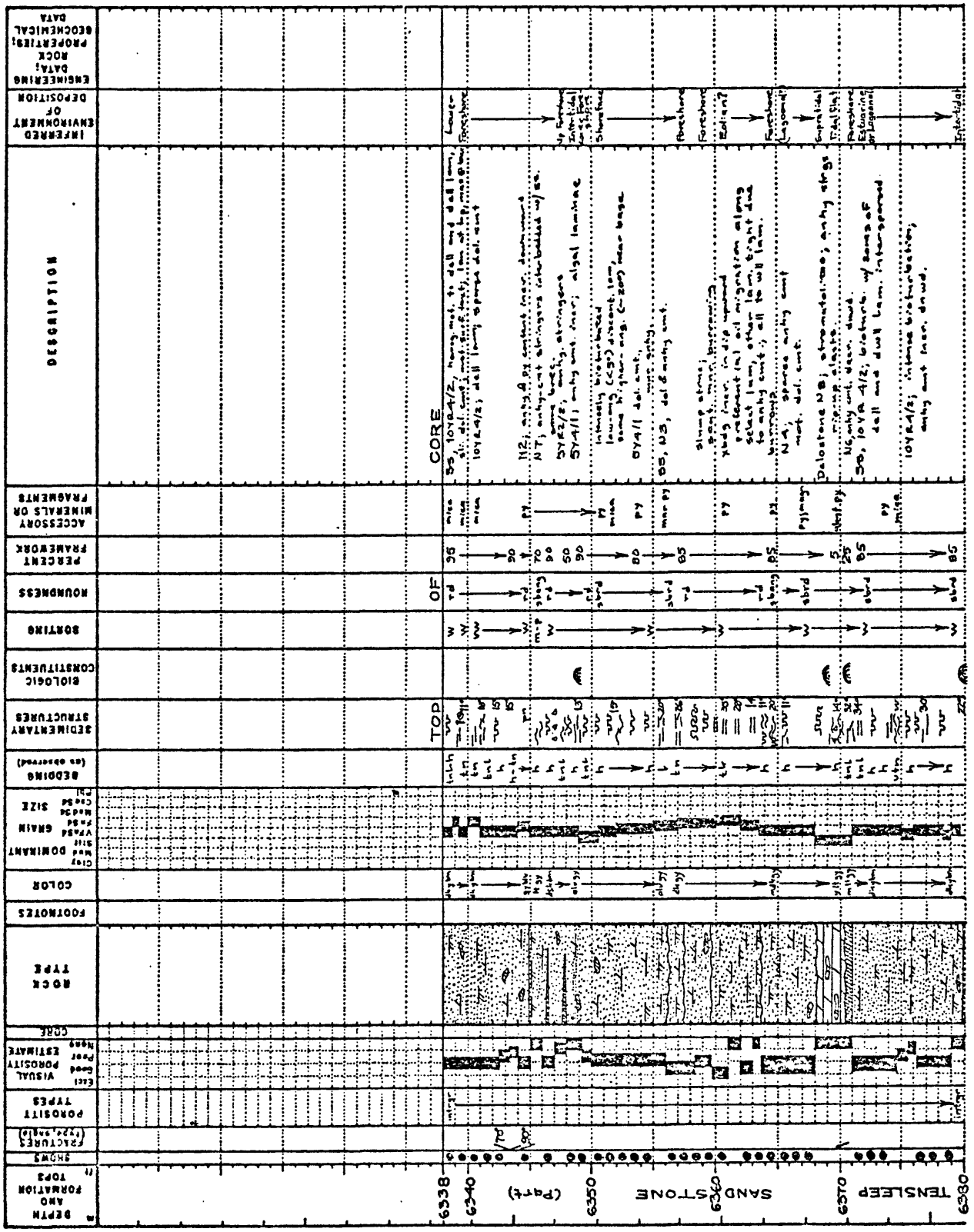


FIGURE 3. — Description of drill core from Atlantic Richfield Company Wertz 46 ABC&E well — Continued

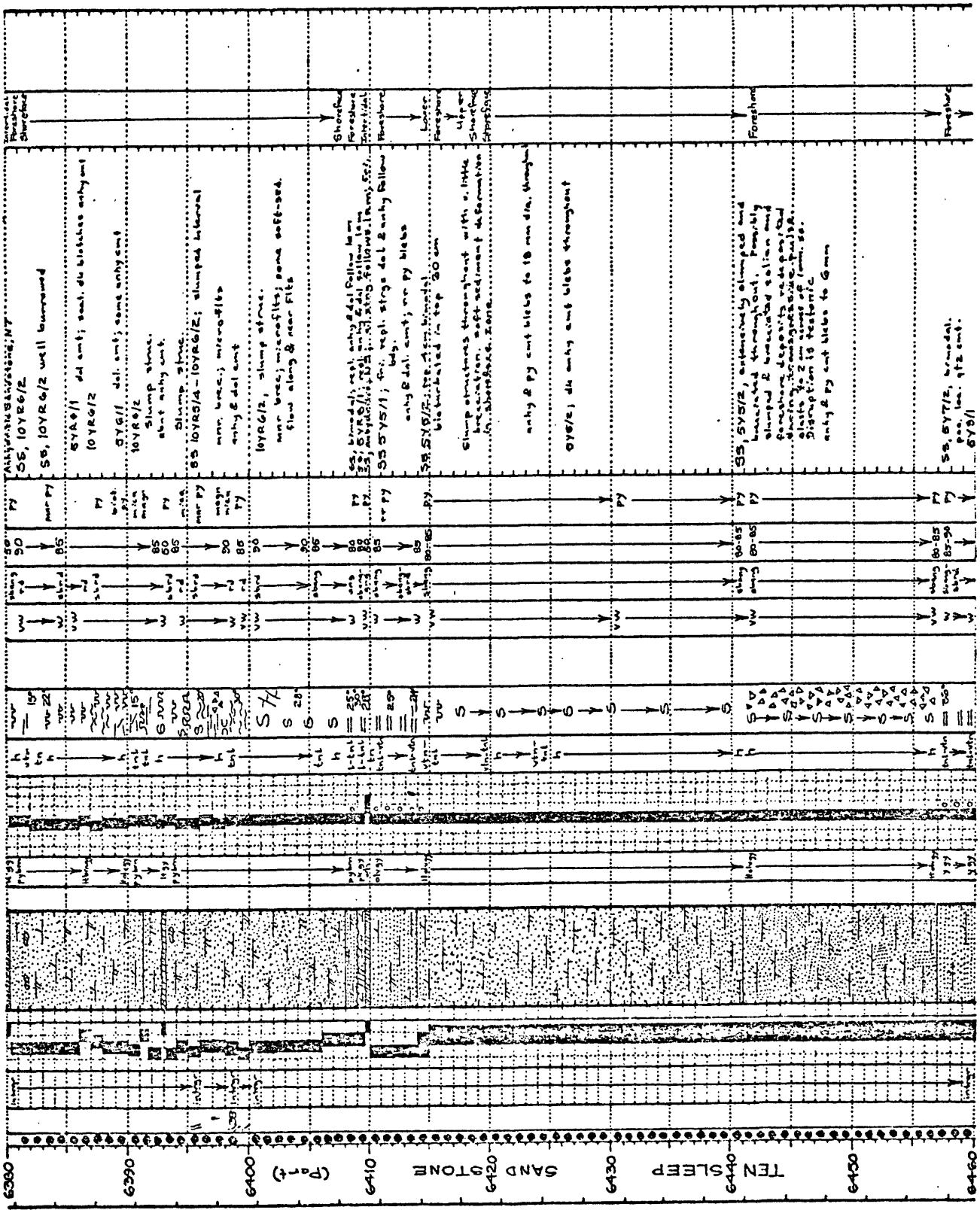


FIGURE 3. — Description of drill core from Atlantic Richfield Company Wertz 46 ABC&E well — Continued

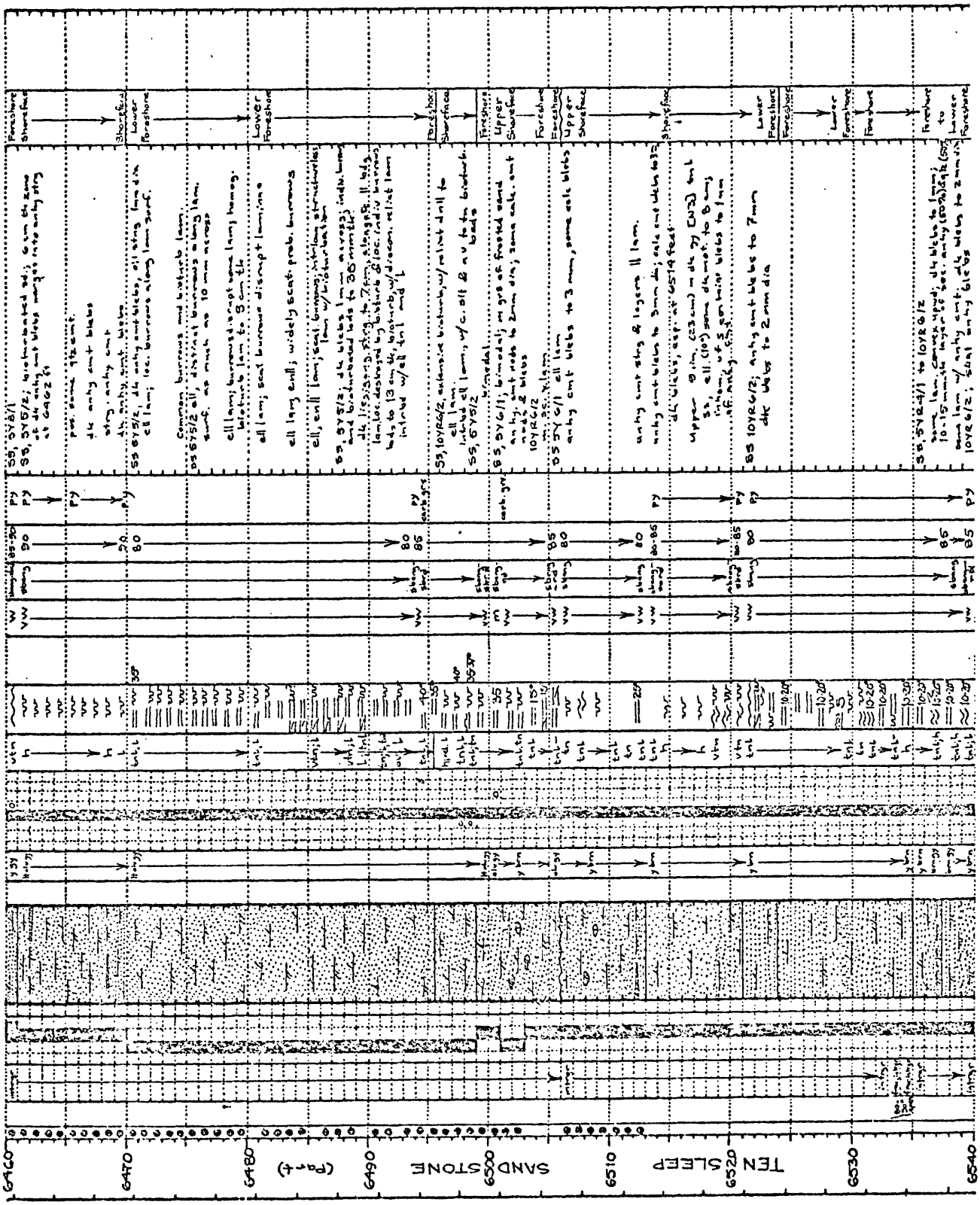


FIGURE 3. — Description of drill core from Atlantic Richfield Company Wertz 46 ABC&E well — Continued

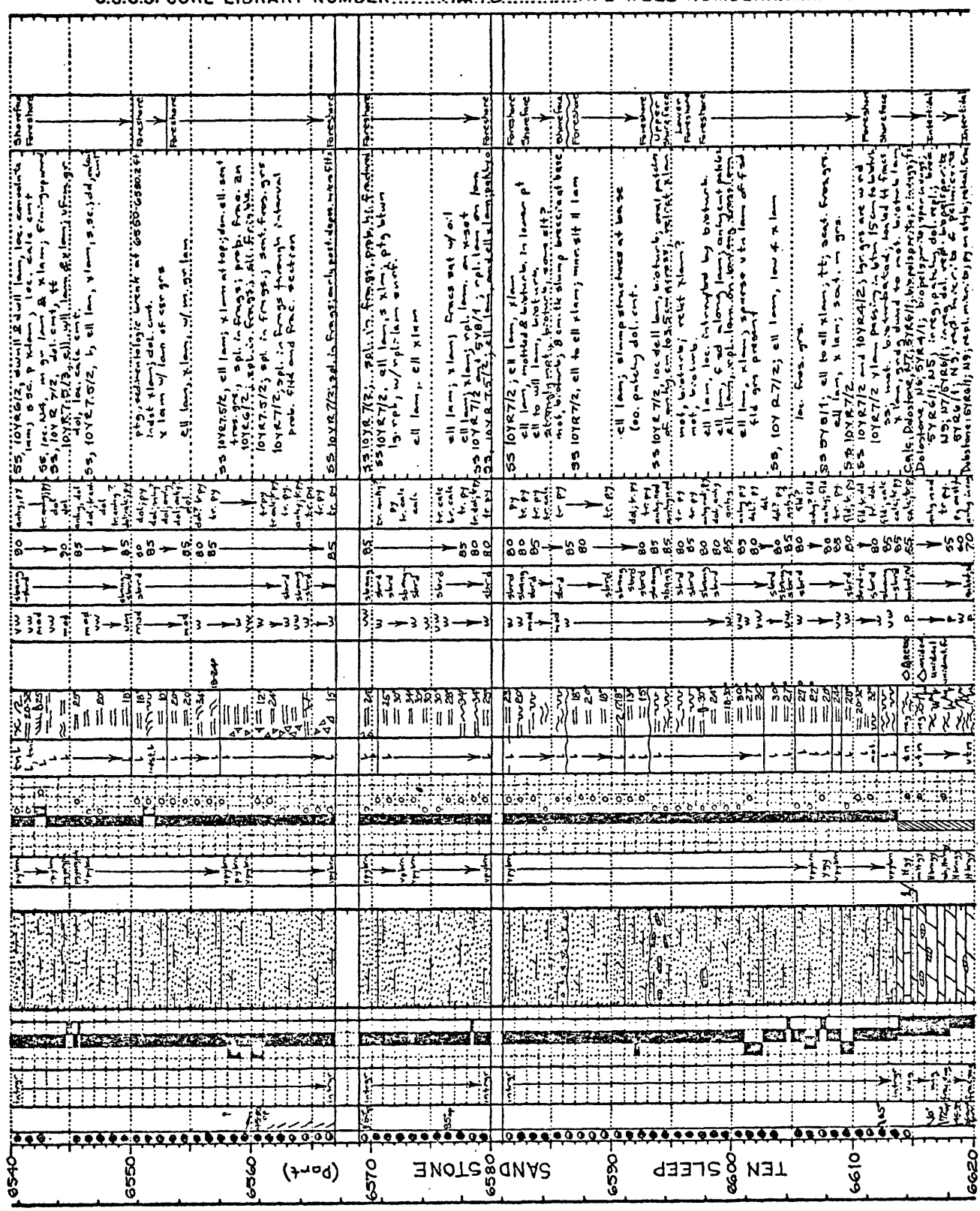


FIGURE 3. — Description of drill core from Atlantic Richfield Company Wertz 46 ABC&E well — Continued

LOCATION NE SE SW Sec. 1 T. 26 N. R. 90 W.
STATE WYOMING COUNTY SWEETWATER
U.S.G.S. CORE LIBRARY NUMBER A248 API WELL NUMBER 49-037-20335

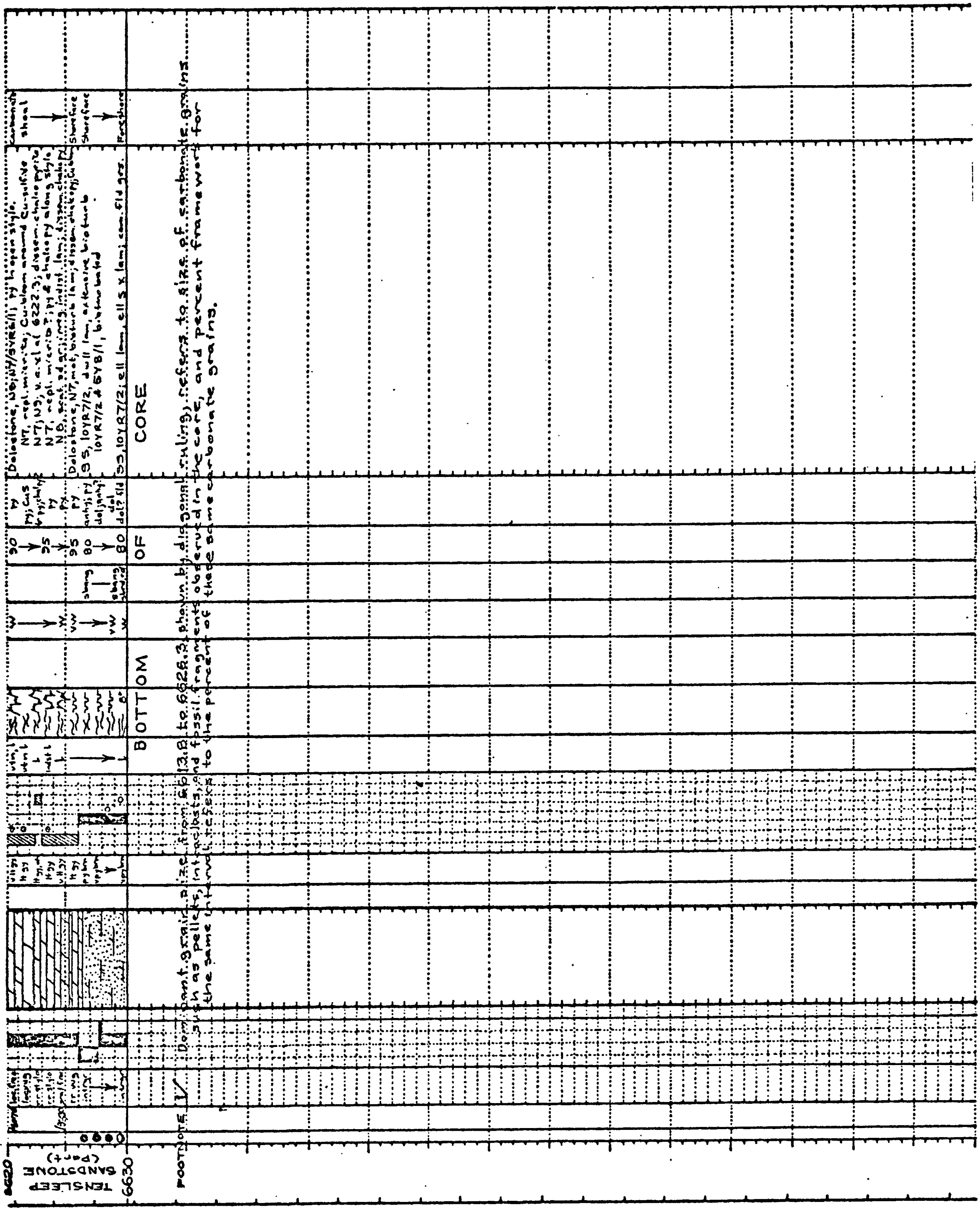
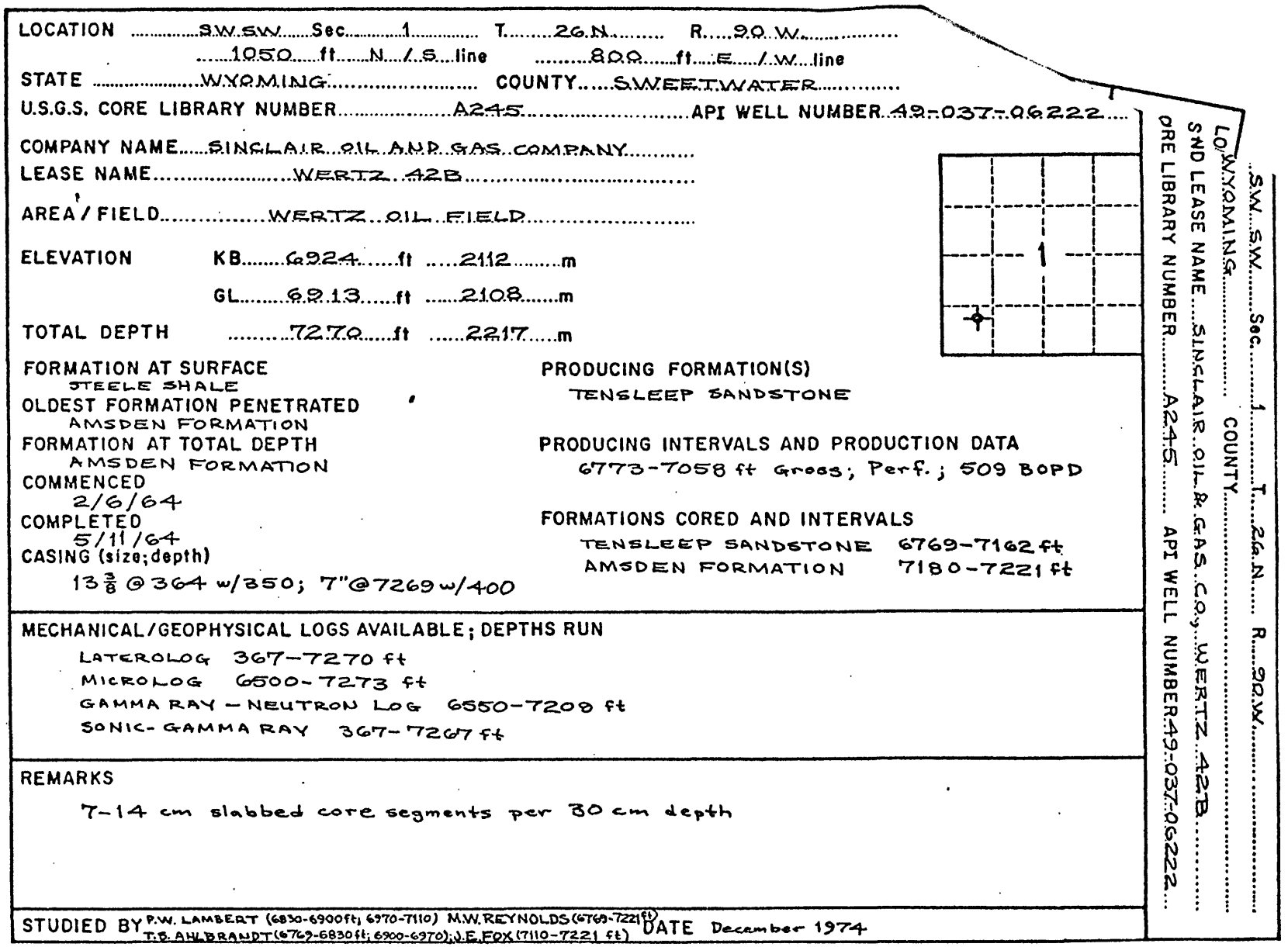


FIGURE 3. — Description of drill core from Atlantic Richfield Company Wertz 46 ABC&E well — Continued



LOCATION SW SW Sec 1 T 26 N R 90 W
1050 ft N / S line 800 ft E / W line
STATE WYOMING COUNTY SWEETWATER
U.S.G.S. CORE LIBRARY NUMBER A245 API WELL NUMBER 49-037-06222
COMPANY NAME SINCLAIR OIL AND GAS COMPANY
LEASE NAME WERTZ 42B
AREA / FIELD WERTZ OIL FIELD
ELEVATION KB 6924 ft 2112 m
GL 6913 ft 2108 m
TOTAL DEPTH 7270 ft 2217 m
FORMATION AT SURFACE
STEELE SHALE
OLDEST FORMATION PENETRATED
AMSDEN FORMATION
FORMATION AT TOTAL DEPTH
AMSDEN FORMATION
COMMENCED
2/6/64
COMPLETED
5/11/64
CASING (size; depth)
13 3/8 @ 364 w/350; 7" @ 7269 w/400
PRODUCING FORMATION(S)
TENSLEEP SANDSTONE
PRODUCING INTERVALS AND PRODUCTION DATA
6773-7058 ft Gross; Perf.; 509 BOPD
FORMATIONS CORED AND INTERVALS
TENSLEEP SANDSTONE 6769-7162 ft
AMSDEN FORMATION 7180-7221 ft
MECHANICAL/GEOPHYSICAL LOGS AVAILABLE; DEPTHS RUN
LATEROLOG 367-7270 ft
MICROLOG 6500-7273 ft
GAMMA RAY - NEUTRON LOG 6550-7208 ft
SONIC-GAMMA RAY 367-7267 ft
REMARKS
7-14 cm slabbed core segments per 30 cm depth
STUDIED BY P.W. LAMBERT (6830-6900 ft; 6970-7110) M.W. REYNOLDS (6769-7221 ft) T.S. AHLBRANDT (6769-6830 ft; 6900-6970); J.E. FOX (7110-7221 ft) DATE December 1974
SW SW Sec 1 T 26 N R 90 W
LO WYOMING COUNTY
SND LEASE NAME SINCLAIR OIL & GAS CO. WERTZ 42B
ORE LIBRARY NUMBER A245 API WELL NUMBER 49-037-06222

FIGURE 4. — Description of drill core from Sinclair Oil and Gas Company Wertz 42 B well

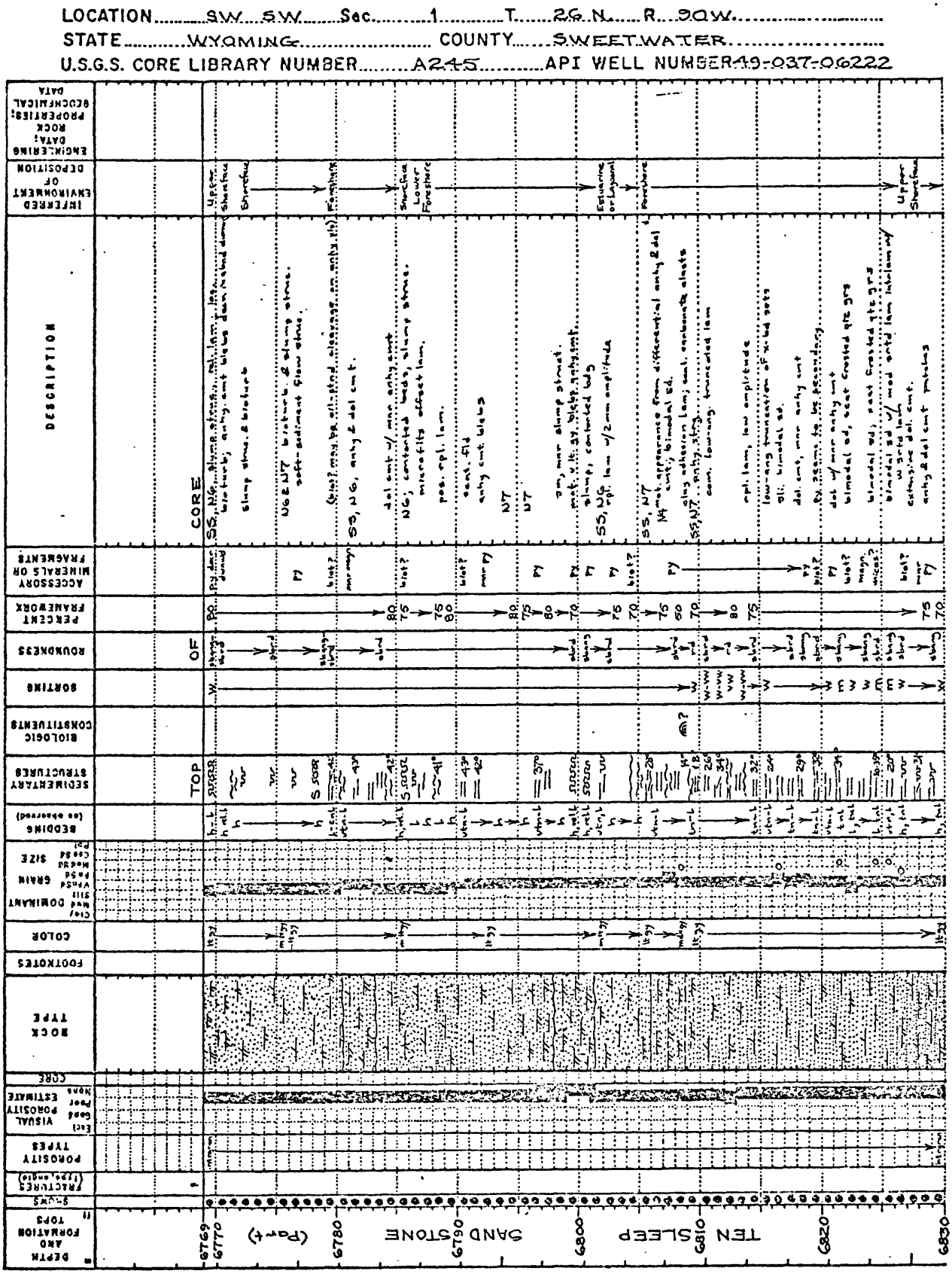


FIGURE 4. — Description of drill core from Sinclair Oil and Gas Company Wertz 42 B well — Continued

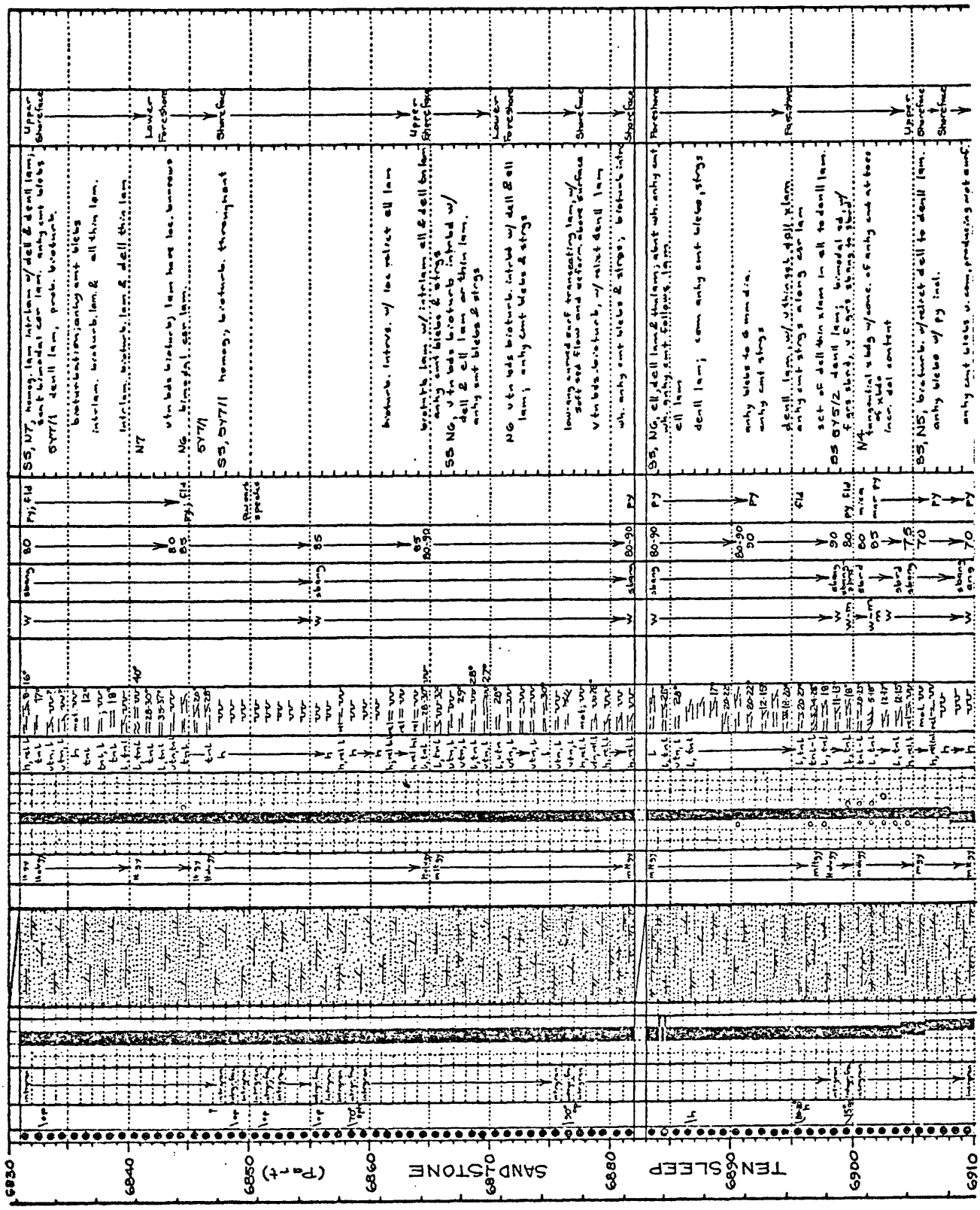


FIGURE 4. -- Description of drill core from Sinclair Oil and Gas Company Wertz 42 B well -- Continued

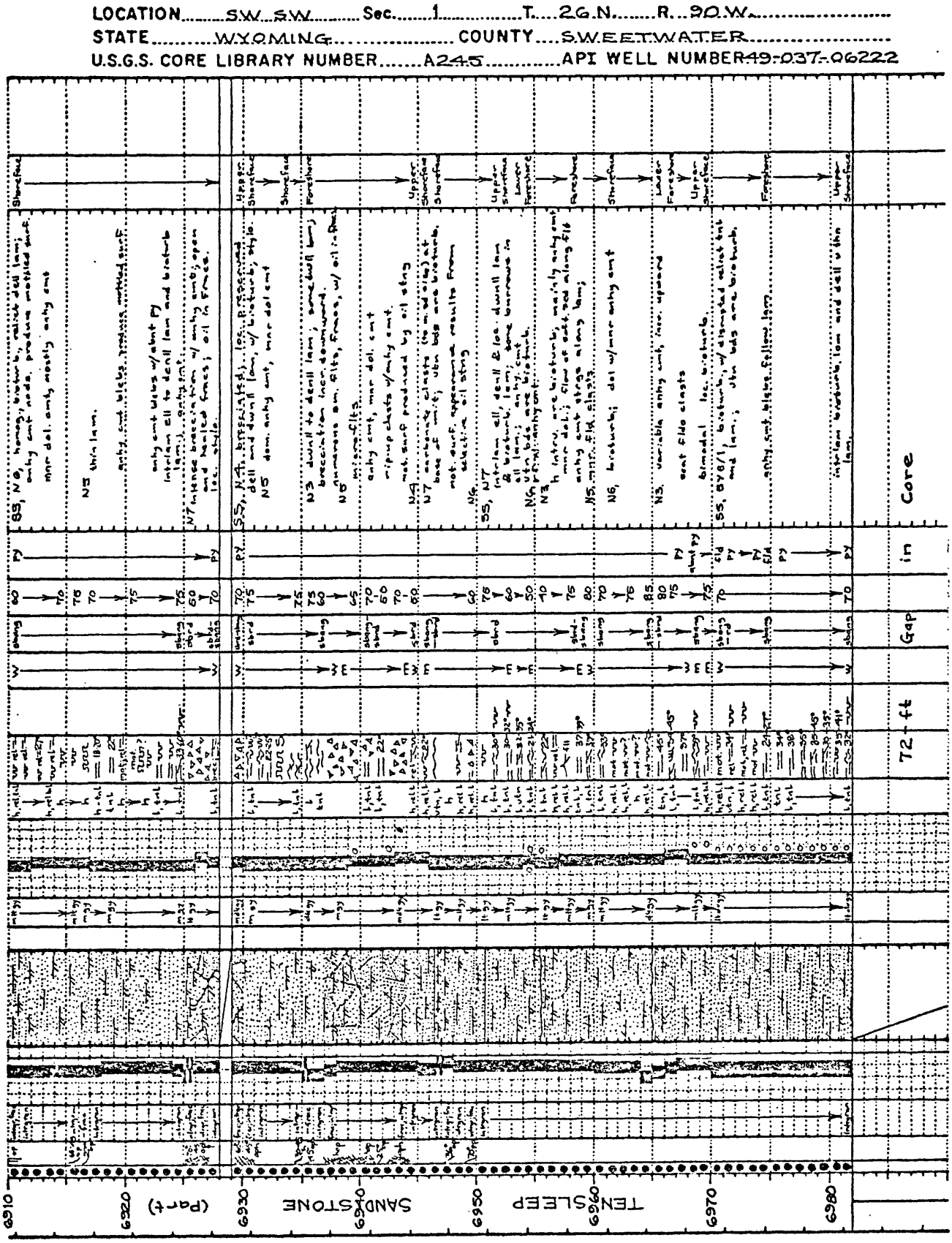


FIGURE 4. — Description of drill core from Sinclair Oil and Gas Company Wertz 42 B well — Continued

LOCATION SW SW Sec. 1 T. 26 N. R. 90 W.
STATE WYOMING COUNTY SWEETWATER
U.S.G.S. CORE LIBRARY NUMBER A245 API WELL NUMBER 49-037-06222

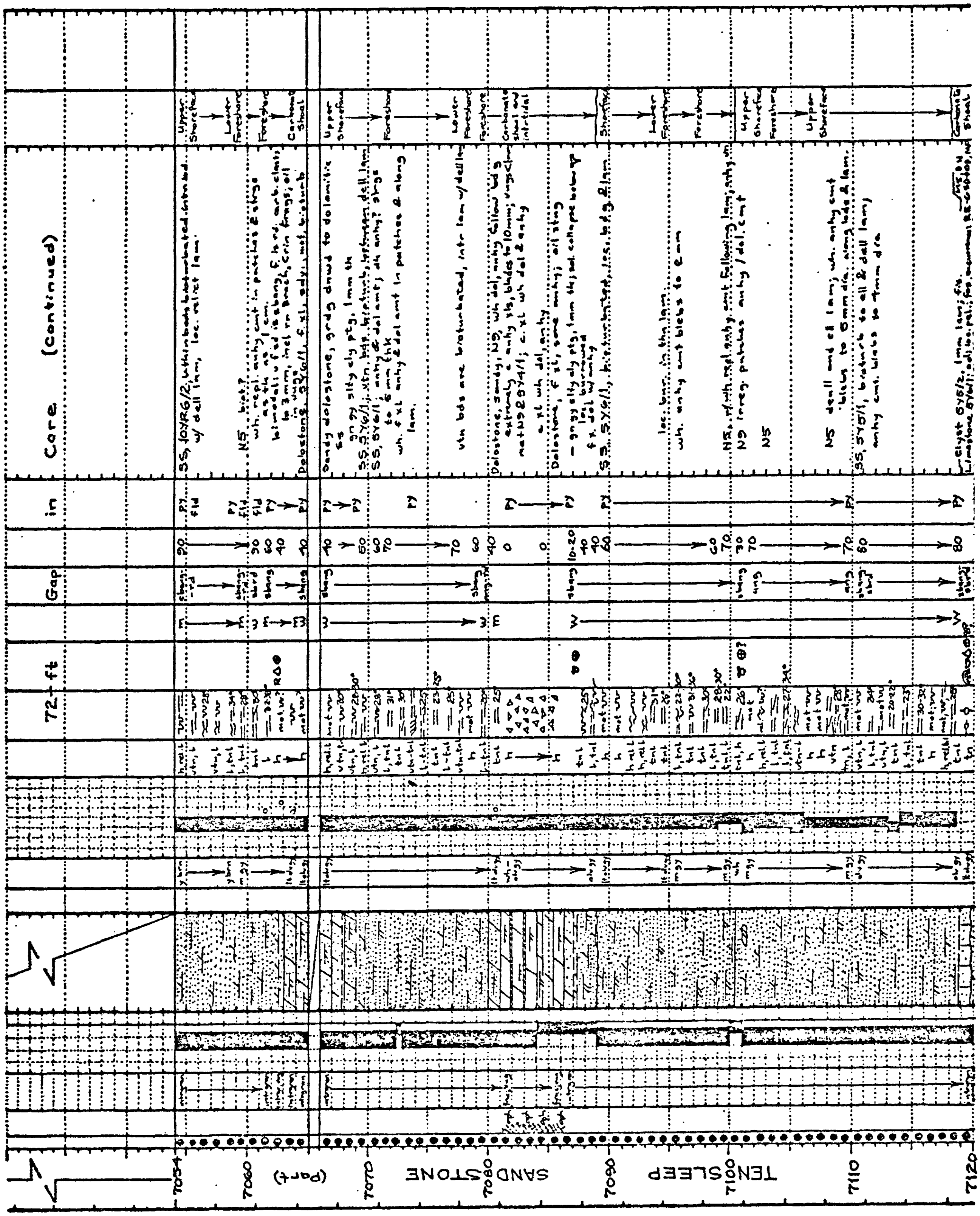


FIGURE 4. — Description of drill core from Sinclair Oil and Gas Company Wertz 42 B well — Continued

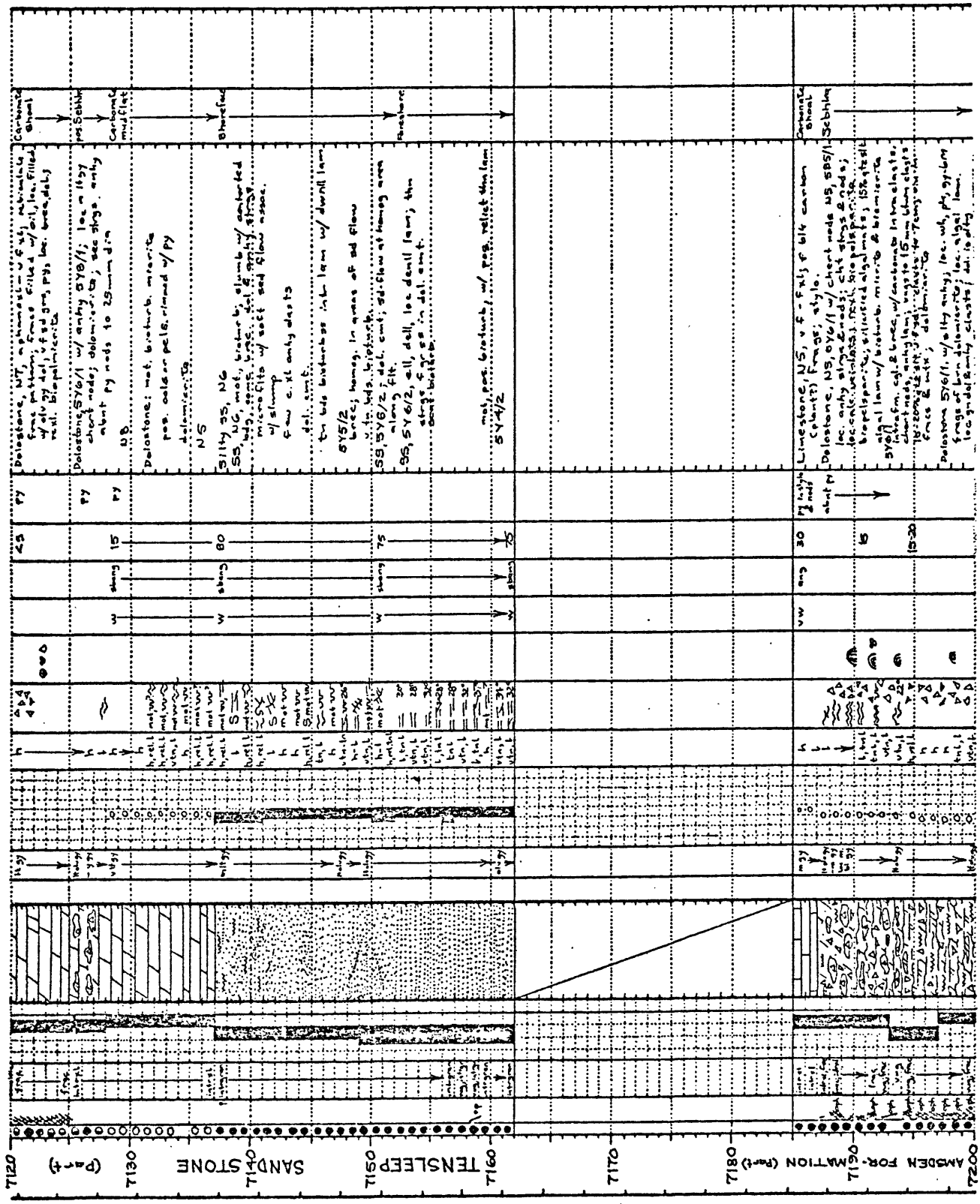


FIGURE 4. — Description of drill core from Sinclair Oil and Gas Company Wertz 42 B well — Continued

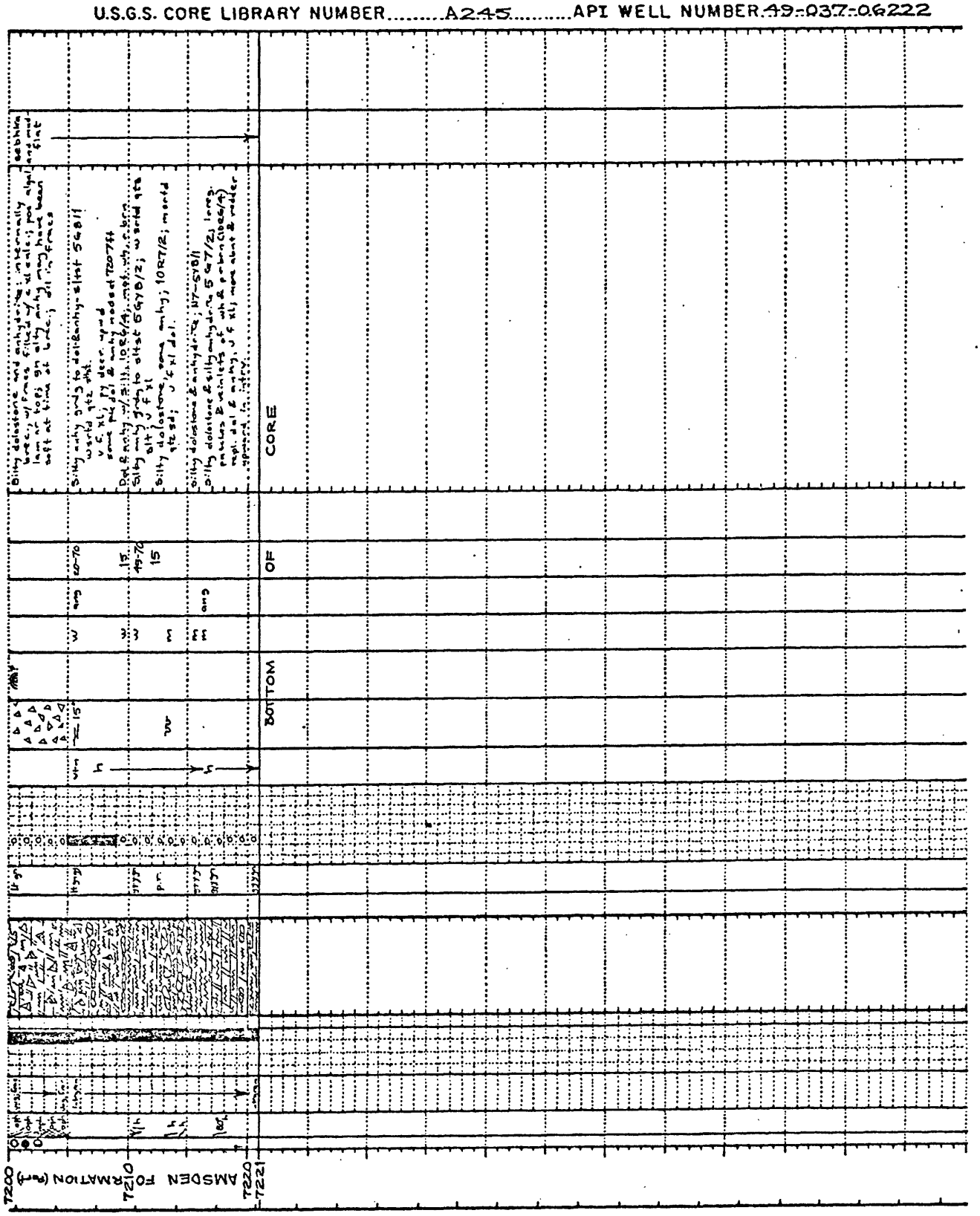
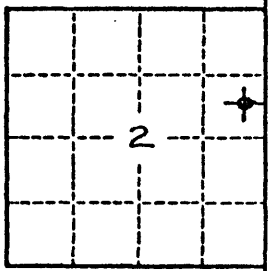


FIGURE 4. — Description of drill core from Sinclair Oil and Gas Company Wertz 42 B well — Continued

LOCATION SE NE Sec. 2 T. 26 N., R. 90 W.
2125 ft. S / N line 475 ft. W / E line
STATE WYOMING COUNTY SWEETWATER
U.S.G.S. CORE LIBRARY NUMBER A302 API WELL NUMBER 49-037-06272
COMPANY NAME SINCLAIR OIL AND GAS COMPANY
LEASE NAME WEST WERTZ 2
AREA / FIELD WERTZ OIL FIELD



ELEVATION KB 7198 ft 2198 m
GL 7036 ft 2164 m
TOTAL DEPTH 7396 ft 2258 m

FORMATION AT SURFACE
QUATERNARY PEDIMENT GRAVEL
OLDEST FORMATION PENETRATED
TENSLEEP SANDSTONE
FORMATION AT TOTAL DEPTH
TENSLEEP SANDSTONE
COMMENCED
2/09/63
COMPLETED
4/23/63
CASING (size; depth)
13 3/8" @ 443 w/440; 7" @ 7380 w/500

PRODUCING FORMATION(S)
TENSLEEP SANDSTONE

PRODUCING INTERVALS AND PRODUCTION DATA
6990-7052 Perf.; 281 BOPD

FORMATIONS CORED AND INTERVALS
TENSLEEP SANDSTONE 6926-7209 ft (Gross)

MECHANICAL/GEOPHYSICAL LOGS AVAILABLE; DEPTHS RUN
LATEROLOG 443-6947 ft
MICROLOG 3050-7389 ft
GAMMA RAY-NEUTRON 6500-7310 ft
SONIC-GAMMA RAY LOG 3000-7387 ft

REMARKS
7-15 cm segments of slabbed core per 30 cm (1 ft) depth

STUDIED BY: M.W. REYNOLDS (6926-6990; 7070-7150 ft) DATE January 1975
T.S. AHLBRANDT (6990-7070; 7150-68; 7200-09 ft)

LOCATION SE NE Sec. 2 T. 26 N. R. 90 W.
STATE WYOMING COUNTY SWEETWATER
COMPANY AND LEASE NAME SINCLAIR OIL AND GAS COMPANY
U.S.G.S. CORE LIBRARY NUMBER A302 API WELL NUMBER 49-037-06272

FIGURE 5. — Description of drill core from Sinclair Oil and Gas Company West Wertz 2 well

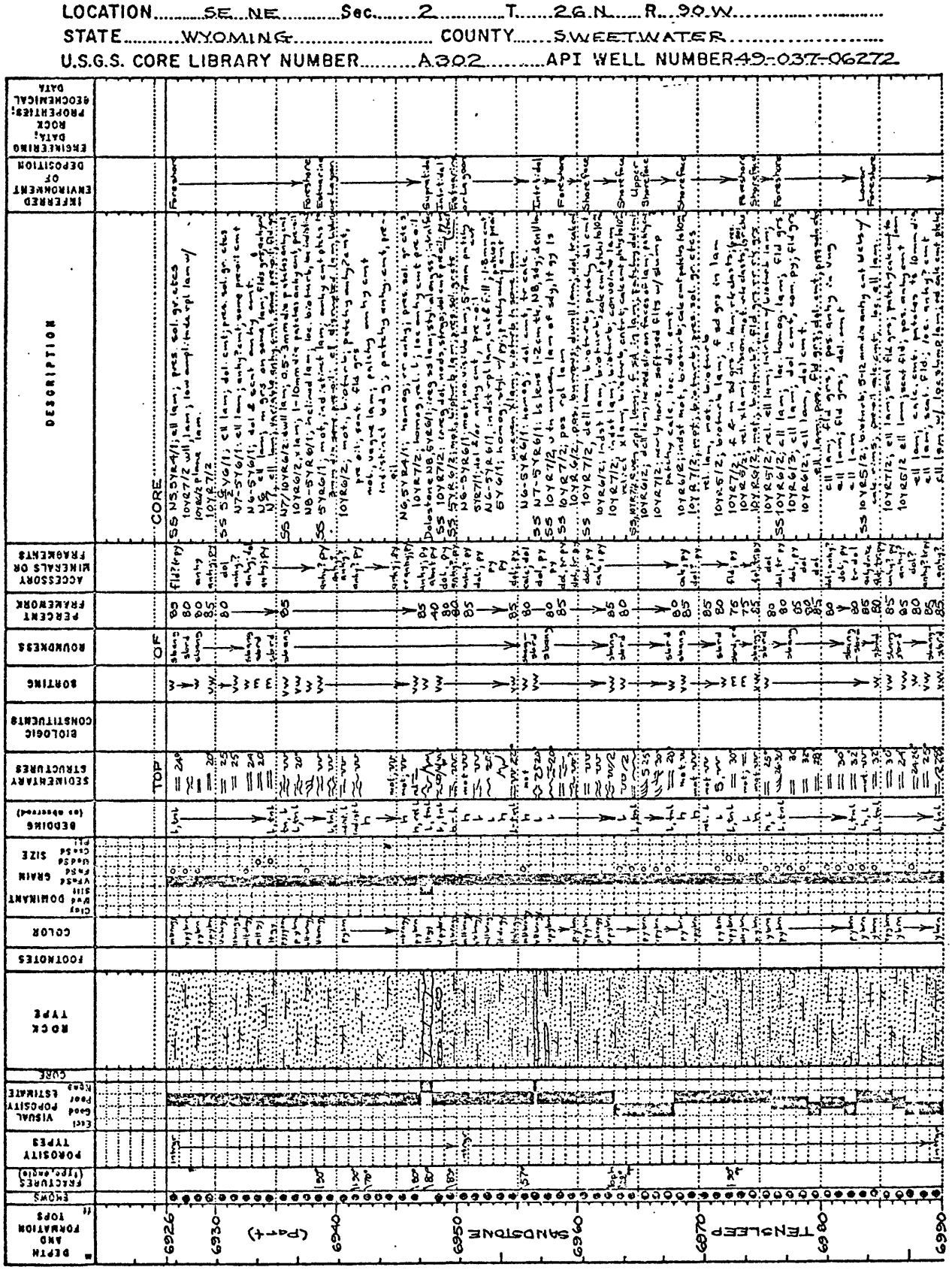


FIGURE 5. — Description of drill core from Sinclair Oil and Gas Company West Wertz 2 well — Continued

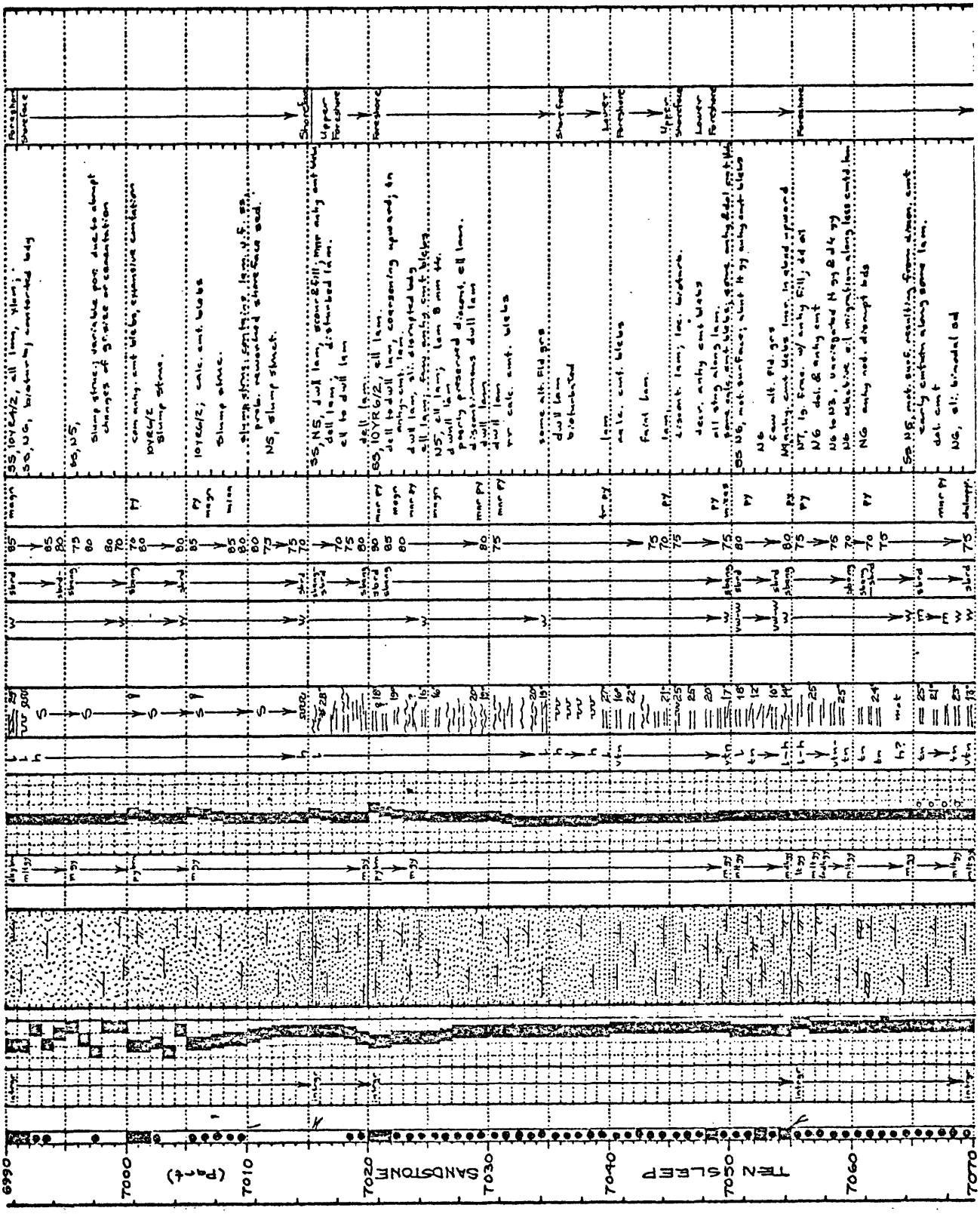


FIGURE 5. – Description of drill core from Sinclair Oil and Gas Company West Wertz 2 well – Continued

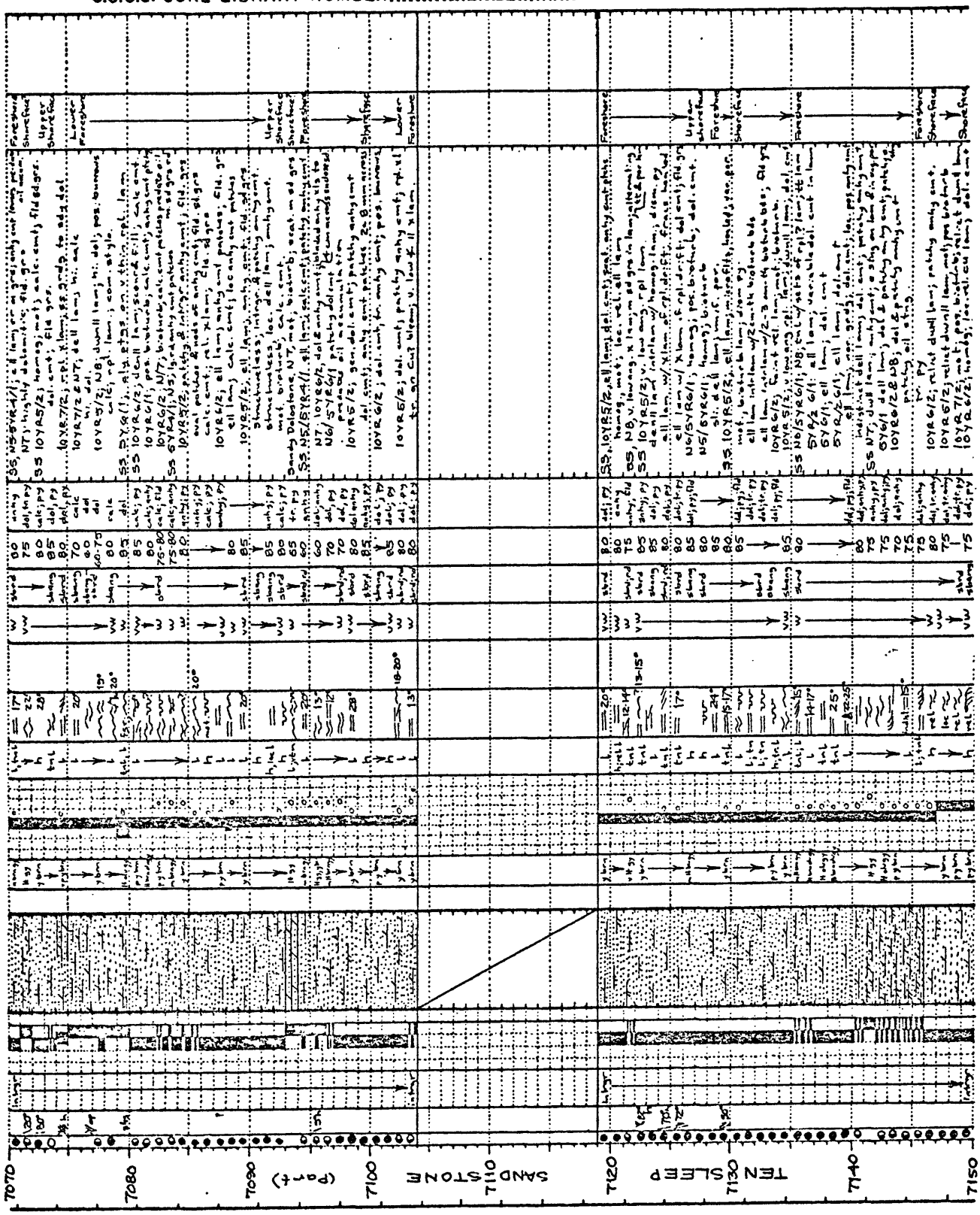


FIGURE 5. - Description of drill core from Sinclair Oil and Gas Company West Wertz 2 well - Continued

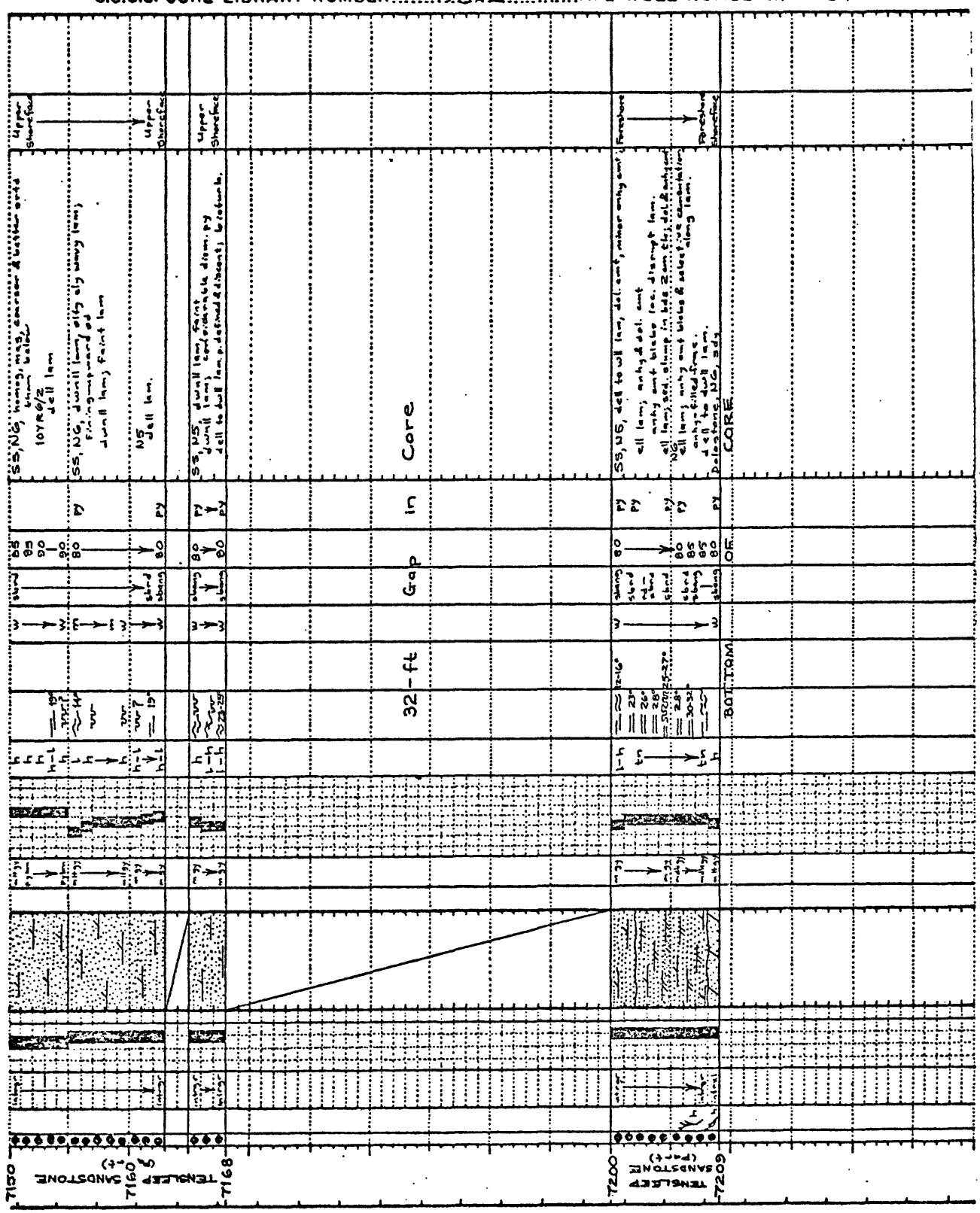


FIGURE 5. — Description of drill core from Sinclair Oil and Gas Company West Wertz 2 well — Continued