See Pocket 5 for encl.

OAK RIDGE NATIONAL LABORATORY
OPERATED BY MARTIN MARIETTA ENERGY SYSTEMS, INC.

WM DOCKET CONTROL CENTER

'85 AUG 19 A11:40

POST OFFICE BOX X
OAK RIDGE, TENNESSEE 37831

August 15, 1985

Dr. D. J. Brooks
Geotechnical Branch
Office of Nuclear Material Safety
and Safeguards
U.S. Nuclear Regulatory Commission
623-SS
Washington, D.C. 20555

Nom-RCS
WM Record File
B-0287
ORNL

WM Project 10, 11, 16
Docket No.
PDR ✓
LPDR B, N, S

Distribution:
BROOKS
(Return to WM, 623-SS) 43

Dear Dave:

Enclosed please find Gary's comments on his recent trip to Austin, Texas. He compiled these as a meeting report (MR-287-4) with three attachments.

Sincerely,

Susan

S. K. Whatley, Manager
Repository Licensing Analysis
and Support
Chemical Technology Division

SKW:bek

Enclosure

cc: G. K. Jacobs
SKW - File

8508290542 850815
PDR WMRES EXIORNL
B-0287 PDR

2334

See B0287 8/15/85
TO D.S. Brooks MR-287-4
8/14/85

MEETING REPORT

AUTHOR: G. K. Jacobs

LOCATION: Texas Bureau of Economic Geology, Austin, Texas

DATE: August 5-8, 1985

PURPOSE: NRC/DOE Meeting to Discuss Palo Duro Basin Geology and to Examine Rock Core from Permian Basin, See Attachment #1 for Agenda

PROJECT TITLE: Technical Assistance in Geochemistry

PROJECT MANAGER: S. K. Whatley

ACTIVITY NUMBER: ORNL #41 37 54 92 4 (189 #B0287)
NRC #50 19 03 01

PARTICIPANTS: See Attachment #2.

GENERAL COMMENTS

The objective of this meeting was to examine selected rock core from the Permian Basin. The three-day meeting was extremely useful in providing information and perspective for evaluations of geochemical information relevant to the performance of the Deaf Smith site. An appreciation of the stratigraphy and petrography of the various rock units in the Palo Duro Basin is important to our evaluation of geochemical conditions, solubility/sorption processes, and the geochemistry of waste package interactions. To facilitate the examination of the core, DOE and its contractors presented information pertaining to the geology, stratigraphy, petrography, and depositional history of the Palo Duro Basin. The cores that we examined included sections from: (1) Grabbe #1, (2) J. Friemel #1, (3) Zeeck #1, and (4) Detten #1. We were able to observe examples of core from active dissolution zones, the entire evaporite sequence (including several examples of the Lower San Andres Unit 4 salt cycle), the Permian Wolfcamp carbonate, and the Pennsylvanian-Permian granite wash. Handouts from the presentations and detailed logs of the cores are included as Attachment #3.

DETAILED COMMENTS

1. The work being accomplished by the Texas Bureau of Economic Geology appears to be of excellent quality and is directed toward some of the more important geologic characterization needs at this time.

2. Geochemistry was not emphasized at the meeting. However, the discussion of stratigraphy, petrography, and depositional history provided excellent background information for future geochemistry and waste package workshops. The examination of the cores provided excellent insight into the site itself and will help to focus future efforts on evaluations related to geochemistry.

3. The staff of the Texas Bureau of Economic Geology indicated that no new analytical work is planned on hydrogeochemistry until new wells can be completed. Work will continue, however, on interpretation of currently available data. In addition, host rock geochemistry and its role in rock/water interactions will be given major emphasis in the next months.

3. It has been found that water can be pumped (72 bbl in 7 months) from the Lower San Andres Unit #4 carbonate zone in the Zeeck #1 well. This zone is separated from the target salt horizon by only a thin layer of anydrite. Therefore, this water-bearing zone will receive increased attention as wells are completed closer to the candidate site (to date, this zone in other wells has not produced significant quanitites of water).

4. The DOE indicated that a draft Program Plan for geochemistry will be available sometime this fall. We anticipate that this document will identify the various geochemical processes that DOE plans to take credit for in their analysis of repository performance. This information will help us to direct our evaluation efforts toward the most important parameters. At this time, DOE appears to be emphasizing rock/water interactions in the water-bearing units beneath the target salt horizon. The Texas Bureau of Economic Geology is studying the geochemical controls on water chemistry. This information will be important in evaluating the potential retardation behavior of radionuclides should they be released into these horizons. This information may also be important to identifying relevant geochemical conditions in the disturbed zone for testing waste package components. The waste package workshop planned for this fall should also help to clarify the DOE position in this area.

AGENDA
PERMIAN BASIN CORE EXAMINATION

August 5

1:00 p.m.	Introductions	J. Sherwin (SRPO) E. Bingler (TBEG)
1:30 p.m.	Opening remarks and expectations of meeting.	J. Sherwin (SRPO) J. Trapp (NRC)
2:00 p.m.	Overview of the Palo Duro Basin, current understandings of structural and sedimentological history.	TBD (SWEC) J. PECK Steve Webster
3:00 p.m.	Origin of the Permian evaporites, with emphasis on LSA 4.	Steve Ruppel TBEG ~~TBD (SWEC)~~
4:00 p.m.	Palo Duro Basin stratigraphic section, locations of DOE test holes, regional correlations of major units, major hydrostratigraphic divisions.	Pat Davidson (10 min) S. Hovorka (TBEG)

August 6

8:15 a.m.	Reconvene	
8:30 a.m.	Geologic logging of DOE drill holes, detailed logs of repository horizon (Lower San Andres Unit 4), geologic cross-sections, correlation of formations and units, description of rocks present in the core, (incl. mineralogic, petrologic, geochemical characteristics), with emphasis on evaporite section and host salt beds.	S. Hovorka (TBEG)
9:30 a.m.	Description of features noted in core from "dissolution wells," regional implications	C. Kreitler (TBEG)
10:00 a.m.	Presentation on available material related to DOE drill hole logs: lithologic logs; geophysical logs; applicable reports and data; correlations of geophysical logs with core; applications of geophysical logging to stratigraphic analysis.	S. Adams (ONWI)
11:00 a.m.	Development of geotechnical logs based on mechanical properties, geophysical logging and visual core logging-correlated with test results performed on drill core; index of laboratory testing for mechanical properties of rock mass; in-situ stress measurements.	T. Lamb (SWEC) TBD (RE/SPEC)
12:00 - 1:00 p.m.	LUNCH	

PERMIAN BASIN CORE EXAMINATION
PLANNED AGENDA
(Continued)

August 6 (Continued)

1:15 p.m.	Reconvene at Balcones Research Center and proceed to core repository. Core examination: Grabbe #1 J. Friemel #1 Zeeck #1 - LSA Unit 4 One dissolution well - TBD * There is not enough table space for all listed core sections to be laid out simultaneously; over two days all core will be available. Concurrent Quality Assurance discussions	

August 7

8:15 a.m.	Reconvene at Balcones Research Center Proceed to core repository.	
8:30 a.m.	Core examination continues.	
12:00 - 1:00 p.m.	LUNCH	
1:15 p.m.	Review of status of Palo Duro Studies; published references; on-going work; data availability.	TBEG SWEC ONWI SRPO

August 8

8:15 a.m.	Propose topics/agenda for Permian Basin data review.	
10:15 a.m.	Prepare summary of meeting.	J. Sherwin (SRPO) J. Trapp (NRC)

Participants

NRC Core Workshop
August 5-8, 1985
Austin, Texas

Sam Panno	DOE HQ/Weston	
Jo-Ann Sherwin	DOE-SRPO	
Steve Frishman	Office of the Governor, Texas	
Don McReynolds	High Plains Water District	806/762-0181
Dick Berry	NRC/Lawrence Livermore	
David W. Carpenter	NRC/Lawrence Livermore	415/422-3976
Robert Cummings	NRC/Engineers International	602/884-8818
Jaak Daemen	NRC/University of Arizona	602/621-2501
Claudia Hackbarth	NRC	301/427-4639
Dale Hedges	NRC	
John Imse	NRC/Weston Geophysical Corp.	617/366-9191
Gary K. Jacobs	NRC/ORNL	615/576-0567
Robert Johnson	NRC/WMPP	301/327-4785
Walt Kelly	NRC/NMSS	301/427-4571
Richard Lee	NRC	
Larry McKague	NRC/Lawrence Livermore	415/422-6494
Jerome Pearring	NRC/WMEG	301/427-4648
Fred Ross	NRC	
Jack Sharp	NRC/Williams & Assoc./Univ. Texas	
John S. Trapp	NRC/WMGT	301/428-4545
Tilak (Teek) Verma	NRC/Columbus	
Roy E. Williams	NRC/Williams & Associates	208/883-0153
Gerry Winter	NRC/Williams & Associates	
Ernst G. Zurflueh	NRC	617/427-4343
Walter E. Newcomb	ONWI	614/424-7685
Owen E. Swanson	ONWI	
Francis D. Hansen	RE/SPEC	605/394-6400
Paul Senseny	RE/SPEC	605/394-6400
Tom Lamb	SWEC	
John Peck	SWEC	
Philip J. Murphy	SWEC	617/589-2173
Ev Washer	SWEC	

Ed Bingler	TBEG	
Roy T. Budnik	TBEG	
Dow Davidson	TBEG	
Alan Dutton	TBEG	
Steve Fisher	TBEG	
Mike Fracasso	TBEG	
Thomas C. Gustavson	TBEG	
Susan Hovorka	TBEG	
David A. Johns	TBEG	
Charles Kreitler	TBEG	
H. S. Nance	TBEG	
Steve Ruppel	TBEG	
Jerry Wermund	TBEG	
Margaret Hart	Texas Dept. of Water Resources	512/463-7797

WELL J. Friemel COUNTY Deaf Smith DATE August 1983

INTERVAL 352'-470' OGALLALA, DOCKUM LOGGED BY ST DJ BL SW CW LE PH

FEET BELOW KB	LITHOLOGY (%)	Structures	COMMENTS	CONTACTS	LITHOLOGIC DESCRIPTION	LOGGER/DATE
350					Light red brown fine ss, poorly sorted, well rounded grains.	
360	CORE NOT RECOVERED					
370					Red brown ss overlain by light gray fine ss poorly sorted (bimodal?) & well rounded grains.	
380	CORE NOT RECOVERED					
390			chert clast		Red brown fine ss, slightly muddy, poorly sorted well rounded grains, contains a 1.5cm diameter chert clast.	
400				S 8	Calcareous, light red brown siltstn, intraclastic w/ mud-rich dark red dendritic stringers surrounding clast.	
				G 4	Light to medium red brown siltstn, burrowed w/ a "blocky" texture, dendritic dark red clay-rich stringers. Mildly calcareous becomes more calcareous upwards & contains calcareous fragments upwards.	BL 8/83
410	NOT RECOVERED		Chert Nodules	1.5	Pale reddish black to dark yellowish orange silty mdstn; moderately burrowed (&/or rootlets) small less than 1mm circular calcareous clasts tend to concentrate in & near burrows, mud in burrows pale olive color. Blocky texture, broken angular clasts in burrows. Carbonate cement.	
420				G	Pale reddish brown fine siltstn; small scale cross beds & ripples in basal portion becoming structureless up section. Grades up section to a silty mdstn. Carbonate cement.	
430			Mottling	2.7		
	NOT RECOVERED		Calcite filled fractures; Clay filled fractures, of calcareous clays with Mn oxides	S	Alternating cross-bedded coarse siltstn & horizontally laminated mdstn w/ siltstn lenses. Top .5' reduced.	
440				25.2	Moderate yellowish black massive to well cross-bedded, micaceous fine to very fine ss; calcite cementation poor to moderate. Hematite staining often defines bedding surfaces & cross-bedding. Carbonate cement. Scattered small 1 x 1 cm calcareous nodules. Climbing ripples.	
450			Flame Structures			
460			Dendritic Mineralization Patterns of Manganese Oxides	G 1.9	Sequences of rounded elongate claystn clasts (up to .3 x 1.0cm) overlain by fine ss; Clasts imbricated; scattered large (1.5 x 2cm). Calcareous (caliche) nodules. Bottom 1.0' reduced.	
	NOT RECOVERED				.15' of reduced sandy mdstn w/ calcareous nodules up to 1 x 1 cm.	ST 8/83
470						

OGALLALA

DOCKUM

logged by ST BL date 8/83

date

checked SH date 9/83

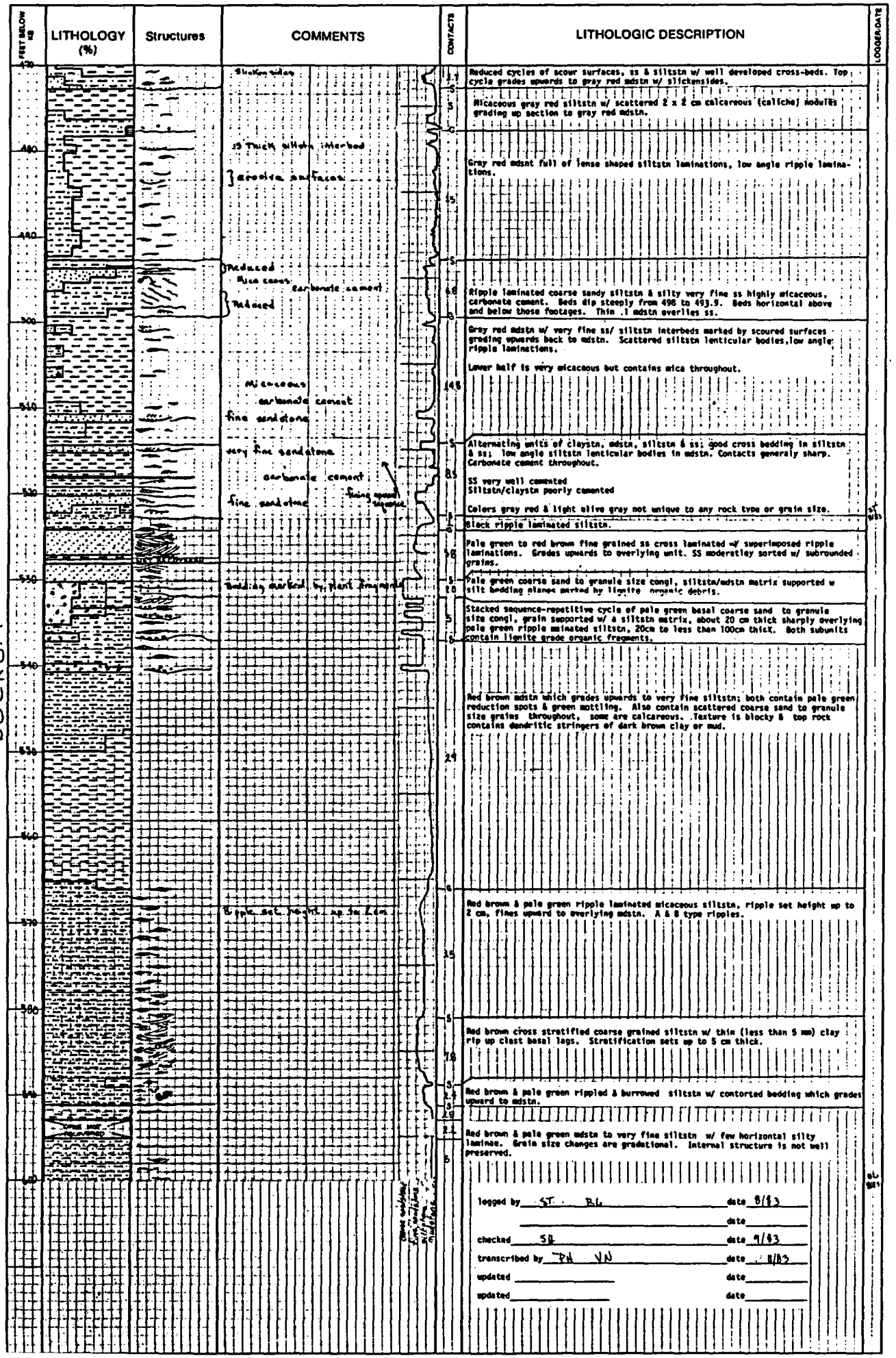
transcribed by PH JN date 10/83

updated date

updated date

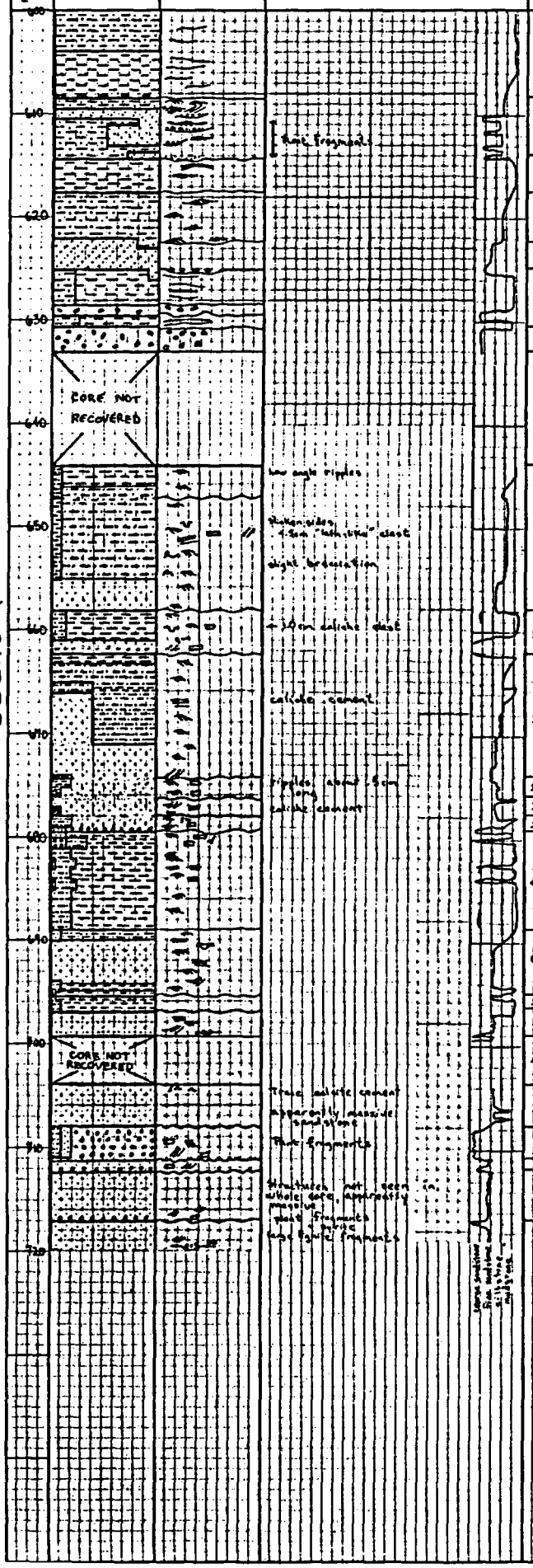
WELL J. Friemel COUNTY Deaf Smith DATE August 1983

INTERVAL 410'-600' DOCKUM LOGGED BY ST, DJ, BL, SN, CW, LE, PH



WELL J Friemel COUNTY Deaf Smith DATE August 1983

INTERVAL 600'-720' DOCKUM LOGGED BY BL, ST, DJ SW CW LE PH



LITHOLOGIC DESCRIPTION

Red brown & pale green mdstn to very fine siltstn w/ few horizontal silty laminae. Grain size changes are gradational. Internal structure is not well preserved.

Pale green stacked sequences of a basal caliche grained sand w/ lignite plant fragments (10-40cm thick) overlain by cross laminated & ripple laminated siltstn (15-30cm thick). The basal contact of sand beds is a scour surface & the upper contact is sharp to gradational.

Pale green & red brown mdstn contains cross laminated silt laminae upwards.

Red brown ripple laminated siltstn, micaceous, fines upwards to overlying unit.

Red brown medium ss w/ a mud-rich matrix, granule rich at the base, calcareous, grains well rounded, poorly sorted.

Red brown w/ a caliche grain congl (see below) interbed; no apparent structure in unslabbed core.

Mixed pale green & red brown mdstn w/ rounded & subangular granules of carbonate & minor sand- grains are matrix supported caliche granule congl.

Gray green ripple laminated fine ss, calcite cement, abundant mica & possible organic material mixed w/ sand; low relief ripple sets at base (about .5cm) to much larger at top (about 2.0cm). Grades upward to red brown ripple laminated siltstn w/ calcite cement; tends to be evenly laminated in middle w/ ripples increasing at top; Burrowing & abundant soft sediment deformation w/ some brecciation & faulting grading into gray green ripple laminated siltstn sharply overlain by black low angle ripple laminated mdstn.

White cross-bedded caliche congl about .9' thick grading rapidly to siltstn w/ soft sediment deformation grading to brown red ripple laminated silty mdstn w/ possible burrows.

Two fining upward sequences; lower set is gray green cross-bedded ripple laminated medium ss, large scale structures grades rapidly into finely laminated ripple laminated fine ss which grades to finely laminated siltstn w/ fine ss lenses (old ripples) w/ small climbing ripple sets (.5-1cm thick) grading to finely laminated silty mdstn. Top set is gray green ripple laminated siltstn grading to ripple laminated mdstn.

Gray green ripple laminated fine ss w/ ss load casts containing clay intraclasts in thin clay bed.

Gray green poorly sorted fine ss w/ clay clasts at base; structures faint, possible large cross beds.

677.8-679.4 Caliche pebble congl. about .3' thick sharply overlain by various poorly sorted subangular-subrounded ss w/ silt coarsening upward sequences about 1.5-2cm thick. This is overlain by a parallel laminated muddy siltstn. Up section a clay dike is truncated by a ripple laminated fine ss & climbing ripple fine ss w/ soft sediment deformation. Overlain by brecciated muddy siltstn w/ 3cm angular clasts & fine ss matrix. Capped by green/gray silty mdstn.

Gray green to red brown to brown sequences of caliche granular congl from .5cm to 12cm thick grading to ripple laminated silty mdstn to parallel laminated silty mdstn from 1.4 feet to 5 feet thick; calcite cement; soft sediment deformation.

Gray green ripple laminated fine sand grading to gray orange pink ripple laminated sandy siltstn grading to brown mdstn grading to gray orange pink cross-bedded poorly sorted medium ss w/ clay clasts & calcite cement grading to gray green ripple laminated parallel laminated fine ss w/ abundant mica & organics? in ripples which grades to gray orange pink ripple laminated sandy siltstn.

Brown mdstn w/ trace of silt.

Gray green apparently medium fine ss; moderate sorting subround to round grains w/ mdstn intraclasts at base; interbeds organic and or opaque minerals. Soft sediment deformation just below unrecovered interval, above break cross-bedded ripple laminations & parallel lamination sequences. Abundant mica flakes.

Gray green cross-bedded grain supported pebble congl; abundant calcite cement; larger pebbles flattened. 10% siltstn fragments, medium ss & silt matrix, subround to round grains.

Gray green cross-bedded medium ss grading upward to pebble congl grading to fine ss w/ calcite cement; 80% silt pebbles.

Gray green matrix supported pebble congl grading upward to medium ss, apparently medium grading to fine ss; mica very abundant, calcareous cement & fine organic or opaque minerals common.

Gray green cross-bedded medium ss, abundant rock fragments & mica, fine organic material interbedded: intraformation scour, subround to rounded grains, moderate to poor sorting, calcareous cement.

LOGGER/DATE

logged by DJ BL date 8/83

date

checked SB date 10/83

transcribed by PK VN date 11/83

updated date

updated date

WELL J Friemel COUNTY Deaf Smith DATE August 1983

INTERVAL 720'-840' DOCKUM LOGGED BY DJ SN ST BL CW LE PA

FEET BELOW KB	LITHOLOGY (%)	Structures	COMMENTS	CONTACTS	LITHOLOGIC DESCRIPTION	LOGGER-DATE
720					see previous page	
			Tiny calcareous cement		Gray green cross-bedded fine ss, abundant rocks, intraclasts, cross beds (20-30 degrees), organic matter & coarse mica flacks abundant, grades up section into fine ss w/ clay clasts overlain by dark brown mdstn w/ scattered sand grains & rounded grains.	
			Abundant organic fragments possible "green" location at top		Gray green cross-bedded fine ss; rounded grains, moderately to poorly sorted, abundant coarse siltstn clasts, organic fragments & muscovite flakes.	
730					Gray green ripple laminated fine ss; poorly sorted, abundant coarse muscovite flakes, organic fragments & fine ss clasts in siltstn.	
			Burrowed mdstn		Gray green ripple laminated fine ss; poorly sorted, abundant coarse muscovite flakes & organic matter. Mdstn is burrowed w/ pyrite nodules.	
			calcareous cement in sand		Red brown/gray green cross-bedded fine sand fining up section to mdstn w/ faint ripple laminations.	
			fine ripple laminations mdstn has calcareous comp		Pale gray/green/red/brown mdstn, fining up section to less silty mdstn; coarse siltstn are contorted & reduced; soft sediment deformation common; mdstn has fine parallel ripple laminations.	
740			calcite sheet in coarse silt coarse silt		Pale green/red brown yellow gray coarse siltstn w/ fine ss interbeds; coarsening up sequences, ripple laminations; poorly sorted, abundant soft sediment deformation.	
			fine ss inter bed -0.3' thick smaller scale structures in finer zones		Red brown/ yellow gray coarse siltstn coarsens up section to fine ss, ripple laminations, poorly sorted, subrounded grains, multiple intraformational scours; abundant soft sediment deformation.	
			fine ss inter bed -0.3' thick			
750			Green mdstn interbed			
			scour surface w/ intra clasts of mdstn		Pale green/gray fine ss, ripple laminations, poorly sorted, subrounded grains.	DAF 8/83
			Several graded sequences fine up		Green to brown contorted ripple laminated siltstn, microfaulted. Clay rich at the top.	
760			micro fault		Green pebble congl (to 7.5cm) white subrounded imbricated grains overlain by green cross-bedded rippled fine ss.	
					Green mdstn, some contorted ripples. Small channels.	
					Red brown mdstn. Soft sediment deformation, ripples and small clay clasts in coarser interval. Two small channels w/ coarser fill.	
			graded boundary above fault reduced along inform fault		Red brown muddy claystn w/ ripples. A little soft sediment deformation, small channel red brown rippled mdstn.	
					Red brown rippled mdstn.	
	NOT RECOVERED					
770			clay clast about 2" long			
			small channel		Red brown rippled mdstn. Ripple bedding contorted (soft sediment deformation?). Several thin reduced intervals.	
					Green rippled siltstn, soft sediment contorted bedding.	
			green top 0.1'		Red brown claystn becomes silty (thin layers) in the top 6 inches.	
780			sand layer ripples		Red brown rippled siltstn, fines up to mdstn at the top. Soft sediment deformation of clay layers (diapirs).	
			about 3" laminated interval			
790					Red brown cross-bedded fine ss, silty calcareous cement. Thin layers of clay clasts occur along some cross-bedding planes. Occasional thin lines of disseminated organics on cross bedding planes. Friable.	
800			silty green interval w/ thin green layers on cross-bedding planes			
			0.5' organic-rich layer which is slightly green			
810						
820						
	NOT RECOVERED					
830			Thin layer of organics		Variable colored sandy congl (clasts up to 2.5cm). Crude cross-beds composed of somewhat graded beds. Silty calcareous cement, clasts subangular to subrounded. Few horizontal lines of organics.	
			1" coal layer		Red tan subtlety laminated fine ss.	
			1" clay rich layer		Variable colored sandy congl, five fining upward sequences. Crudely laminated.	
840					Red fine ss w. thin (less than .1cm) mud interlayers. No pebbles in top 3 inches.	SN 8/83

DOCKUM

logged by DJ SN date 8/83

date

checked date

transcribed by PA VN date 12/83

updated date

updated date

WELL J Friemel COUNTY Deaf Smith DATE August 1983

INTERVAL 840'-960' DOCKUM LOGGED BY ST, DJ, BL, SN, CW, WE, PH

DOCKUM

FEET BELOW KB	LITHOLOGY (%)	Structures	COMMENTS	CONTACTS	LITHOLOGIC DESCRIPTION	LOGGER/DATE
840			silty silty layer		Red tan fine ss w/ pebbles (1-3cm), silty calcareous.	
					Green gray claystn, thinly laminated, becomes silty in top 0.3 feet.	
850	CORE NOT RECOVERED					
860						
870						
					Red tan fine ss w/ a few small (about 1cm) mud clasts. No obvious structures a few very thin (less than 1mm) black lines oriented horizontally (possible organics). Friable calcareous cement.	
					Black, silty claystn. 3cm of green clay at the top.	
880						
					Calcite cemented pyritized congl, grain size very coarse, sand to cobble w/ granule to pebble size predominate. Clasts; rounded to subrounded w/ scattered angular clasts, about 85% chert pebbles, orange, purple, red, pink & pink, about 15% carbonate clasts, pebble to cobble and less than 1% plant fragments. Clasts often enclosed w/ yellow rims (uranium?).	SN 8/83
890			plant fragments		Vertical sequence ; scour surface, chaotic fabric, slight imbrication, graded beds of very coarse ss- repeated sequence.	BL 8/83
	CORE NOT RECOVERED					
900					Unconsolidated massive dark red brown mdstn. Basal 2.5' reduced w/ brecciated, broken texture w/ small rounded calichefied clasts, calcareous to about 904.5.	
					(Soil texture?)	
910			Reduced			
	CORE NOT RECOVERED					
920						
			Reduced		Dark red brown massive mdstn.	
					Finely laminated muddy micaceous dark red brown siltstn.	
930					Dark red brown massive mdstn w/ gradational upper & lower contact.	
					Ripple laminated dark red brown siltstn.	
940					Moderate reddish orange massive claystn grades up to moderate dark red brown claystn w/ numerous fine interlaminae of pale yellowish orange micaceous siltstn. Laminations are .5mm- 1mm.	
950						
					Low angle & horizontal laminated dark red brown/moderate red brown slightly muddy fine ss. Grains well rounded & poorly cemented.	ST 8/83
960						

logged by ST, BL, SN date 8/83

date

checked date

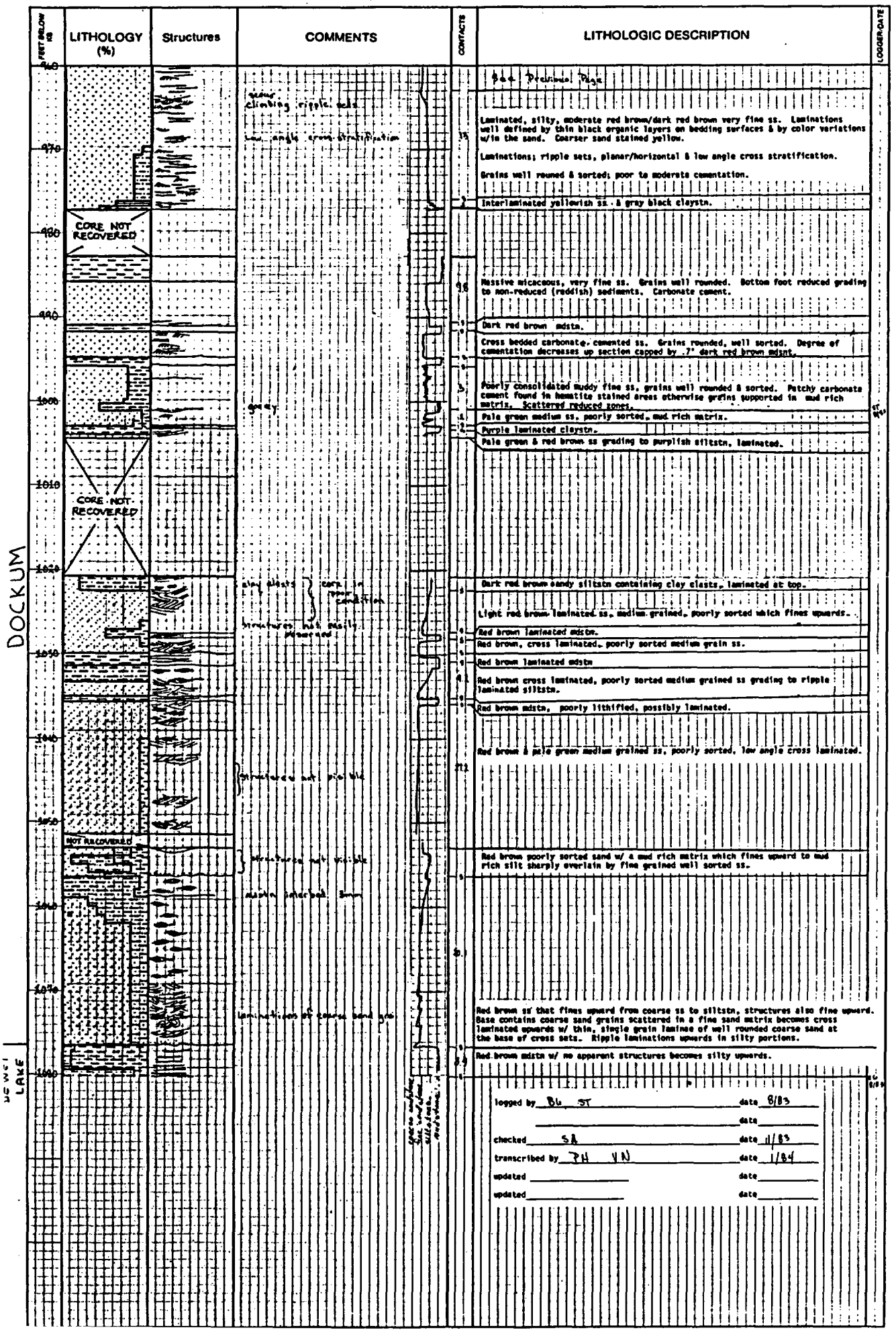
transcribed by PH VN date 1/84

updated date

updated date

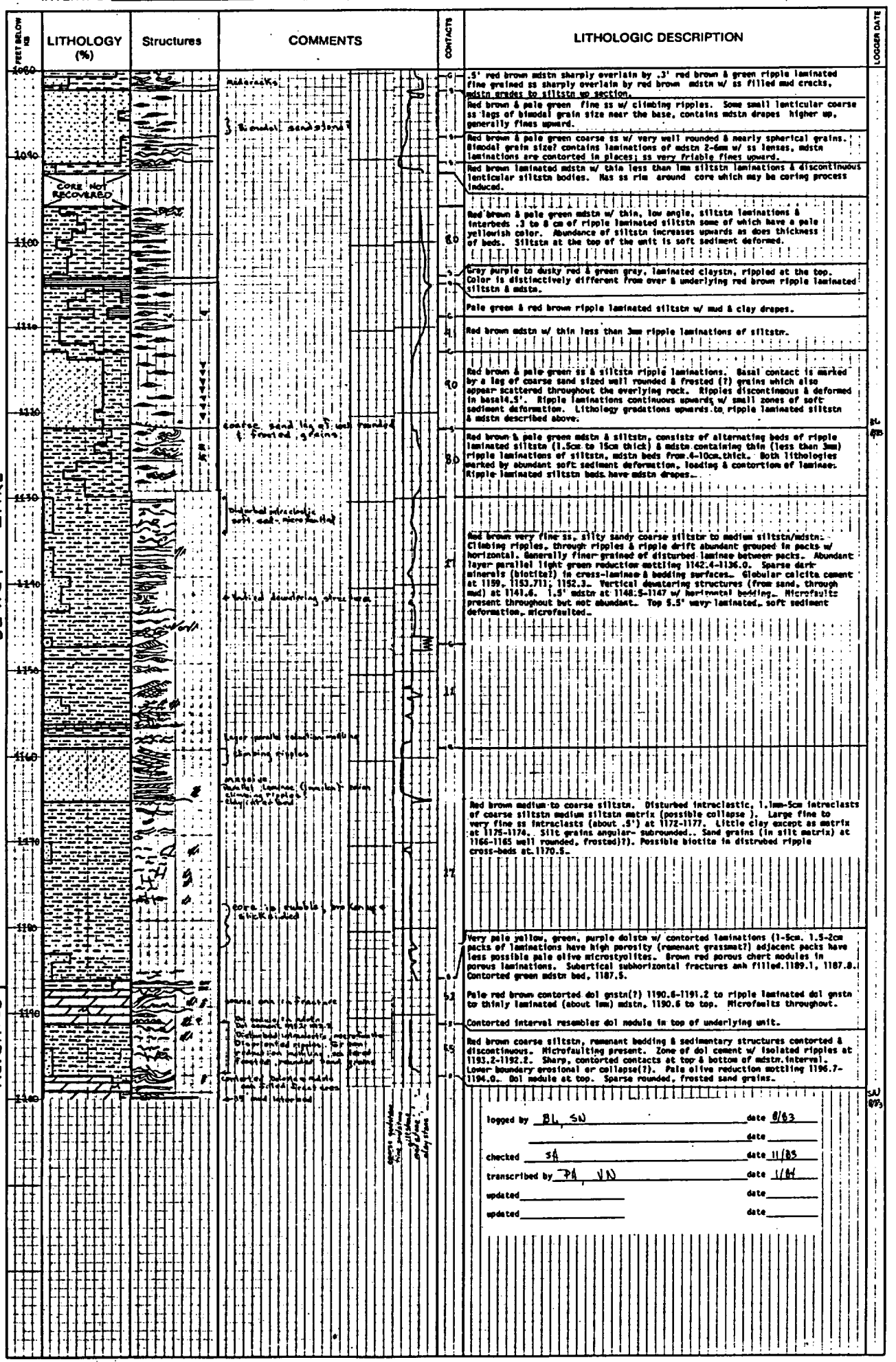
WELL J. Friemel COUNTY Deaf Smith DATE August 1983

INTERVAL 960' - 1080' DOCKUM, DEWEY LAKE LOGGED BY BL, ST, SN DJ, CW LG PH



WELL J. Friemel COUNTY Deaf Smith DATE August 1983

INTERVAL 1080'-1200' DEWEY LAKE, ALIBATES LOGGED BY ST, DJ, BL, SN, CW, LE, PA



WELL J Friemel COUNTY Deaf Smith DATE October 1983

INTERVAL 1200' 1317' ALIBATES, SALADO-TANSILL, YATES LOGGED BY ST, DJ, BL, SN, SW, WE, PH,

FEET BELOW KB	LITHOLOGY (%)	Structures	COMMENTS	CONTACTS	LITHOLOGIC DESCRIPTION	LOGGER/DATE
ALIBATES						
1200					Pale red brown to gray yellow green ripple laminated dol mdstn w/ thin mud drapes at 1200.9 -1200.4. mud interbed at 1200. Red hue decreases up from interbed. Top is contorted, collapse of mud interbed into dolstn. Discontinuous parallel fractures (anh ? filled) in dol. Subvertical to collapsed mdstn. Upper 1' pale gray red purple.	
1210					White dolomitic mdstn to intraclastic wkstn. Mud cracks? at 1209.8-1209.4 & 1204.9 separated by contorted & microfaulted intraclastic wkstn. Porosity well developed in intraclasts. Gray olive microstylolites & abundant discontinuous well developed along microstylolites, could be truncated intraclasts. Primary textures obscured by diagentic alteration.	
1220	CORE NOT RECOVERED					
1230						
SALADO-TANSILL						
1240					Moderately dark reddish brown mdstn w/ numerous fractures infilled w/ gyp, small gyp blebs & discontinuous contorted gyp laminations: sand sized euhedral gyp crystals scattered evenly throughout mdstn; 1' vein (1242') shows evidence of brittle deformation.	
1250					Light medium reddish brown siltstn w/ numerous fractures infilled w/ gyp & small gyp nodules; 1' mdstn interbed at 1251.5; Lower 3' has disturbed intraclastic fabric w/ contorted laminations.	
1260	CORE NOT RECOVERED					
					Light medium red bedded anh w/ gyp fractures parallel to bedding & gyp nodules throughout.	
1270					Light dark reddish brown mdstn w/ gyp infilled horizontal fractures, & bedded modular mosaic anh interbeds; disturbed intraclastic fabric & disrupted gyp lamination at 1271-1272; sand & silt size euhedral gyp crystals scattered through mdstn at top & bottom of unit; Hal cement. Mdstn/gyp/anh insoluble residue.	
					Light bluish gray bedded anh w/ parallel wavy laminations, gyp nodules scattered throughout. Euhedral vertical gyp at base.	
1280					Medium dark reddish brown siltstn w/ disturbed intraclastic fabric. Fabric is accentuated by zones of preferential hal crust from 1280.4-1283.5'; zone from 1284.5-1286.0 is composed of very fine siltstn transitional to mdstn & is fractured. Some porosity.	
					Medium dark reddish brown very fine ss w/ wavy laminations, near vertical upper contact w/ unit above; hal cement.	
					Medium dark reddish brown very fine ss w/ disturbed intraclastic fabric; fabric is accentuated by zones of preferential hal cementation.	
YATES					Light dark reddish brown siltstn w/ mdstn interbeds; wavy laminations & disturbed intraclastic fabric are common in siltstn; mdstns have disturbed intraclastic fabric & numerous hairline fractures, reduction zones & iron banding are common; Hal crust.	
1300					Light medium reddish brown siltstn w/ vague wispy lens-shaped pods of darker siltstn; vague wavy laminations, hal crust.	
1310						
1320						

logged by SN, WE date 11/83

date

checked SH date 11/83

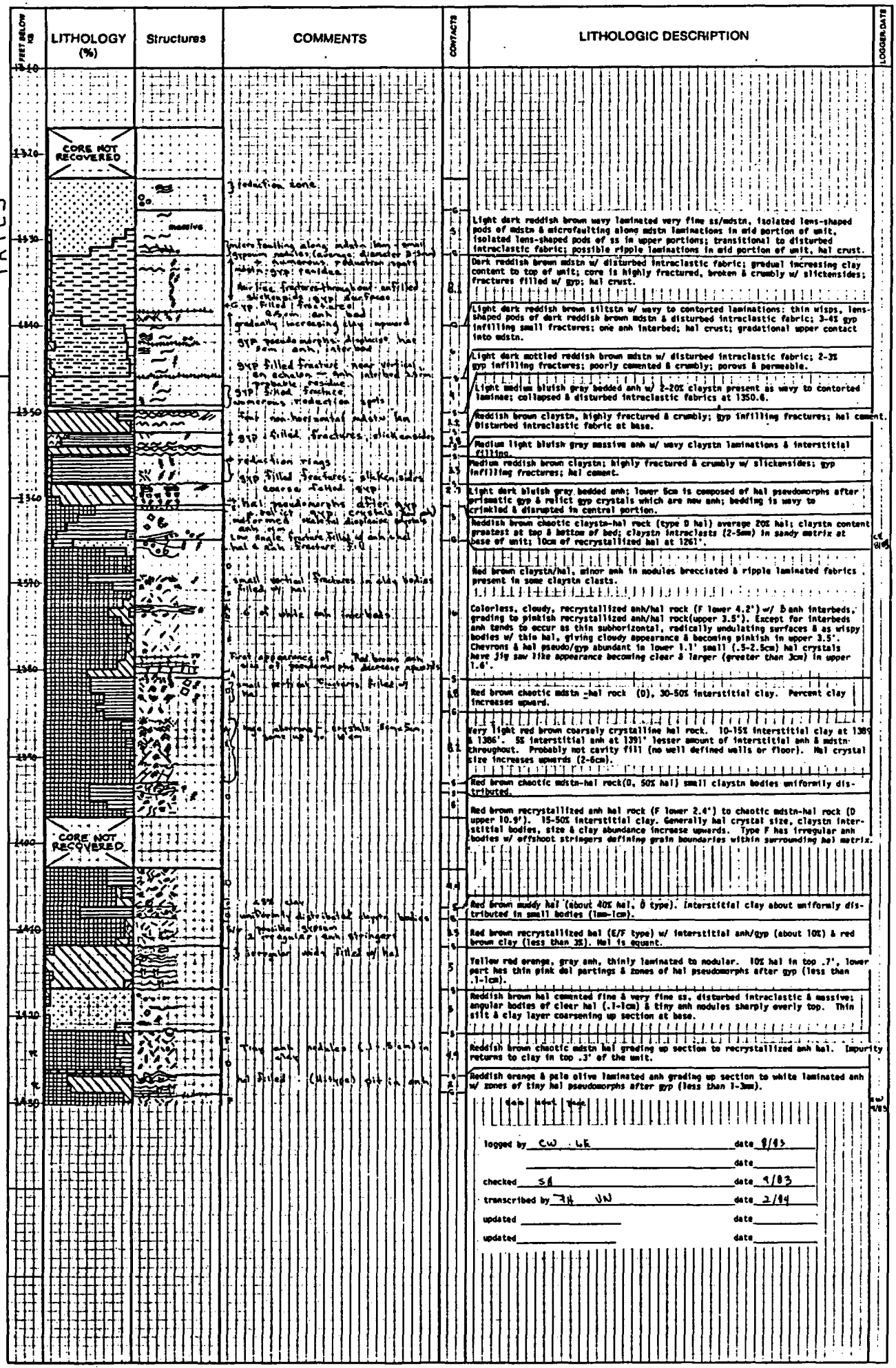
transcribed by PH, VA date 2/84

updated date

updated date

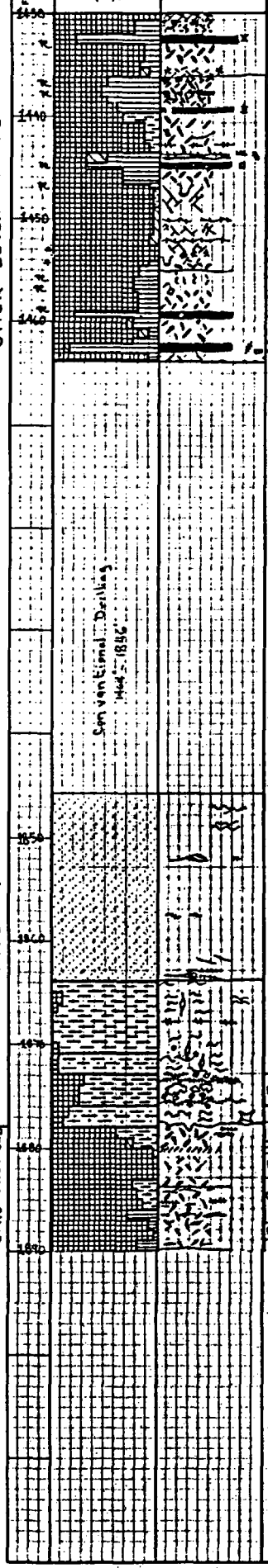
WELL J Friemel COUNTY Deaf Smith DATE August 1983

INTERVAL 1317' - 1430' YATES UPPER SEVEN RIVERS LOGGED BY ST, DJ, BL, SN, CW, LE, TH



WELL J. Friemel COUNTY Deaf Smith DATE Nov. 83

INTERVAL 1430' - 1890' UPPER SEVEN RIVERS QUEEN-GRAYBURG UPPER SAN ANDRES LOGGED BY ST, DJ, BL, SN, CW, LE, PR



COMMENTS	CONTACTS	LITHOLOGIC DESCRIPTION	LOGGER/DATE
anh blades replace anh nodules		Cavity filling pure hal grading up to recrystallized anh hal.	
white fibrous hal filled fractures 10cm wide, 30cm long		Reddish brown chaotic mdstn-hal. Top 30cm fine (8mm) mdstn clasts, hal middle 30cm mdstn w/ displacive hoppers. Lower 72cm coarse (2-5cm) hal-mdstn.	
pink & white wavy laminated anh bed 7cm thick, probable pressure sol. hal filled fractures, polygonal in plan view at 1445.5		Mostly anhydritic hal w/ about 2% mud within crystals. Anh is in large irregular bodies (.5-6cm) between hal crystals & is being replaced by gray large crystals of gyp (.1-5mm) long.	
		Reddish brown chaotic mdstn-hal. Mud & clay content increases up section towards interbeds. Mudsalt at top 1 inch is composity of densly packed mdstn masses, hal functions as cement.	
1% anh, angular, vertical fracture		Clear coarse crystalline anhydritic hal (1-4cm) w/ several pits. Grades up to recrystallized reddish muddy hal. H typ hal fills pits. Chevrons are abundant at the base of the unit.	
		Reddish brown chaotic mdstn-hal. Somewhat coarsely recrystallized w/ clay between & within crystals. Contains few displacive hal cubes. Claystn in 1mm-1cm rounded masses.	
Anhydrite, 0 fractures filling hal		Reddish brown chaotic mdstn-hal, white & gray anh occurs in the same form as the angular & rounded bodies (.2-4cm) of clay which are within & between crystals.	
Irregularly distributed laminae of greater cementation - dissipation structure?		Reddish brown mostly massive hal cement fine & very fine ss w/ only very vague evidence of cross laminae in a few zones. Contains a homogeneous distribution of greenish gray reduction spots (.1-15cm in diameter covering 15% of the rock.)	
5% ANH, irreg. cemented areas	18		
2% ANH			
subrounded fine SS anhydritic laminae			
reduction spots stop against fractures (spots younger)		Reddish brown massive to disturbed intraclastic mdstn & siltstn w/ numerous greenish gray reduction spots (.1-15cm in diameter) Clear fibrous hal filled vertical fractures occur throughout the unit.	
intraclastic ANH bed; maybe residual	91		
fibrous fracture fills are white			
2% ANH			
wavy ANH laminae, probable insoluble residue		Reddish brown chaotic mdstn hal & anhydritic hal w/ a zone of siltstn. Anh occurs as laminae & tiny nodules (.1-.4cm) throughout the unit.	
intraclasts			
ANH; wavy laminae		Reddish brown, brown and dark gray recrystallized hal. Alternating between chaotic mdstn hal & muddy hal rock. Faint dark banding occurs near the top of the unit along w/ some vertically oriented crystals.	
4-8%			
2% mud			

logged by CW date 11/83

date

checked SA date 11/83

transcribed by TR, VN date 2/84

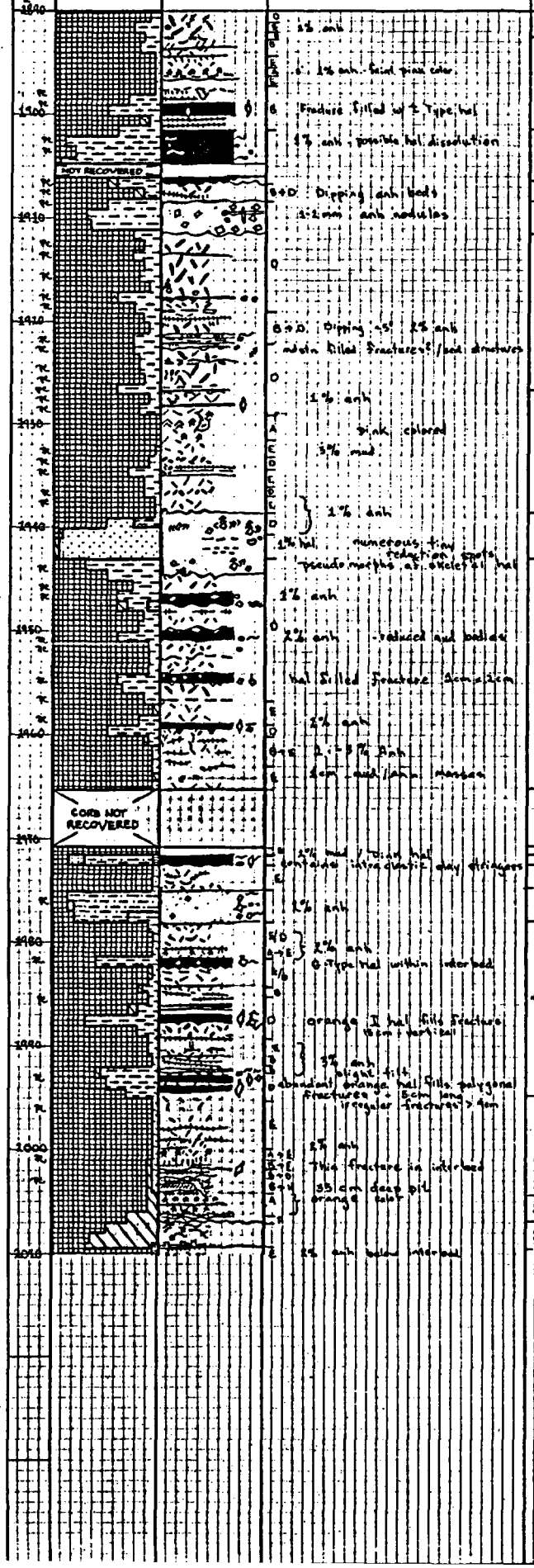
updated date

updated date

WELL J. Friemel COUNTY Deaf Smith DATE October 1983

INTERVAL 1890'-2010' UPPER SAN ANDRES LOGGED BY ST, DJ, BL, SN, CW, LE, PH

UPPER SAN ANDRES



CONTACTS	LITHOLOGIC DESCRIPTION	LOGGER/DATE
6	Brown & yellowish brown color banded hal w/ vertically oriented crystals & cross cut by numerous recrystallized pits. 0.3' of chevron hal occurs at 1295.7'. A wide orange hal filled fracture makes up about 50% of a mdstn/siltstn interbed near the base of the unit.	
4	Reddish brown massive to contorted mdstn contains several tiny anh nodules (less than 3cm), numerous irregular reduction zones and isolated bodies of D & E type hal.	
3	Mostly chaotic mdstn/anh hal rock. Lower .3' shows bedded hal cross cut by a 4-5cm wide pit.	
3.1	Yellowish brown siltstn w/ disturbed intraclastic fabric & zones of large displacive hal hoppers (1-3.5cm). I-hal type filled fracture 30 cm long & 1-5mm wide in the center.	
15.1	Dark reddish brown & brown chaotic mdstn-hal w/ some muddy & anhydritic hal rock. Small anh nodules (.2-.5cm) occur w/in mud near 1918'. Pinkish clear chevron hal is found near 1930'. Several muddy interbeds occur throughout this unit from .2to .7cm thick. Interbeds contain either or both vertical orange hal filled fractures & displacive hal hoppers.	
13	Dark reddish brown & brown chaotic mdstn, hal w/ some muddy & anhydritic hal rock. Small anh nodules (.2-.5cm) occur w/ in mud near 1918'. Several muddy interbeds occur throughout the unit from .2 to .7 cm thick & contain varying amounts of anh and hal filled vertical fractures.	
4.5	Dark reddish brown highly contorted to massive very fine ss. contains several isolated gray anh nodules (.2-2cm) & a few very tiny hal hoppers (.2cm). Possible desiccation structures in lower half.	
22	Mostly dark brown muddy hal, chaotic mdstn hal & anh hal w/ numerous muddy interbeds. 1-15cm thick. Interbeds contain either or both vertical orange hal filled fractures & displacive hal hoppers, mud content generally increases up section. A few small anh nodules (.1-.5cm) are found near 1946.8'.	
4	Reddish brown siltstn coarsening up section to very fine ss contains .5-2cm anh nodules & an 11 cm long .3cm wide vertical hal filled fracture, I type.	
3	Dark brown recrystallized anhydritic hal.	
3.1	Dark reddish brown & yellowish brown mdstn contains large displacive hoppers (2-4cm) & a few small gray anh nodules.	
4.6	Brown muddy & anh coarsely crystalline hal w/ numerous mdstn interbeds which commonly contain orange fibrous hal in vertical fractures and/or euhedral displacive hoppers.	
6	Brown & slightly reddish brown muddy & anh hal. Mostly recrystallized zones banding, vertical crystals & chevrons. A deep pit (30cm) occurs at the base of the unit.	
1.7	Reddish orange & light brown chevron hal associated w/ f type hal.	
1.7	White felted anh & anl. Bottom 15cm becomes reddish gray & brown w/ hal pseudomorphs after gyp (.1-.5cm long at the base).	
3		

logged by CW date 10/83

date

checked DB date 11/83

transcribed by PH, WN date 2/84

updated date

updated date

WELL J. Friemel COUNTY Deaf Smith DATE September 1983

INTERVAL 2010'-2150' UPPER SAN ANDRES LOGGED BY ST, BL, SN, DJ, CW, LG, PH

UPPER SAN ANDRES

FEET BELOW KB	LITHOLOGY (%)	Structures	COMMENTS	CONTACTS	LITHOLOGIC DESCRIPTION	LOGGER/DATE
2010			mud, anh grade into each other; 2-5% anh	11.7	Brown to reddish brown hal w/ numerous interbeds of both mud & anh. Vertically oriented crystals & dark banded hal grading up to recrystallized muddy & anh hal w/ zones of chaotic mdstn hal. Much of the mud grades into the anh and crystal sizes tend to coarsen upwards.	
2010			mudstone top to anhydrite; well formed, fan tail halite pseudomorphs		Light gray white & red laminated anh packed w/ hal pseudomorphs after gyp (.1-4cm). Includes displacive hal cubes (2cm) at top.	
			ripple laminated, very fine ss or siltstone draped over anhydrite;		Interbedded dark brown rippled very fine ss & red & white laminated anh w/ hal pseudomorphs after gyp (.1-1.5cm) w/ a 3 cm E Type hal at the top. Horizontal cracks & irregular voids in ss are hal filled.	
			not recovered 2023-2029			
2050			Brown mud interbeds 1-3cm thick	4.4	Dark brown chaotic mdstn hal w/ some euhedral displacive hal cubes (1-2cm) in mud.	
					Brown banded hal w/ vertically oriented crystals up to 4 cm long. Banding is cut by a pit 10 cm deep at 2034.6'.	
					Pink chevron hal rock w/ verttical crystals grades up to light brown in color.	
2040			mdstn interbed, 10cm, 20% hal; mdstn interbed, 1cm; mdstn interbed, 1cm; mdstn interbed, 1cm, w/ thin dark horizontal drape		Color-banded vertically-oriented bedded (B-Type) hal transitional to anhedral muddy (E-Type) hal. Mdstn percentage varies from 2-30% , chaotic mudsalt is present in zones w/ high mdstn percentages; abundant mdstn interbeds, reddish brown to dark gray in color; 8cm of chevron hal at top.	
2050			mdstn drapes	7.9		
			mdstn interbeds; mdstn interbeds, 8cm, 50% hal; mdstn interbed, 4cm, laminated			
2060			mdstn interbed, 2cm; mdstn interbed, 1cm; thin mdstn drapes; mdstn interbeds			
			chaotic mudsalt w/in solution pit; large solution pit, 2' filled w/ mdstn, anh intraclasts, & displacive hal hoppers; hal pseudomorphs after twinned gyp; fine anh fabric transition, 50cm		Chaotic mud salt (D-Type) transitional to anhedari muddy (E-type) hal; bottom portion is characterized by large solution pits containing thick reddish brown to dark gray mdstn, large displacive hal hoppers, & anh clasts; mdstn contnet & hal crystal size increases upward; small fracture filled w/ red fibrous hal at top.	
2070					Light medium bluish gray anh (60-80%) composed of alternating contorted beds of anh & hal pseudomorphs after twinned gyp; pseudomorphs increase in size & become better formed upward; largest pseudomorph is 7 cm in length.	
					Medium dark gray nodular mosaic anh; interstices between nodules filled w/ dolomitic mud; small (1-2mm) salt crystals at top of unit.	
2080					Light olive gray dolostone; 20 cm contains red anh nodules, burrows & wispy laminations.	
					Reddish brown to olive gray very fine ss/siltstn; abrupt color change at 2079.4' Contains displacive hal hoppers, disturbed intraclastic fabric & contorted laminae, vertical fractures filled w/ fibrous hal; red anh nodules in upper portion.	
			hal drapes; cubic inclusion zoning in hal		Chaotic mudsalt (D-type hal) transitional to anhedral muddy (E-type hal); Mdstn is reddish brown in color w/ some light olive gray reduction zones. Mdstn percentages vary from 15-75%; present as interstitial material between grain boundaries & as interbeds; interbed at 2090' is 35cm thick & contains displacive hal hoppers & vertical fracture filled w/ deep orange fibrous hal; zone of vertically oriented hal crystals; chevrons & cubic inclusion zoning at 2085-87'.	
2090			mdstn interbed, 12cm, 25% hal, contains fracture filled deep orange hal; mdstn interbed, 4cm, 10% hal, contains euhedral displacive hal hoppers			
2100			mdstn interbeds w/ contorted laminations, 8cm, 80% hal		Color banded; vertically oriented bedded (B-Type) hal w/ 8% reddish brown mdstn in the form of thin interbeds & interstitial between grain boundaries; less than 1% anh as thin interbeds & drapes & finely disseminated between grain boundaries, thin zone of chevron hal at 2106'.	
			mdstn interbed, 4cm, 25% hal; anh drapes; mdstn interbeds, uppermost contains euhedral displacive hal hoppers, hal beds capped by mdstn beds			
2110			mdstn interbeds, 8cm, 50% hal contains euhedral displacive hal hoppers, 0.5'; mdstn interbed, 1cm		Vertically oriented bedded (B-type) hal transitional to anhedral muddy (E-type); contains 6-10% mdstn in the form of interbeds, lining solution pit floors & interstitial between grain boundaries; bedded (B-type) hal is best preserved in basal & mid portions of unit & becomes less well preserved upward.	
2120			anh interbed, 8cm, 25% hal; zone of solution pits, hal	8.7	Anhedral anh/hal w/ continuous & discontinuous anh interbeds & interstitial anh outling grain boundaries; transitional to anhedral muddy hal (E-type); contains 15cm of vertically oriented (B-type) hal at 2123'; small solution pipes & pits floored w/ anh.	
2130			altered anh fabric transition, approx 5cm, pseudomorph screening not preserved		Light medium bluish gray anh (about 75%) w/ small (1mm) hal filled cavities & hal pseudomorphs after zoned gyp crystals (up to 2 cm in long direction); discontinuous anh laminations at base.	

logged by CW LG date 9/83

date

checked SH date 10/83

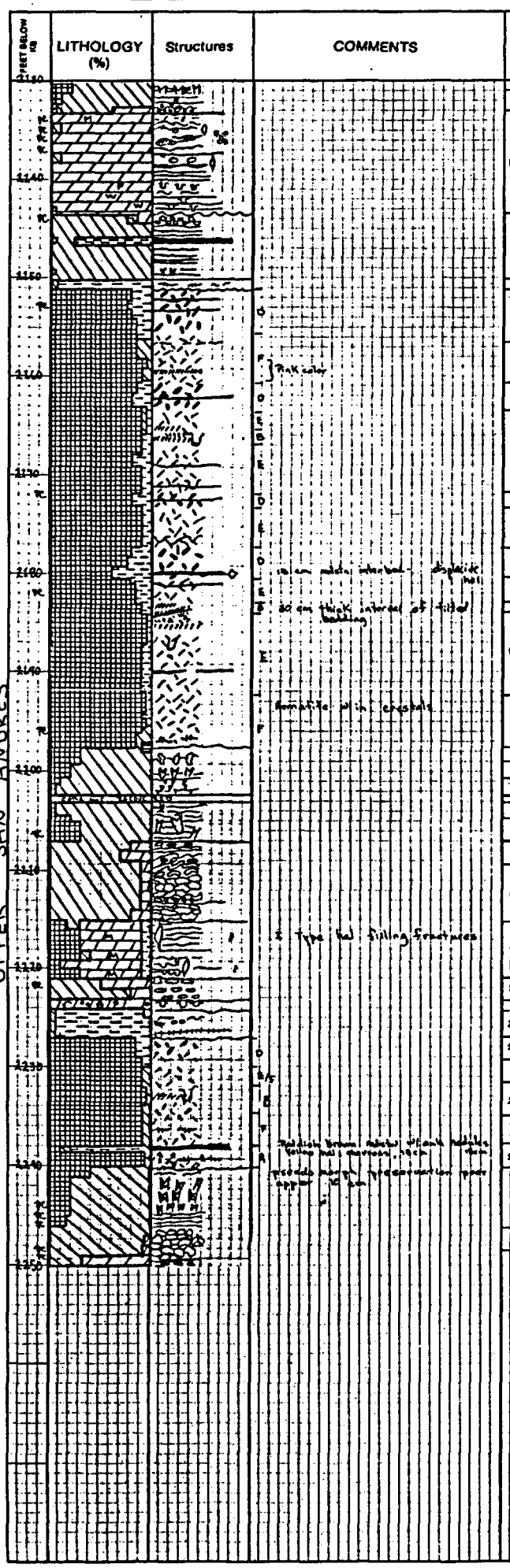
transcribed by PH, VN date 2/84

updated date

updated date

WELL J Friemel COUNTY Deaf Smith DATE August 1993

INTERVAL 2130'-2350' UPPER SAN ANDRES LOGGED BY ST, DJ, BL, SH, CW, LE, JA,



CONTACTS	LITHOLOGIC DESCRIPTION	LOGGER/DATE
	Gray thinly bedded anh w/ tiny hal pseudomorphs after gyp. Bottom .6' highly contorted dol & anh nodules (.1-1cm) & laminations.	
	Blue light olive gray & Grayish yellow white horizontally laminated hal cemented dolmstn. Contains isolated zones of fracture filling hal & anh & anh nodules (.2-2.5cm). Some black wispy laminations, bioturbation & ripples. Top 1.5' becomes highly fractured. Fractures randomly vertical orientation .5-3cm long.	
	Gray bedded anh contains numerous reddish brown laminae. Top 1' becomes nodular in a dol matrix.	
	Black dark gray & reddish brown mdstn w/ moderately contorted anh stringers.	
	Chaotic mdstn hal, reddish brown mud bodies .2-2.5cm.	
	Mostly dark gray to brown recrystallized anh hal but sharp color change to moderate orange pink from 2157.6-2159.5'.	
	Chaotic mdstn hal; angular mud bodies (.5-2cm) vary in color from reddish brown at base to brown at the top.	
	Recrystallized muddy hal mostly reddish brown & gray. Mud w/in & between crystals. Thin zone of cavity filling hal at 2171'. Bedding (dark bands) is cross cut by a 10cm deep pit at 2165'.	
	Very muddy recrystallized hal. Mud grades up section reddish brown to dark gray.	
	Recrystallized hal w/ dark gray mud between crystals & reddish mud w/ in crystals.	
	Recrystallized hal w/ large pieces of reddish mud (1-5cm) between & w/in crystals. Mud becomes grayer at the top.	
	Recrystallized muddy hal, mud is both red & gray.	
	Bedded muddy hal.	
	Recrystallized muddy hal. Top 1 foot contains some evidence of bedding. Minor traces of anh are found near the bottom & the middle of the unit.	
	Recrystallized hal grading up section from dark brown to light yellow. Top .1' contains ftraces of hematitic mud.	
	Felted anh in hal matrix; trace mdstn at top.	
	Numerous large (3-8cm) anh & hal pseudomorphs after gyp cutting bedded anh.	
	Bedded anh w/ very small gyp pseudomorphs between bedding.	
	Thinly laminated anh w/ lone (1-10cm) hal pseudomorphs after gyp.	
	Nodular & bedded anh & dol w/ traces of hal filled porosity. Some dol interbeds contain crystallotopic anh.	
	Nodular anh (.1-8cm) w/ mostly dol matrix. Nodules at base have yellow-green or reddish centers.	
	Yellowish blue to gray laminated dol wkstn w/ long vertical fractures filled w/ orange fibrous hal. Tiny anh nodules (less than .5cm) throughout but more in top portion. Bottom half is well bioturbated, top silty.	
	Gray anh nodules become supported in dol matrix 30cm.	
	Dol gnstn (tan) & pkstn (gray) burrowed.	
	Dark gray anhydritic mdstn, disturbed intraclastic texture.	
	Dark muddy recrystallized hal w/ angular mud bodies (2-4cm).	
	Mostly recrystallized hal w/ some relict bedding of mud & anh.	
	Dark banded hal w/ numerous treations by pits & pipes of recrystallized hal w/ anh layers at the bases.	
	Minor discontinuous anh interbeds in hal. 2.5cm of anh just above mdstn interbed.	
	Hal sparse chevrons, discontinuous anh partings, anh cavity floor?	
	Horizontal laminated anh grading up to interlaminated hal & anh (contorted) grading up to large-scale herringbone hal & anh after gyp pseudomorphs.	
	Med gray nodular to nodular mosaic anh w/ internodular dol mdstn. Dol proportion decreases up section.	
	Yellow brown ripple laminated pkstn/gnstn, abundant anh nodules.	CW 8/93

logged by CW date 8/93

date

checked JA date 9/93

transcribed by JA JD date 3/94

updated date

updated date

WELL J. Friemel COUNTY Deaf Smith DATE August 1983

INTERVAL 2250'-2370' UPPER SAN ANDRES, MIDDLE SAN ANDRES, LOWER SAN ANDRES-UNIT 5 LOGGED BY ST BL DJ LE SN PH CW

FEET BELOW KB	LITHOLOGY (%)	Structures	COMMENTS	CONTACTS	LITHOLOGIC DESCRIPTION	LOGGER/DATE
SAN ANDRES			ANH nodules HAL replacement of allochems and patchy HAL cmt 2251.0-2252.0	3.6	Yellow white gray dol mdstn & pkstn. Burrowing present throughout in varying concentrations.	
			dark	5	Medium gray bedded anh, nodular mosaic anh in upper portion.	
2260			ANH nodules HAL hoppers (small) ANH nodules red	8.3	Highly disturbed mdstn/siltstn interbeds grading to hal cemented very fine ss w/ mdstn interbeds also highly disturbed. Mdstn interbeds less than 0.5 cm thick. Mostly gray medium gray at top, intraclastic.	
			10cm DOL Mdstn layer at 2268.0 10 cm DOL Mdstn layer at 2269.7	6.1	Medium gray nodular, nodular mosaic & mosaic anh w/ internodular dol mdstn.	
2270			Single fossil valves predominantly preferentially oriented	10	Wispy laminated olive gray dol mdstn w/ abundant compressed horizontal burrows. 1.0cm x 0.5cm. Patchy hal cement, controlled by location of burrows. Grading up section to pkstn.	
			Remnant lg-scale herringbone pseudomorphs 10cm clay-rich anhydritic DOL layer at 2279.2 Discon. incipient horizontal fractures present at 2281.0	6	Nodular mosaic anh w/ internodular dol.	
2280				6	Anh & hal pseudomorphs after gyp, remnant large scale herringbones.	
				6	Highly disturbed mud dark gray anhydritic mdstn.	
				3	Medium gray mosaic anh.	
				6	Minor dol & hal define layering in anh. Layering becomes disturbed & truncated by nodular growth in upper portion.	
2290				6.9	Mosaic & nodular mosaic anh w/ dol mdstn present in internodular areas.	
				3.7	Dol mdstn underlying dol gnstn composed of unidentifiable allochems .12mm in diameter. Anh filled vertical burrows present at 2295.2. 0.2mm anh nodules present.	
				6.1 2.0 3	Dark gray mdstn dolomitic at the top strongly disturbed & silty at base	
2300			discontinuous mottled texture in ANH dark and light upper contact has 20 cm irregularity			
2310			4" Dolomite interbed		Gray massive anh w/ irregular voids filled w/ hal & gray thinly laminated anh. Somewhat nodular in lower 12 feet.	
			dark mudstone ≈ 3 cm	5 5	Light to dark yellow brown interbedded gnst & wkstn, ripple laminated 3cm olive gray mdstn at base.	CW 8/83
					Light brown, gray black thinly laminated anh (about 1cm thick). Laminae defined by subparallel horizontal layers of colored anh. Abundant poorly preserved small anh pseudomorphs after gyp.	
2320				5	Gray massive anh w/ irregular vertical cavities (up to 2 cm) filled w/ hal, could be pseudomorphs after gyp.	
MIDDLE SAN ANDRES			1½" Nodular ANH Layer-parallel ANH nodules ripples ANH nodules are euhedral possible pseudomorphs	6	Light brown hal cemented thinly laminated dol mdstn w/ isolated layer parallel anh nodules.	
2330				5		
			1cm ripple lam. dk mudstone nodular	6.1 8	Gray nodular mosaic anh, top 30cm & basal 25cm dol matrix.	
			lam. ANH, ANH pseud. after gypsum poorly preserved grassmat texture 2-5% HAL, in pseudomorphs nodular ANH, bedding preserved nodular ANH	14.1	Gray anh, nodular w/ dol laminae at base, nodular fabric grades upward to laminated fabrics w/ pseudomorphs after gyp at top.	
2340				6	Yellow brown thinly bedded dol w/ ripples, anh nodules at top.	
2350			nodular ANH dk. gy. mudstone relict pseudomorphs after gypsum	5 2.0 5 5 5	Interbedded dark gray anhydritic mdstn& nodular to bedded anh. Anh is stained red at contacts. Gray crudely bedded anh. Red brown mdstn disturbed intraclastic texture.	
2360				10.0	Yellow gray, white nodular mosaic anh. Less than 5% NaCl. Nodules to 5cm. Finer less than 1 cm anh nodules in dol matrix 27 cm at base.	
			black mudstone red mudstone red mudstone ANH with HAL	6 5 2.1 5	Yellow gray ripple cross laminated dol oold gnstn, laminations up to 2cm thick. Dol mdstn at top. Moderate brown mdstn w/ chaotic texture, anh interbeds, soft sediment microfaulted & ripple cross laminated. Dark mdstn top 15cm slightly dolomitic.	
2370					Light gray felted anh in hal matrix, hal masses, relict pseudomorphs after gyp.	CW 8/83
ANDRES-UNITS						

logged by DP SH date 8/83

date

checked SH date 9/83

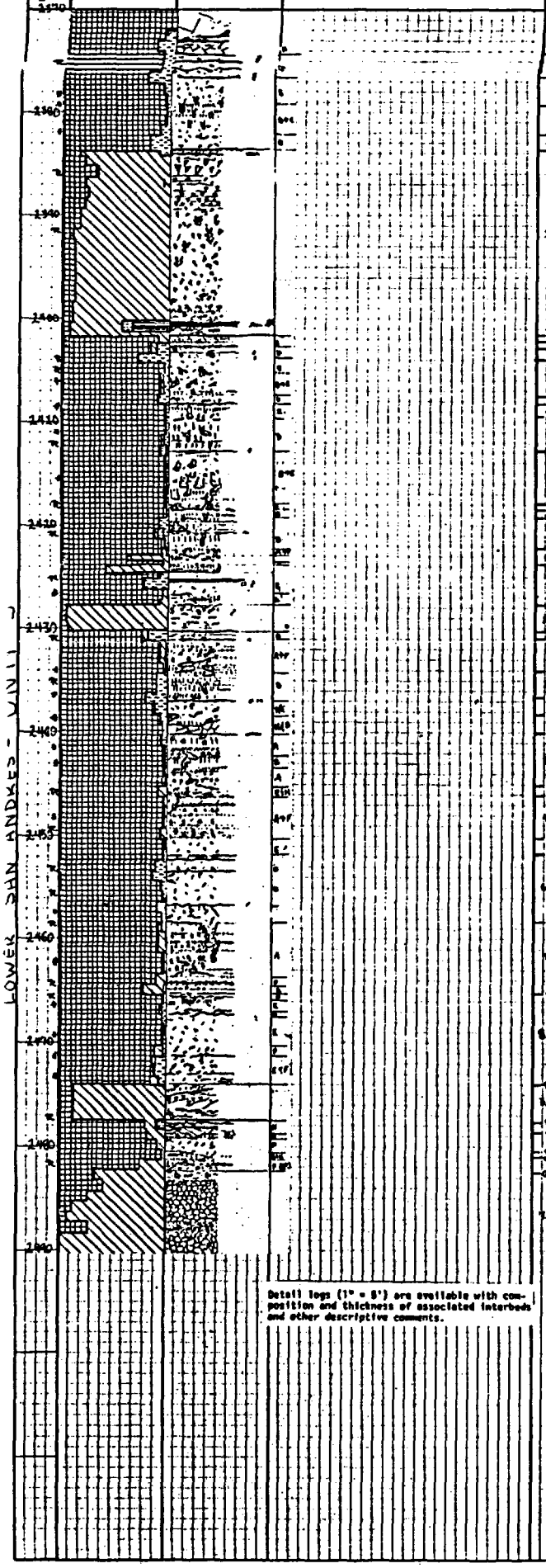
transcribed by PH VN date 1/84

updated date

updated date

WELL J Friemel COUNTY Deaf Smith DATE June 83

INTERVAL 2370-2490' LOWER SAN ANDRES - UNIT 5 LOGGED BY ST BL DJ SN LE CW PH



CONTACTS | LITHOLOGIC DESCRIPTION | LOGGER/DATE

4.1 Extremely coarse (8cm +) euhedral cavity fill. Fluid inclusion rich.

2.9 Bedded/banded hal cut by large pipe; cavity crystals 5 x 5 cm.

2.7 Bedded (B type) hal 80% recrystallized to recrystallized muddy hal (type E). Grades to 100% type E at 2279.1. Crystals subhedral polygons up to 1cm. Grades up section to mudsalt w/ increasing mud.

Typical chaotic mudsalt; crystals generally coarse (up to 2cm), anhedral to subhedral w/ large interstitial bodies of mudsalt.

15 Nodular/nodular mosaic anh w/ patchy interstitial hal. Grades up section to grassmat texture w/ hal replacing gypsum pseudomorphs first as semi-herringbone patterns then as well formed blocks & swallowtails. Pseudomorphs up to 17cm, average 7-8mm. Pseudomorphs display growth bands. Minor mdstn at top, pseudomorphs preserved but host becomes anh/hal mixture.

Interbed comprised of claystn & siltstn. Ripple forms.

Coarse euhedral cavity fill, less than 1% disseminated mdstn; crystals 6cm

Recrystallized anhydritic hal w/ felty irregular han bodies. Hal has reddish hue.

Typical chaotic mudsalt.

3.5 Bedded hal grades up section to recrystallized (about 80%) muddy hal w/ some remnant primary bedding grading up section to 100% recrystallized hal.

Typical chaotic mudsalt (crystals anhedral/subhedral to 2cm) bounded by mdstn interbeds.

Recrystallized muddy hal w/ some vertically oriented crystals under disturbed mdstn laminations.

Bedded hal w/ mostly very dark impurities outlining crystal growth; some slight banding.

Recrystallized muddy hal; crystals from .1-1cm subhedral/anhedral polygonal in form. Mdstn finely disseminated throughout. Some vertically oriented crystals in top 2 feet.

Bedded hal w/ scattered zones of chevron concentration becoming increasingly disturbed & recrystallized from 2420.6. Pipes & pits common throughout

Felty, crinkly anh bodies in a matrix of clear type F hal. Some small (less than 1mm) hal replaced gyp pseudomorphs.

Recrystallized hal becoming increasingly muddy up section. Basal foot contains chevrons & some vertically oriented crystals & minor interstitial mud.

Massive bedded anh w/ lenses of highly disseminated hal replacement, skeletal hal top .5'.

Typical chaotic mudsalt.

Chevron hal cut by numerous pipes filled w/ red brown mdstn; becomes increasingly recrystallized up section.

Bedded hal w/ interstitial dark reddish brown up section to black mdstn as numerous partings and interstitial material outlining vertical crystals.

Recrystallized hal; crystals anhedral/subhedral reddish brown mdstn with in crystals and as interstitial bodies.

Extremely coarse euhedral pure cavity fill (type H). Crystals 6-7cm. Cuts muddy type B hal.

Bedded/banded hal w/ some beds containing chevrons; Dark bands defined by mud, anh, and organic impurities; bands become reddish top foot.

Recrystalized anhydritic hal & cavity fill w/ irregular anh bodies. Bottom .5' increasing mud up section. Grades to bedded hal.

Chevron hal in varying degrees of recrystallization. (A going to E) pipes, pits and thin anh partings common.

Recrystallized muddy hal (black reduced? mdstn); crystals subhedral up section euhedral cubes to 1 x 1 cm.

Recrystallized muddy hal (reddish brown mdstn) w/ chaotic zones near interbeds; at 2456-2457 mdstn laminated interbed cuts core at angle to horizontal (see salt whole core description 2456.5-2456.9); crystals anhedral & coarse.

White chevron hal cut by numerous pipes & pits, large pipe in upper half partially filled w/ red mdstn. Interbeds general. broken irregular zones. Anh heavily outlines vertical crystal growth throughout.

Recrystallized muddy hal w/ the interstitial mud in varying degrees of anhydritization (type E going F). Some vertically oriented crystals top foot. Crystals generally anhedral/subhedral typically .5cm-1.5cm, the larger ones in bottom 2/3 of the unit.

Contorted anh w/ interstitial hal finely disseminated throughout, also occuring in lenses & irregular bodies. Grades to tilted grassmat texture. Hal after gyp pseudomorphs contorted ripple laminated siltstn at 2464.0. Felty anh w/ hal skeletal growth top .1'.

Extremely coarse hal cavity fill (up to 4 x 4 cm) w/ contorted anhydrite interbeds; large fluid inclusions.

Recrystallized anhydrite hal (crystals subhedral-anhedral) grades to bedded/banded hal; yellowish impurities in bottom foot. ST 6/83

Recrystallized anhydritic hal w/ irregularly shaped interstitial anh bodies. Crystals sub-anhedral, some possibly vertical orientation.

Medium gray nodular mosaic & mosaic anh, dol mdstn w/ occasional hal cement present internodularly. DP

logged by ST date 6/83

date

checked SH date 6/83

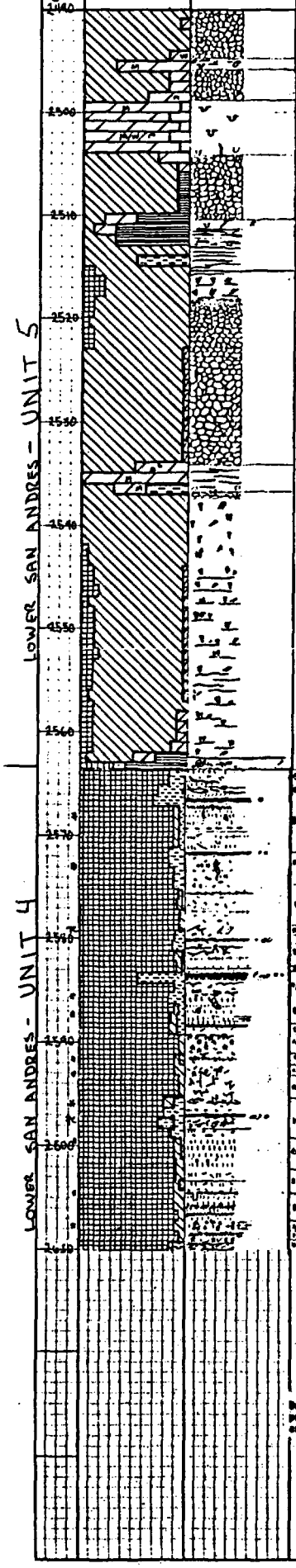
transcribed by PH VH date 4/84

updated date

updated date

WELL J Friemel COUNTY Deaf Smith DATE June 1983

INTERVAL 2480'-2610' LOWER SAN ANDRES - UNIT 5 - UNIT 4 LOGGED BY ST BL DS LE SN JW DP PH



COMMENTS	CONTACTS	LITHOLOGIC DESCRIPTION	LOGGER/DATE
		See Previous Page	
		Light olive gray to yellow white gray burrowed (?) mdstn/wkstn.	
		Medium gray nodular mosaic anh w/ dol as internodular material.	
		Yellow/white gray limey dol w/ patchy hal cement, compressed burrows. Some fossil fragments hal replaced.	
		Light gray to medium light gray nodular mosaic anh w/ dolomitic terrigenous claystn present as internodular material.	
		Olive gray dolomitic terrigenous claystn, laminated. Very fine ripple laminations, disturbed intraclastic at base.	
		Bedded, massive anh w/ minor terrigenous clay defining bedding.	
		Gressmat hal after gyp pseudomorphs w/ pseudomorphs up to 1 cm in height.	
		Medium gray mosaic anh w/ dol present on some sides of the nodules.	
		Grayish olive to yellow white gray dol mdstn overlain by gnstn. Carbonate is underlain by dark gray anhydritic mdstn.	
		Medium gray to medium dark gray anh w/ yellow gray ripple laminations composed of dol.	
		Gray black anhydritic claystn. Contorted intraclastic texture.	DP 6/83
		Banded B type hal w/ well developed interstitial disseminated bands of mdstn & minor anh; vertically oriented crystals are 1 to 1.5cm high. Bedding is transected by pipes & pits. The unit contains an interbed unit (less than 1') of D type hal.	
		Anhedral hal w/ interstitial bodies of mdstn w/ contorted silt laminations & anh nodules. D-type hal; The D-type hal contains an interbedded zone of H-type. Crystal mosaic of crystals up to 3cm & a zone of F-type hal, anhedral crystals w/ discontinuous irregular anh laminae mixed w/ D-type hal.	
		Banded B type hal w/ vertically oriented crystals about 1cm high, transected by a large pipe filled w/ hal & irregular bodies of red brown mdstn.	
		Mixed E & F type hal w/ pipes at the base protruding into underlying A.	
		Type A hal w/ chevron fluid inclusions & vertically oriented crystals 2 cm high.	
		Predominately F type hal of anhedral crystals w/ discontinuous, irregular anh laminations mixed w/ vertically oriented crystals w/ chevrons at the base & also mixed w/ E type hal throughout.	
		Clear coarse crystal mosaic of H type hal w/ minor interstitial anh & a concentration of anh at the base.	
		Type D hal, chaotic mudsalt w/ interstitial bodies of contorted & disturbed laminated siltstn & mdstn. The unit contains isolated patches of banded B-type hal.	
		Bedded & banded B type hal w/ vertically oriented crystals & bedding marked by disseminated bmed of anh & mdstn. At 2600.5 there is a planar crack about .5' deep filled w/ gray mdstn. The B type hal contains a zone in which the banded hal is becoming partly recrystallized anhedral hal w/ interstitial bodies of anh F type hal.	
		Bedded A type hal w/ chevron fluid inclusions & anh drapes & pipes.	
		See Next Page	BL 6/83

Detail logs (1" = 5') are available with composition and thickness of associated interbeds and other descriptive comments.

logged by BL DP date 6/83

date

checked SN date 6/83

transcribed by PH JN date 4/84

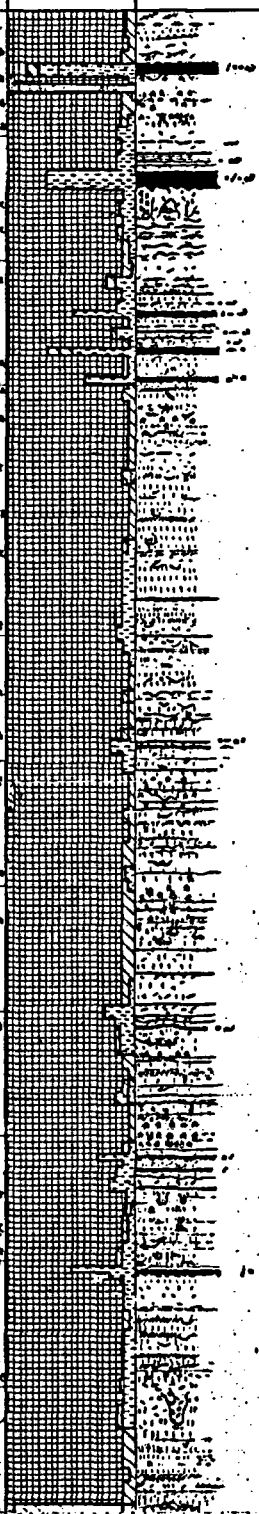
updated date

updated date

WELL J. Friemel COUNTY Deaf Smith DATE June 1983

INTERVAL 2610'-2730' LOWER SAN ANDRES - UNIT 4 LOGGED BY ST BL DJ SN LE CW JH

LOWER SAN ANDRES - UNIT 4

FEET BELOW KB	LITHOLOGY (%)	Structures	COMMENTS	CONTACTS	LITHOLOGIC DESCRIPTION	LOGGER/DATE
2610				4	Complex interval of primarily F type hal of anhedral crystals w/ interstitial anh; this is mixed w/ a .75' interbed of banded B type hal at 2612 that has non-horizontal bedding. At 2609 it contains an interbed of D-type hal & at the upper contact it is mixed w/ some crystals containing chevrons.	
				6	Red brown & pale green siltstn w/ mdstn drapes-ripple laminated is contorted & disturbed.	
				3.7	Poorly developed A type hal w/ chevron fluid inclusions, bedding not well marked, contains zones of recrystallization. F type hal contains pits filled w/ chaotic mudsalt some pink color.	
2620				4		
				2.5	D type hal, chaotic mudsalt, anhedral hal w/ interstitial bodies of red mdstn containing anh nodules.	
				6	Banded B type hal going to E type; crystals anhedarl; bands preserved, no vertically oriented crystals, contains interbeds.	
				18	Red brown mdstn disrupted & contorted textures w/ orange fibrous hal filled fractures.	
				8.5	Anhedral hal w/ interstitial mdstn bodies; D type, chaotic mudsalt w/ small patches of banded B type hal at the base & an elongate patch of bedded A type hal w/ chevron fluid inclusions at the top. Some mdstn & anh beds have horizontal orientations.	
2630				5		
				11.0	Predominately banded B type hal w/ vertically oriented crystals & disseminated mdstn & anh drapes & partings, bedding is transected by pipes & pits of recrystallized hal. Also contains localized zones of A type hal w/ chevron fluid inclusions & zones of E & F hal also of anhedral hal w/ interstitial laminations of mdstn & anh; laminations are discontinuous & fluid inclusions are few, these zones occur predominately bordering interbeds. Many mdstn beds are rippled.	
2640				5		
				3	Anhedral hal w/ interstitial laminations of anh; little internal structure.	
				6	Banded B type hal w/ pits & pipes filled w/ clear hal, banded hal has vertically oriented crystals & disseminated interstitial material.	
				11		
2650				5	Chaotic mudsalt, D type hal, anhedarl crystals w/ interstitial bodies of mdstn.	
				6		
				3.7	Banded, B type hal w/ vertically oriented crystals & dark disseminated mdstn throughout.	
				5		
2660				6.0	Banded B type hal going to E type, anhedral crystals w/ interstitial laminae of mdstn & minor anh, these lithologies are mixed w/ D type chaotic mudsalt.	
				6		
				8.0	Bedded & banded B type hal, at the basal 3' it is mixed w/ A type hal w/ chevron fluid inclusions, both types are transected by pits w/ insoluable residue & pipes of coarser crystalline hal. Bedding is marked by disseminated bands of mdstn & anh w/ some interbeds of mdstn & anh drapes.	
2670						
				3.0	Orange/yellow hal; interbedded B & F hal types, .3'-.4' thick, w/ anh partings & drapes. Stringers of anh completely surround vertically oriented crystals; chevron fluid inclusions are poorly preserved.	
				6		
				6.0	Bedded B type hal w/ vertically oriented crystals, disseminated anh bands & pipes transecting bedding. Contains a one foot interbed of A type hal w/ chevron fluid inclusions & small zones of recrystallized hal.	
2680				6		
				4.6	Bedded hal w/ well developed chevrons fluid inclusions pipes cutting bedding & anh drapes & partings.	
				5		
				4.5	Predominately bedded B type hal w/ local zones of recrystallized anhedral hal w/ interstitial anh & mdstn.	
				5		
2690				2.7	Anhedral hal w/ interstitial bodies of red brown mdstn containing disturbed silt laminae-D type hal, base of unit is a large pit w/ insoluable residue at base.	
				5		
				3.5	Bedded B type hal w/ vertically oriented crystals & predominantly anh drapes & partings w/ one zone of A type hal w/ chevron fluid inclusions (see left), contains pipes transecting bedding.	
2700				5		
				3.0	Milky white bedded A type hal w/ abundant & well developed chevron fluid inclusions. Crystals are vertically oriented, bedding 1-2cm thick marked by anh drapes. Bedding transected by few pipes.	
				5		
				4.0	Anhedral hal w/ angular & irregular shaped interstitial bodies of red brown mdstn-D type hal, contains irregular & undulose mdstn interbeds cut across by orange fibrous hal filled fractures.	
				5		
				3.0	Bedded & banded B type Hal w/ vertically oriented crystal, some chevroned A type hal near top; chevrons poorly developed. Bands, transected by pipes of recrystallized hal; contains drapes & partings of anhydritic mdstn.	
2710				5		
				2.0	D type Hal anhedral w/ interstitial bodies of dark red brown mdstn w/ disturbed silt laminae-chaotic or disorganized texture.	
				5		
				19.5	Predominantly bedded to banded B type hal, cut through by pits & pipes, also containing localized zones of anhedral, recrystallized E & F type hal. B type hal has vertically oriented crystals, anh drapes, & disseminated mdstn & anh bands. Chunks of mdstn in zones of D type hal (see left) are dark grey, breccia-bearing or intraclastic.	
2720						
				5	Banded B type hal w/ patches of vertically oriented crystals & disseminated bands of anh going to disturbed F type hal of anhedral hal w/ interstitial anh, contains disturbed irregular anh beds near contact w/ underlying anh.	BL 6/83
				2.5		
2730						

Detail logs (1" = 5') are available with composition and thickness of associated interbeds and other descriptive comments.

logged by BL date 6/83

date

checked SN date 6/83

transcribed by PL SN date 4/84

updated date

updated date

WELL J. Friemel COUNTY Deaf Smith DATE August 1983

INTERVAL 2730' - 2830' LOWER SAN ANDRES - UNIT 4 LOGGED BY ST BL DJ SW LE PH CW

UNIT 3

FEET BELOW KB	LITHOLOGY (%)	Structures	COMMENTS	CONTACTS	LITHOLOGIC DESCRIPTION	LOGGER/DATE
2730			Laminations of dol mdstn inclined. Nodules in mosaic anh-1-10cm laminae of dol.	6.0	Medium gray nodular mosaic anh & interlaminated anh & dol.	
2740			Hal cavity fill, possible displacive. Oolite grain size from upward from 0.3mm to 0.04mm from 2745.5 to 2746.7 sharply overlain by 0.3mm grained. Discontinuous 1.0cm anh layer at 2744.6.	5 / 4.4	Oolite-fossil fragment gnstn w/ oolites well sorted, ranging locally from grain size of 0.04mm to 0.4mm. Abundant anh & hal replacment of allochems. Mollusk fragments are up to 1.0cm in length.	
2750				5 / 4.0	Mollusk fragments mdstn/wkstn, light olive gray in color. Oncolites at 2754.2-.5 Intraclasts ? 2750-51	
2760			10 cm carbonate mdstn bed w/ contorted fabric.	5 / 6.0	Medium dark gray nodular mosaic & mosaic anh w/ dol mdstn present as intermodular material.	
			Hal hoppers w/ pyrite present at crystal boundaries.	5 / 3.6	Yellow gray oolite gnstn w/ anh nodules & brachiopod fossil fragments. Oolites are 0.2mm.	
				5 / 4.0	Yellowish gray to grayish olive mdstn grading up section to wkstn. Patchiness of color variation suggests patchy hal cement.	
				5 / 5.1	Light olive gray to grayish olive burrowed wkstn. Burrows contain lower concentration of fossils. (Brachs/bivalves).	
2770			Undisturbed contorted laminations 2769.5-2770 in wkstn bed.	5 / 6.6	Yellow gray to light olive gray wispy laminated mdstn w/ compressed horizontal burrows. Hal/calcite cementation variations defined by patchy color differences.	
			Wispy lam. lime mdstn interbeds. 2779.5 1cm anh nodule. 2780: burrow open in horizontal burrow. Lower 1m patches (2.0-4.0cm) of hal cement.	5 / 6.4	Brach-mollusk-phylloid algae (?) pkstn/gnstn grading up section to a form-mollusk gnstn w/ mdstn interbeds. Possible encrusting algae or bryozoans variably present.	
2780				5 / 5.0	Light olive gray mdstn w/ occasional organic wisps, compressed horizontal burrows. Patchy color variations define hal and calcite cement variations. Brachiopod spines abundant.	
			Anh nodules.	5 / 3.1	Light olive gray bryozoan-mollusk-fossil fragment gnstn, hal cement defined by lighter patches. Grading to wkstn then mdstn.	
2790			Fractures hal filled. Hal filled 10.0cm x 1.0cm horizontal burrows 2791 - 2791.2.	5 / 6.1	Light olive gray bryozoan-mollusk pkstn grading upward to limey dol mdstn. Organic wisps present. Burrows slightly compressed. Wispy laminae present in varying concentrations, up to highly concentrated. Brachiopod spines abundant.	
			Ripples, and carbonate mdstn drapes with B.S. Contact shown is dol/mdstn lithology change.	5 / 4.0	Light olive gray to yellow white gray dol mdstn grading to pkstn w/ mdstn filling 0.3cm burrows. Allochems are mollusk fragments and unidentifiable moldic pores.	
2800			Most vertical anh nodules in dol matrix. Laminated dolomitic partings. 10cm thick dol mdstn bed, vertically oriented nodular mosaic anh destroyed possible pseudomorphs above 1.5cm dol layer. Vertically oriented anh nodules below 40cm thick dol layer are possible pseudomorphs - like the anhydrite laminations. Vertical fractures - no fill.	5 / 12.0	Medium gray anh w/ intermodular yellow gray dol mdstn.	
2810			Basal - very organic rich > 10cm thick anh layers. Lower 0.1 clay rich anh.	5 / 2.0	Yellowish gray sparsely wispy laminated bedded mdstn. Bedded nodular anh present, small nodules.	
2820				5 / 4.7	Poorly indurated grayish black claystn w/ disturbed siltstn layers & possible starved ripples, anh present as cement, discontinuous & continuous layers, nodules & bedded nodules.	
				5 / 5.0	Recrystallized anhydritic hal (F type) intra & intercrystalline anh present, anh more concentrated in crude discontinuous 1cm layers. Hal crystals average less than 1.0cm, 1.0mm fluid inclusions abundant.	
			Pit > 150 sandeee	5 / 3.0	Bedded & hal w/ mdstn laminations & vertically oriented crystals cut by pit.	
2830				5 / 2.9	Brown to light red brown ripple laminated mdstn w/ interbedded anh containing lenticular bodies of hal & hal hoppers, laminations are contorted at the top.	

LOWER SAN ANDRES - UNIT 4

ANDRES - UNIT 3

Conventional Coring from 2830 - 3859

logged by DP BL date 8-83

date

checked SW date 9-83

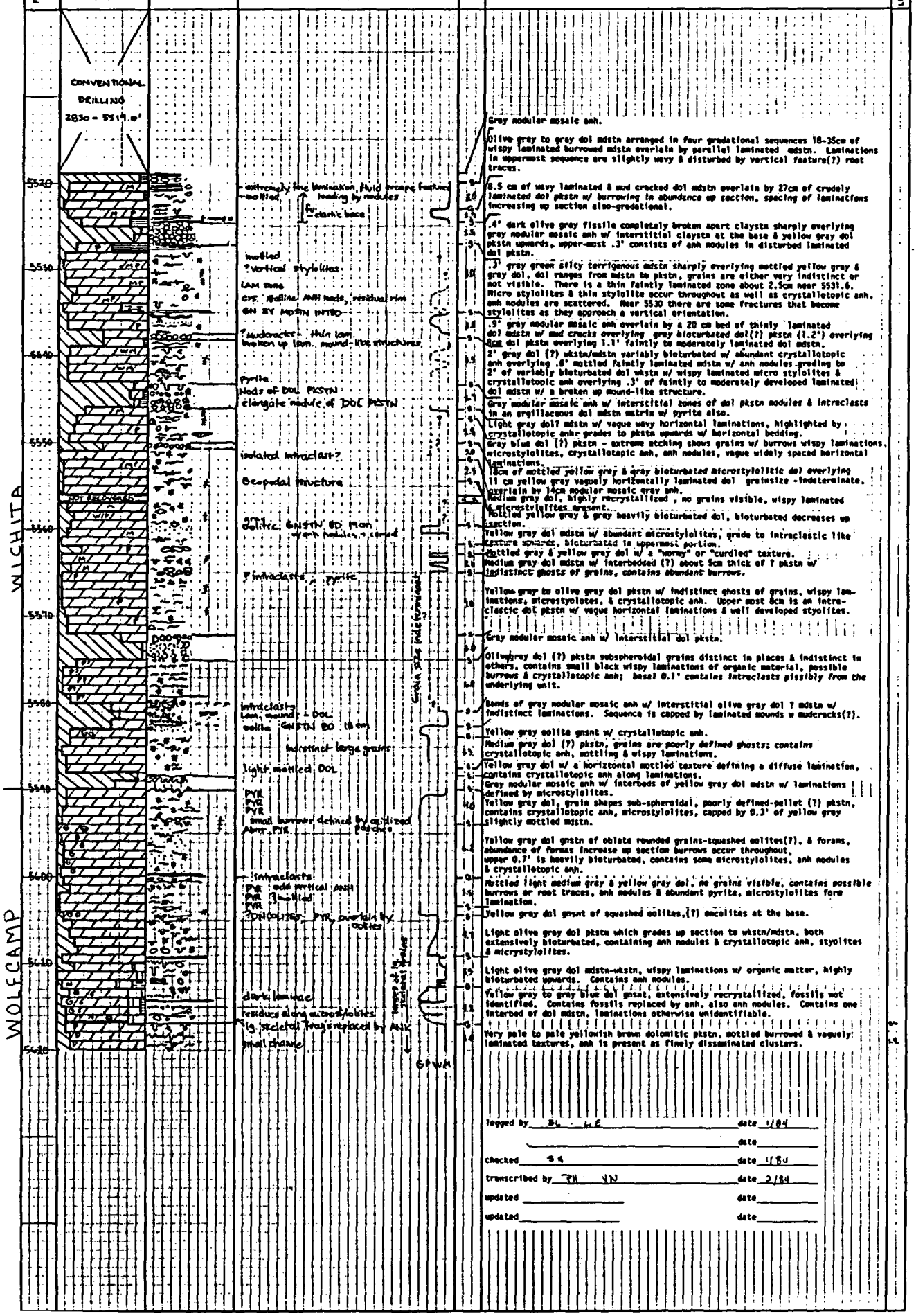
transcribed by PA JN date 2-84

updated date

updated date

WELL J. Friemel COUNTY Deaf Smith DATE January 1984

INTERVAL 5519.0 - 5620 WICHITA, WOLFCAMP LOGGED BY ST BL DJ SN LE PH CW



WELL J. Friemel COUNTY Deaf Smith DATE December 1985

INTERVAL 5620'-5740' WOLFCAMP LOGGED BY ST DJ BL SN LE CW PH

WOLFCAMP

FEET BELOW KB	LITHOLOGY (%)	Structures	COMMENTS	CONTACTS	LITHOLOGIC DESCRIPTION	LOGGER/DATE
5620			coarse fossil bed dif. irregular pyrite bodies frac. 3cm long discont. microstylolites bluish-gray, slightly porous, bedded GNSTN	7.1	Yellowish gray dol contains abundant stylolites & a few very large anh nodules (4-10cm). Long vertical fractures occur throughout & are often seen radiating from anh nodules, remnant allochems have been completely dolomitized. Gnsnt/pkstn is massive, cut by stylolites & microstylolites.	
5630			large ANH nodules, ANH-filled fractures radiating from them Patches of carbonate replaced by ANH gradually lighter colors	C		
5640			Angular ANH nodules and ANH filling fractures	4.9 C	Dark gray massive dol w/ dark blue angular anh nodules (2-7cm) & anh filling numerous fractures. Fusulinid molds filled w/ anh are dispersed throughout. Massive, no bedding defined.	
5650			Lg. Zone finely disseminated ANH crumbled ANH filling numerous small frac's larger calcite 4-7cm Mud-rimmed ANH nodules Green WSTN w/chert-filled burrows? Fusulinids replaced by DOL and/or ANH	11.0 S	Gray massive dol w/ numerous thin fractures & abundant finely disseminated anh. "allochems" are all replaced by anh or recrystallized to dol. Lower 2' are very burrowed. Anh also occurs as blue large modular mosaic areas.	
5660			Black clay w/in horizontal frac's & distorted lam. Porous zone surrounds ANH nodules	8.0 S	Yellowish gray dol wkstn/pkstn w/ abundant anh disseminated throughout.	
5670			laminated calcite chert nodule Zoned porous? chert ANH filling frac's and discontinuous stylolites Black mud? filling vug 25x5cm extremely coarse xtalline black DOL nodule	12.6	Gray & yellowish gray very porous, massive dolostone. All allochems are recrystallized remnants or filled w/ anh. Some anh nodules are partly silicified & solid chert occurs at 5673.2'. Much of the unit contains thin vertical fractures 1-10cm long. The top 1.5' appears less porous.	
5680	NOT RECOVERED		black mud or oil stains(?) in core break, faint microstylolites microstylolites black mud in frac's ANH filled frac's local large variation in porosity	S		
5690			Fusulinid replaced by DOL or ANH calcite? Black mud fingers ≤ 1cm	8.5 S	Dark gray, porous coarse crystalline dolomitized wkstn/pkstn. Allochems have been leached away leaving large secondary porosity. Anh nodules generally increase up section in size & abundance & often are partically silicified w/ soft black mud rims.	
5700			ANH nodules surrounded by soft black mud ANH Chalcedony nodules Partly silicified ANH nodule (9cm) chert nodule w/ fossil frags V. coarse xtalline DOL pellets	9.5 C	Massive partially dolomitized gnsnt/pkstn w/ fusulinids, crinoids, coarse brown dol crystals & isolated anh, chert or chalcedony nodules (1-9cm). Completely dolomitized zone show contorted laminations at 5707.2'. Top contract is an erosional surface.	
5710			ANH nodules Gastropods in Chert nodule (16cm) ANH nodules fractures filled w/ ANH 4-8cm Chert nodules (4-6cm) Chert nodules (11cm)	7.5 C 3.5 C 4.1 S 4.1 C	Dark gray & yellowish gray, contorted & wispy laminated, mostly dolomitized pkstn/gnsnt. Contains isolated coarse crystalline anh nodules (1-4cm) & a very large chert nodule at base which contins mollusk fragments. Very coarse crystalline dol occurs near the chert. Yellowish gray, coarse partially dolomitized gnstn. Contains fusulinids, crinoids, dol pellets & silicified grains. One anh nodule (2cm) at 5720'. Dark gray dolomitized Pkstn?. Remnant allochems are fusulinids, crinoid columnals & bryozoans. Includes isolated silicified nodules & anh filling 4-8 cm fractures at 5722'. Coarse fusulinid pkstn/gnsnt w/ some dolomitized zones, chert nodules, & a few silicified grains. Fabric shows wispy laminations & is heavily stylolitized in bottom 15cm.	
5730			V. coarse xtalline ANH nodules V. fine vertical fractures $\$Z$ calcite	6.4	Dark gray wispy & contorted laminated dolostn w/ isolated anh nodules which have micrite rims & some are partly silicified. Calcite component increases above base & fusulinids occur in the lower half. Fine vertical fractures are found at 5734.5'.	
5740					All intervals were point counted	

logged by CW date 12/85

date

checked SH date 1/84

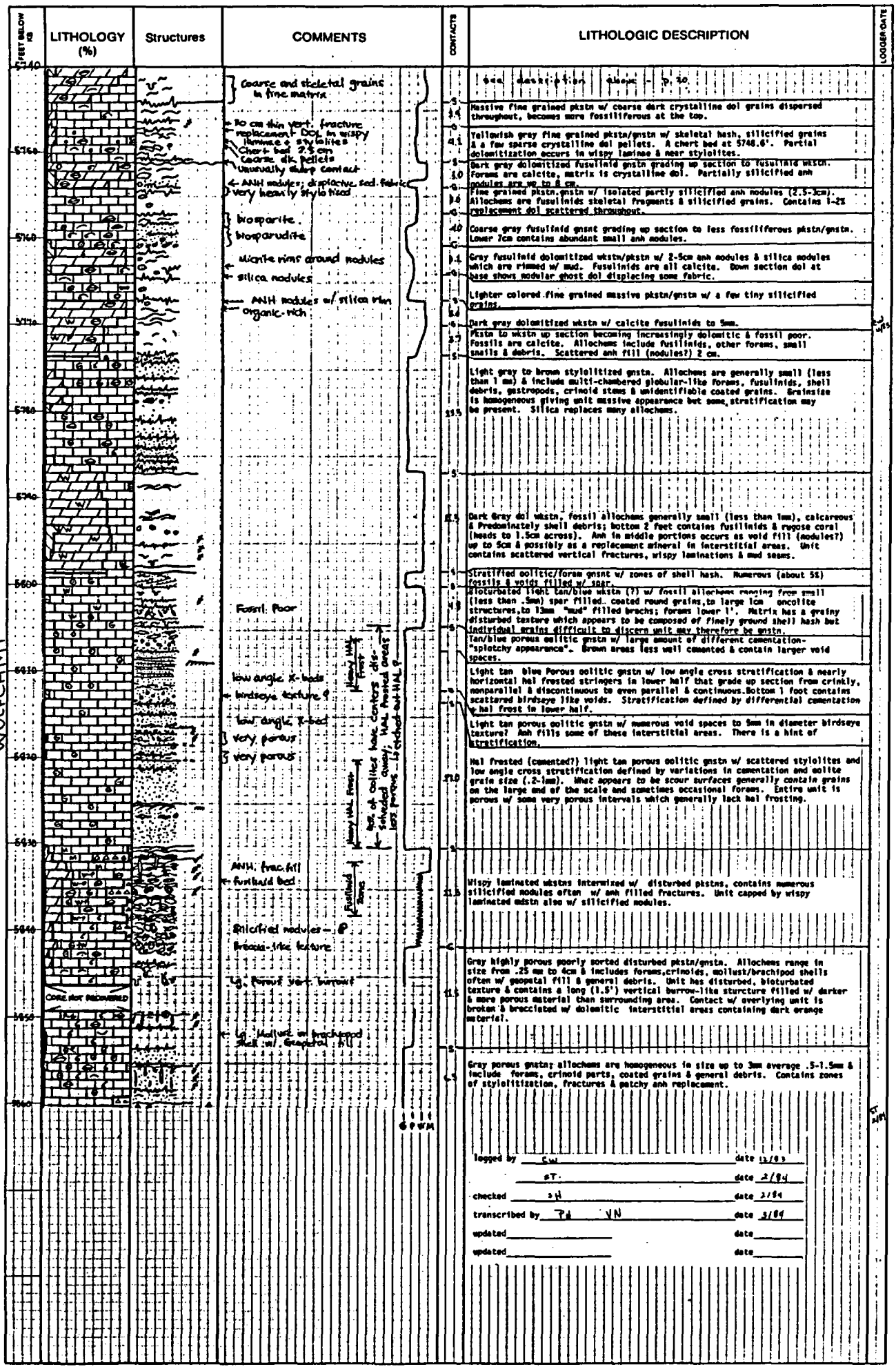
transcribed by PH VN date 2/84

updated date

updated date

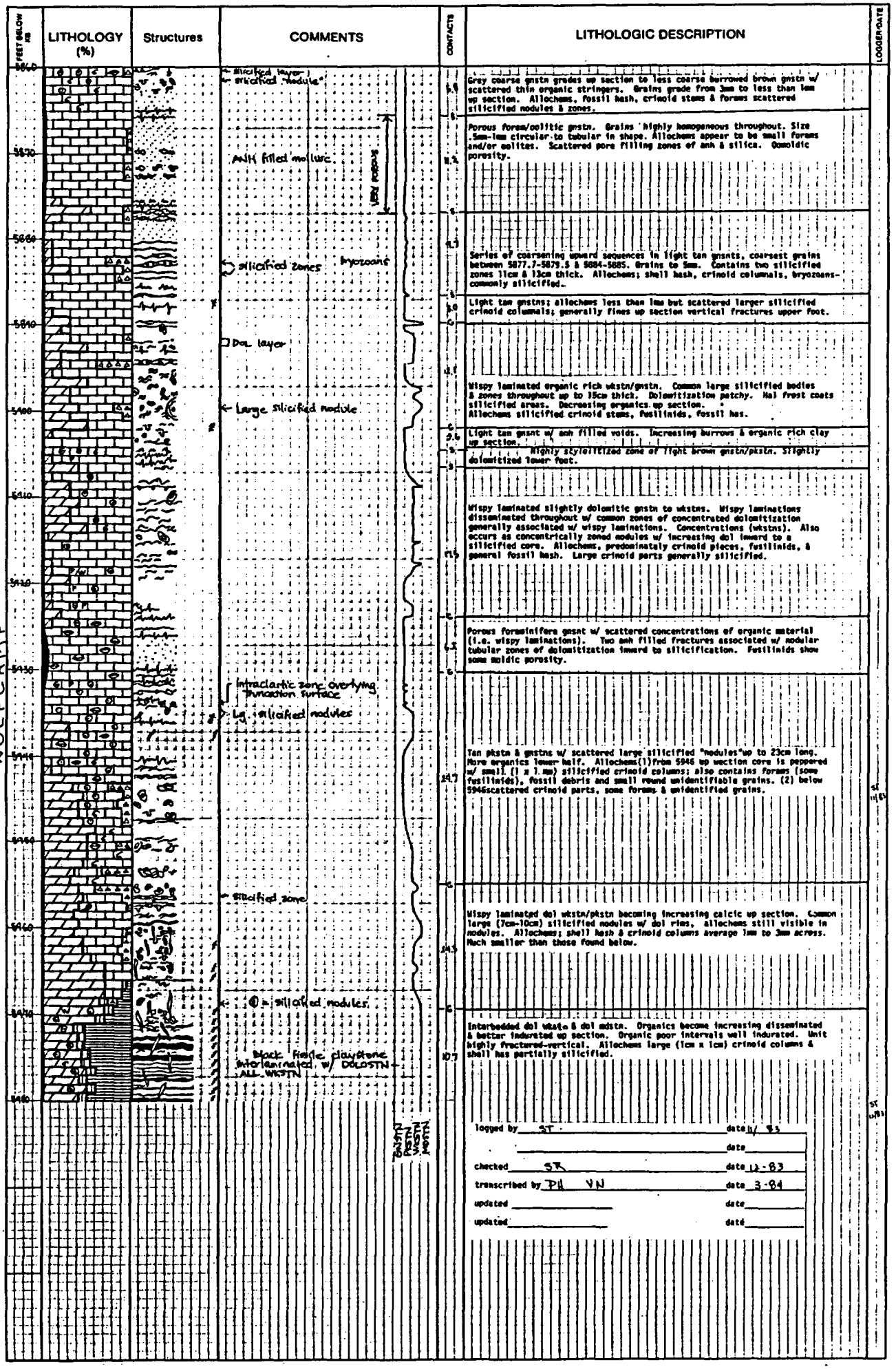
WELL J. Friemel COUNTY Deaf Smith DATE

INTERVAL 5740'-5860' WOLFCAMP LOGGED BY ST DI BL SW LE CW PH VN



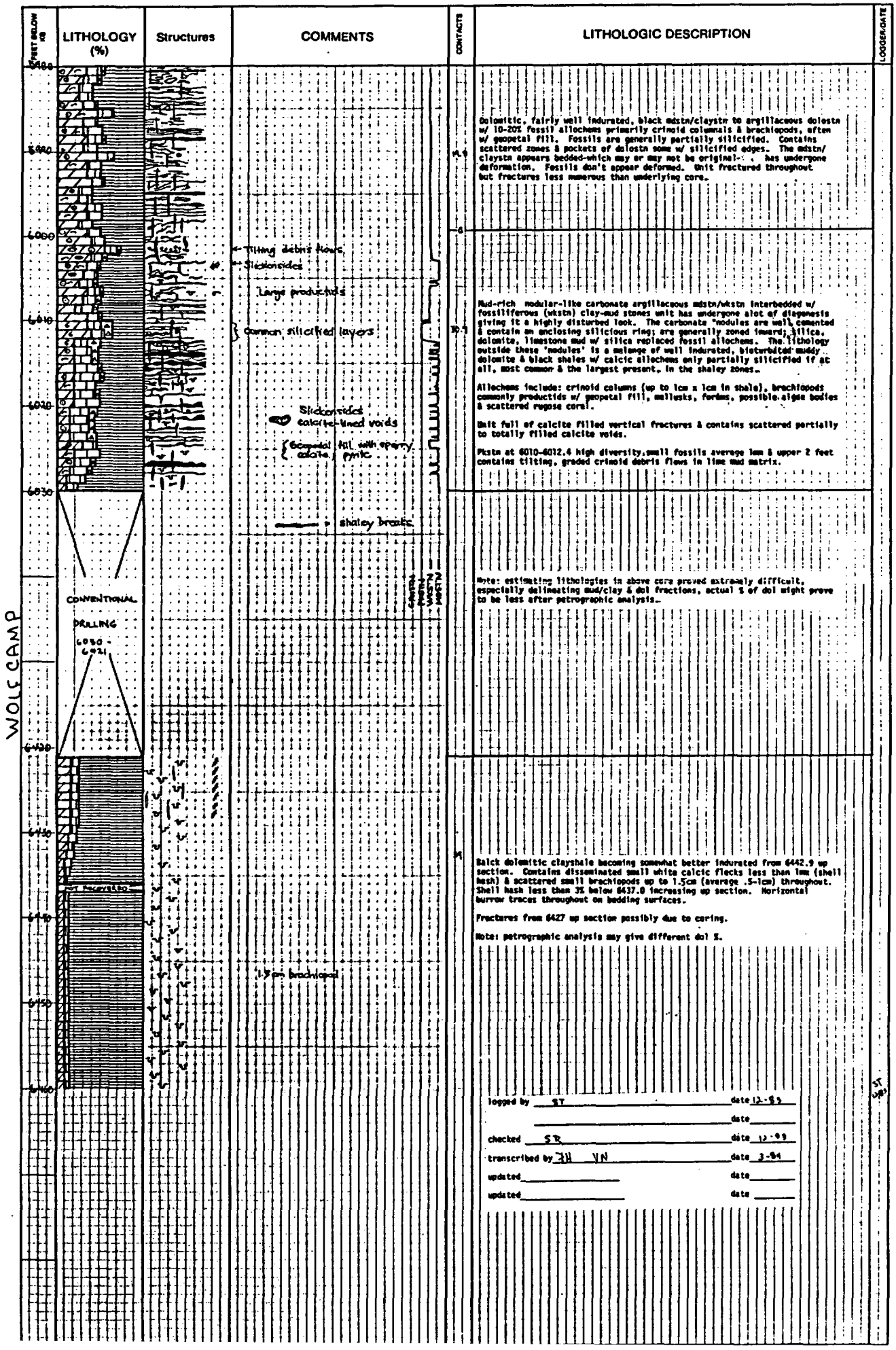
WELL J. Friemel COUNTY Deaf Smith DATE November-December 1983

INTERVAL 5860 - 5980 WOLFCAMP LOGGED BY ST BL DJ LE SN CW PH



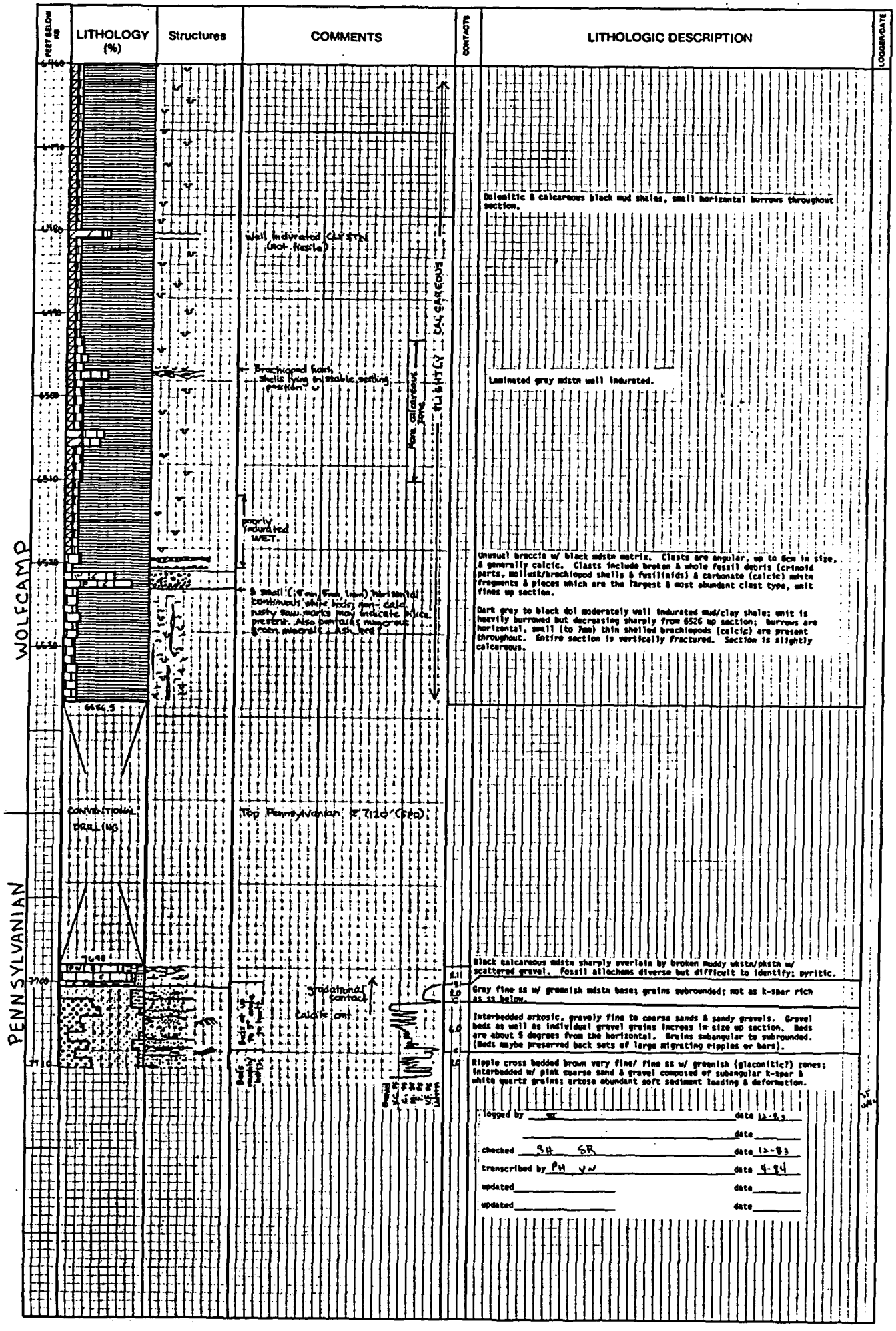
WELL J. Friemel COUNTY Deaf Smith DATE December 1993

INTERVAL 5980' - 6460' WOLFCAMP LOGGED BY ST BL DJ SN LC CW PH



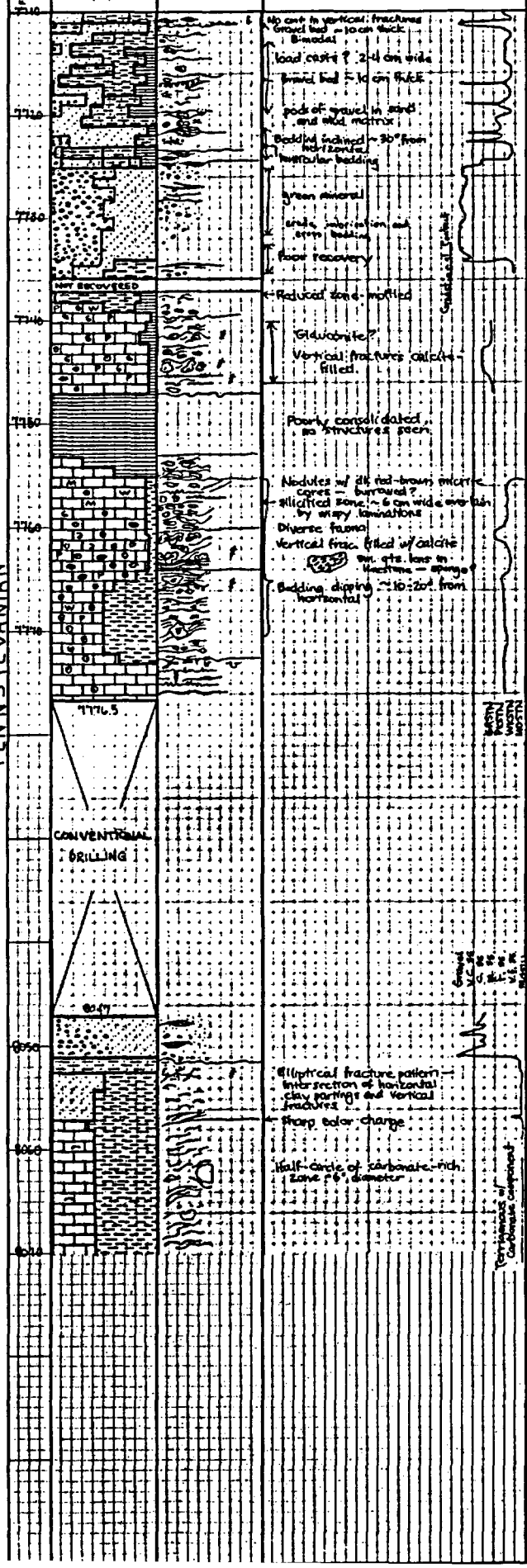
WELL J Friemel COUNTY Deaf Smith DATE December 1983

INTERVAL 6460'-7710' WOLFCAMP, PENNSYLVANIAN LOGGED BY ST BL DJ SN LE CW PH



WELL J. Friemel COUNTY Deaf Smith DATE Jan-Feb 1984

INTERVAL 7710'-8010' PENNSYLVANIAN LOGGED BY ST BL DJ SN LE EW PH



Dark red disturbed to wispy laminated mdstn containing several types of pink ss bodies w/ quartz & feldspar grains: 1) irregular lenses of gravel & sand grains surrounded by a mud matrix;2) beds of subrounded to rounded gravel which appears to coarsen upward; 3) ungraded subangular granules floating in a mud matrix some w/wispy clay clasts; 4) irregular fine to medium ss beds,some w/ remnant cross-bedding.

Some ss bodies contain dark platy mineral & are surrounded by an olive green zone.

Pink cross laminated, generally coarsening upward sequences of fine ss's to pebble congl, some laminations defined by dark green/black platy mineral.

Alternating red/green/black disturbed ripple laminated mdstn containing small (about 3mm) irregular bodies & laminations of fine pink ss & areas of coarser grained sand disseminated in mud matrix.

Pink pebble/granule crudely cross laminated congl w/ coarse ss matrix, contains subangluar to subrounded k-spar, quartz and green rock fragments. Carbonate cement

Lower 1.5' has dark gray finer matrix.

Mottled gray/green & dark red disrupted siltstn/very fine ss w/ irregular body of subrounded pebble sized feldspars at base & black wispy bodies (organics?) throughout.

Dark red wispy laminated carbonate cemented mdstn w/ shell fragments & clay partings decreasing in abundance upwards.

Pale yellow/white blue to olive green wispy to crudely cross laminated pkstn, contains silt sized grains of sand & k-spar (orange color). Allochems increase in abundance upwards, patchy carbonate cementation occurs lending a modular appearance.

Light olive green contortedly laminated argillaceous pkstn containing "nodules" of tan pkstn, some w/ fragments of bryozoans & mollusks. Nodules similar to those in overlying unit. Some laminations defined by organics.

Pink/tan/gray shell hash pkstn/gnstn modular appearing w/ dark olive green/black contorted laminations argillaceous pkstn surrounding pkstn/gnstn areas.Allochems include crinoids, fusilinids, shell fragments. Contains silt sized grains of pink mineral (k-spar), pyrite, yellow red green minerals "staining" fossil fragments.

Tan massive stylolitized pkstn w/ increasing clay content down section.

Dark reddish brown uncolsolidated to poorly consolidated claystn, organic rich body at the top of the unit.

Nodular tannish gray wkstn in dark red brown clay matrix w/ alternating contorted red and olive green laminations.

Tan/buff to light olive green mdstn/wkstn w/ "cheese curd" texture due to color change. Tan areas (1-6cm long) draped & surrounded by light green silty zones, becomes contortedly laminated w/ nodules (1-8cm long) at base.

Tan/light brown modular to mottled shell hash pkstn w/ wispy laminations of olive green mud rich areas surrounding nodules. Some modules have embayed surfaces filled w/ terrigenous-carbonated cemented areas. Silicified module at 7763.(See drawing in comments).

Black to dark tan/gray wispy laminated argillaceous crinoid wkstn. Some limey areas have burrows and show embayed contacts w/ darker organic-rich finer zones. Black clay-rich areas drape and undercut coarser zones in upper portion w/ unit becoming more homogenous towards base and clay content increasing. Allochems also include shell fragments.Generally crinoids are disseminated throughout w/ some concentrations in zones. Calcite filled high angle (about 60 degrees) at 7766

Yellowish gray stylolitized massive wkstn w/ clay breaks, cal filled vertical fractures, stylolites and irregular voids (some suggesting replaced allochems) filled w/ spar throughout. Contact w/ overlying unit is sharp w/ clay lenses in wkstn and irregular voids (burrows?) filled w/ clay and spar in top .3' of unit.

Pink pebble crudely cross laminated congl/coarse ss, calcite cement and areas of pyrite cementation. Laminations more apparent in finer areas. Contains sub-rounded/subangular qtz and pink feldspar grains.

Grayish olive green wispy laminated siltstn/mdstn. Top .15' contains subrounded sand sized feldspar grains. Clay partings and fractures decrease downwards and laminations become somewhat parallel. No calcite.

Grayish black wispy laminated limey mdstn/claystn w/ medium gray lenticular and irregularly shaped carbonate rich areas. Finer areas drape a large circular shaped carbonate zone and wispy laminations appear distorted below the zone. Unit contains a few bivalves and sand/pebble sized grains of feldspar. Bedding dips 10-15 degrees from horizontal.

Note: In J. Friemel drilling deviated in Wolfcamp by 18 degrees. This would effect bu-ding angles and dips may be drilling induced. (Budnik personal communication)

Note: Fine grained terrigenous component in carbonate units, grain size is indeterminate.

logged by PH date 3-84

date

checked SH date 4-84

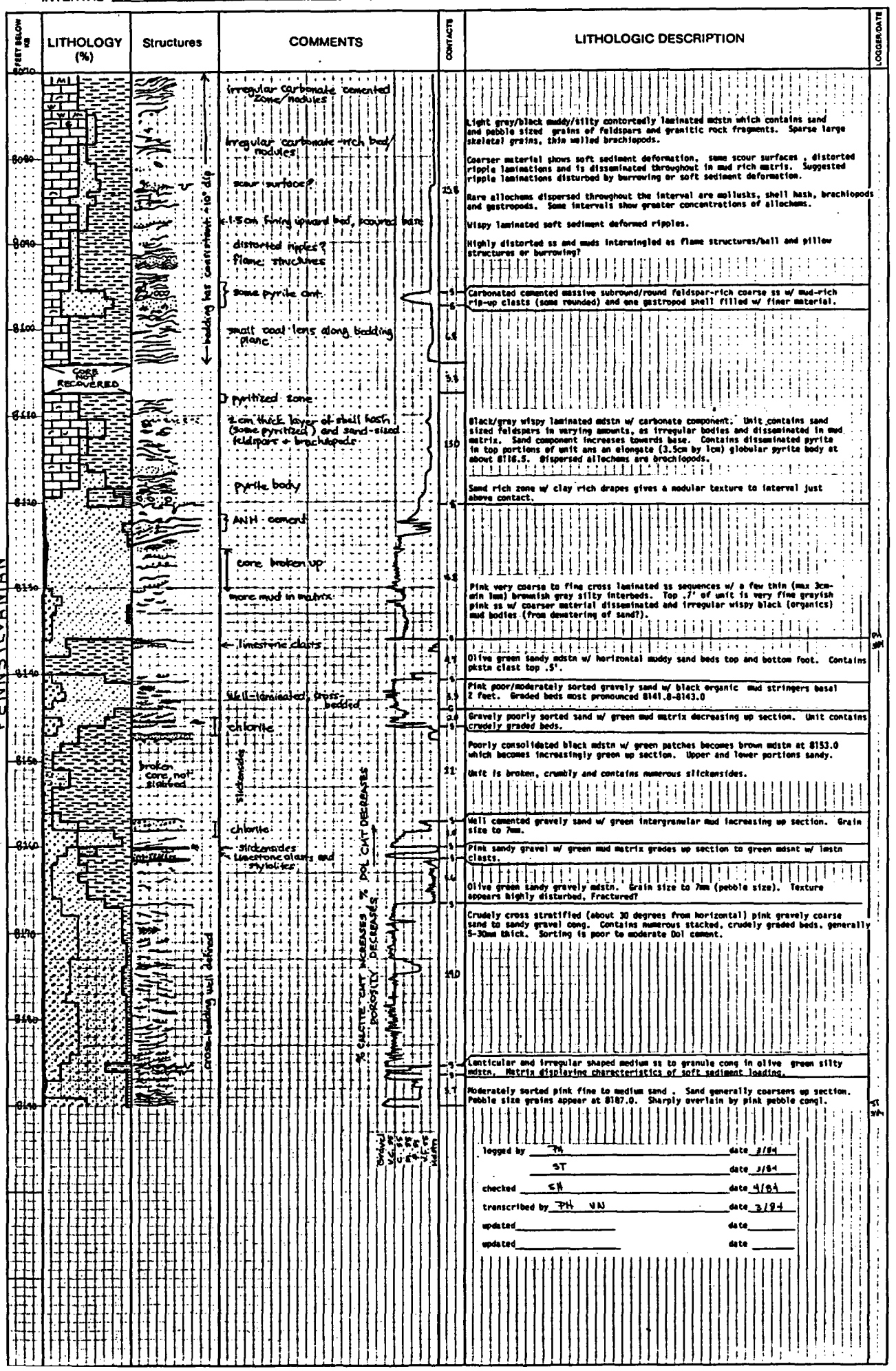
transcribed by PH VN date 4-84

updated date

updated date

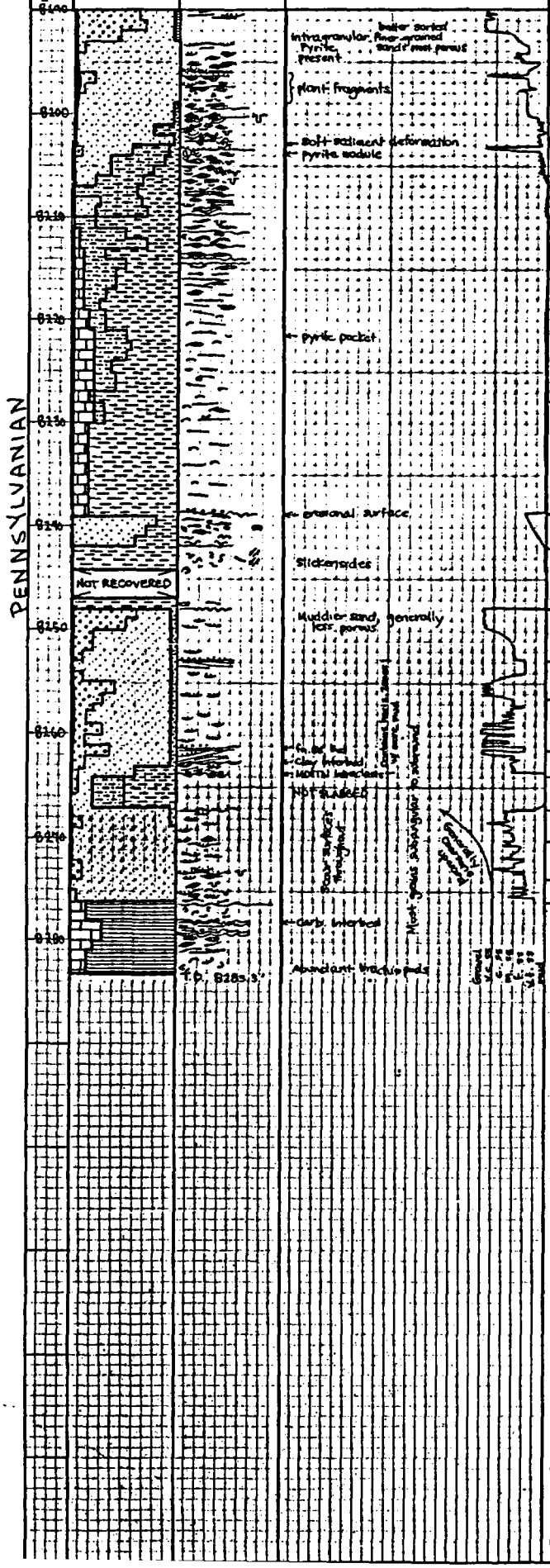
WELL J. Friemel COUNTY Deaf Smith DATE March 84

INTERVAL 8010-8190 PENNSYLVANIAN LOGGED BY ST BL DJ LE SN CW PH



WELL J. Friemel COUNTY Deaf Smith DATE February-March 84

INTERVAL 8190 - 8283.3 PENNSYLVANIAN LOGGED BY ST, BL, DJ, LE, SH, CW, PH



CONTACTS

LITHOLOGIC DESCRIPTION

Well sorted fine sand grades up section to pinkish sandy gravel/gravely sand w/ poor to moderate sorting. Contains crude cross stratification and graded beds in upper 2 feet. Dol cement.

Horizontally stratified graded beds, of very coarse sand to fine sand. Dol cement.

Very porous gray to pinkish very fine to fine ss containing repeating sedimentary structure sequences, of trough cross bedding, climbing ripples and fine parallel to undulatory ripple laminations. Black organics generally increas in each sequence up section and most abundant in capping parallel laminations. Contains sharply bounded gravel bed at 8196.6. Dol cement?

Finely interlaminated ss/siltstn and black mdstn. Sedimentary structures in fine parallel and ripple laminations and climbing ripples. Black mdstn often forms small discontinous lenses, 1cm long by 1mm high. Thickest at center thinning outwards and slightly curved concave up. Burrows & soft sediment deformation features common.

Interbedded slightly calcic black, pyritic, mdstn/mud shale and lighter colored ripple laminated siltstn. Common horizontal partings occur along bedding planes. Siltstn grades from discontinous lenses to continuous horizontal beds. Silt bed thickness and percentage silt increasing up section. Brachiopods disappear up section.

Black carbonaceous mud shale becoming better indurated and increasingly calcareous up section. Contains faint whitish silty laminae which increas in number last 2 feet. Small (less than 1mm) brachiopods scattered throughout, increase up section.

Greyish olive green muddy very fine fine ss, w/ disturbed intraclastic texture; some ripple laminations in middle portion.

Broken crumbly, fractured (calcite filled) mud/mdstn, mottled greyish red and greyish green in color. Slickensides throughout.

Poorly sorted gravely medium/coarse ss grades to sandy gravel (to pebble size). Gravel size increases up section. Contact w/ overlying mdstn marked by about 5-6cm immature gravel which contains green mud. Carbonate cement.

Poorly sorted sandy gravel (to pebble size) grades to stratified mature fine ss. Carbonate cement.

Repeating sequences of sandy gravel grading to coarse to medium ss becoming very coarse sands grading to medium sands up section. Units generally become thinner and less defined up section. Dol cement.

Repeating sequences of sandy gravels grading to fine ss; interval thickness increases up section. ST 3/84

Green to reddish brown unconsolidated mud.

Mature to submature medium to coarse qtz-kspar ss. Dol cement.

Poorly sorted, submature fine to gravely coarse qtz-kspar ss. Larger grains more angular. Dol cement.

Burrowed greenish very fine to fine ss with thin medium ss interbeds sorting decreases and medium sand component increase up section. Mature to submature up section. qtz, kspar ss. Some calcite cement in lower half. Dol cement.

Carbonaceous black shale w/ scattered carbonate interbeds (up to 2 cm) and carbonate starved ripples. Carbonate (shell) debris also defines faint laminations at about 20 degrees from horizontal. Large brachiopod valves to 4cm present upper and lower portions.

Note: In J. Friemel drilling deviated in Wolfcamp by 18 degrees. This would effect bedding angles and dips may be drilling induced.

Note: Fine grained units, grain size indeterminate without grain size analysis. ST 3/84

LOGGER/DATE

logged by ST date 3-84

date

checked SH date 3-84

transcribed by PH VN date 4-84

updated date

updated date

WELL #1 GRABBE COUNTY SWISHER DATE 5/85

INTERVAL 0 - 100 OGALLALA LOGGED BY DAJ

FEET BELOW KB	LITHOLOGY (%)	Structures	COMMENTS	CONTACTS	LITHOLOGIC DESCRIPTION	LOGGER DATE
0			caliche nodules up to 4 cm sharp color change			
10			calichification intensifies			
20			calichification intensifies abundant root traces with MnO_2 thin calcite jointing in cement base to course	30'	Base mod BR (10R 4/6), muddy med-fine sa, no calc cement, rootlets with MnO_2 coating sides, calc veinlets, calc veinlets and fracs + vert caliche nodl overlain by (from 28-3') mod Yw-B (10YR 5/4) fine-med sa (no calc cement) with rootlets which fine upward into muddy siltsts with scattered sand + inc calc cement content; overlain by (from 3 to 0') mod B (5YR 3/4) calc cemented silty sdsts with calc nodu.	
30			stratigraphic contact sharp color change tend breaks up in tubular fashion	3 6.9'	Lt B (5YR 5/6), calc cemented, fine-v fine sa with abdnt med sand grains + rootlets with Mn (manganese?) residue around many root traces.	
40			nice root traces	5 14.9'	Lt B (5YR 5/6) fine-med sa (no calc cement) with abdnt vert and hz calcitic fracs overlain by Pk-Oy (5YR 8/1) fine-med sa with lt B burrows or root traces.	
50			silty, calcite-rich strata color change	5 9'	Lt B (5YR 5/6) med sa (no calc cement) with abdnt calcitic fracs, inc upward into v pale Orng (10YR 8/2) calc cemented fine-med sa.	
60			calc and caliche nodules (root conglomerate)	5 5.4'	Oy-Orng-Pk (10R 8/2) fine sa with abdnt med grains, apparent shrinkage fracs and abdnt calc nodu or caliche nodu with sand grains.	
70			stratigraphic contact (cement)	6 25'	Oy-Pk (5YR 8/2), poorly sorted, calc cemented, v fine sa with rootlets, burrows + scattered med to coa sand grains, becomes slightly coar upward color changes to lt B (5YR 6/4) at 63' (probably due to preservation in bags than anything else).	
80			nodular caliche			
90						
100	CORE NOT DELIVERED		large calc. nodule (~11cm)			

OGALLALA

logged by DAJ date 5/85

date

checked date

transcribed by PLr date 6/85

updated date

updated date

WELL #1 GRABBE COUNTY SWISHER DATE 5/85

INTERVAL 100 - 180 OGALLALA LOGGED BY DAJ

FEET BELOW KB	LITHOLOGY (%)	Structures	COMMENTS	CONTACTS	LITHOLOGIC DESCRIPTION	LOGGER DATE
100	CORE NOT RECOVERED					
110						
120			3.5 cm lt. fragment	3'	Gy-Orng-Pk (5YR 7/2) calc cemented ss, large (3.5 cm) rounded lt lo frag at top with zone of calichification surrounding it.	
130	CORE NOT RECOVERED			24'		
140					Base of caliche and mud-rich soil horizon overlain by Gy-Orng-Pk (5YR 7/2) silty ss with opal-filled frags, about calc nodes (up to 8 cm), better sorted upward.	
150				22'		
160			-chert nodule -abundant calcite nodules better sorting? - opal filled fracture - calc nodules - clay dimples - pedogenic clays?	6	Lt B (5YR 5/6) mdstn with about 20% fine to coa ss grains, no structures visible; overlain by a lt B (5YR 6/4), v porous, calcitic, fine to v fine ss, v little bedding preserved, pervasive root traces + burrows, scattered clay clasts + possible pedogenic clays, opal-filled vert frags with pyrolusite, better sorting upward, soil horizon at about 174.5'.	
170			- mud clasts - better sorting	14'		
			- calc nodules			
180			- mud clasts - beginning opal filled fractures c 6 8 m			

OGALLALA

logged by DAJ date 5/85

checked date

transcribed by PG date 6/85

updated date

updated date

WELL Grabbe COUNTY Swisher DATE 3/84

INTERVAL 180-300' OGALLALA, DOCKUM LOGGED BY DAJ

FEET BELOW KB	LITHOLOGY (%)	Structures	COMMENTS	CONTACTS	LITHOLOGIC DESCRIPTION	LOGGER DATE
100						
190						
200						
210						
220						
230	CORE NOT RECOVERED					
240				107.5		
260						
260						
270						
280						
290		cross bed structures; core in poor condition	calcite nodules; large (8cm) fm as clast (post. slump)	112.5'	Base is orange-red ripple-laminated siltstone with fine sandstone which is brecciated and fractured (filled with mud) and with a reduced very fine sandstone slump. Overlain by orange-red mudstone (possibly silty) with calcareous nodules grading upward into very fine sandstone with abundant silt, capped by a structureless mudstone (possibly containing silt).	
300						

OGALLALA

DOCKUM

logged by DAJ date 3/84

date

checked date

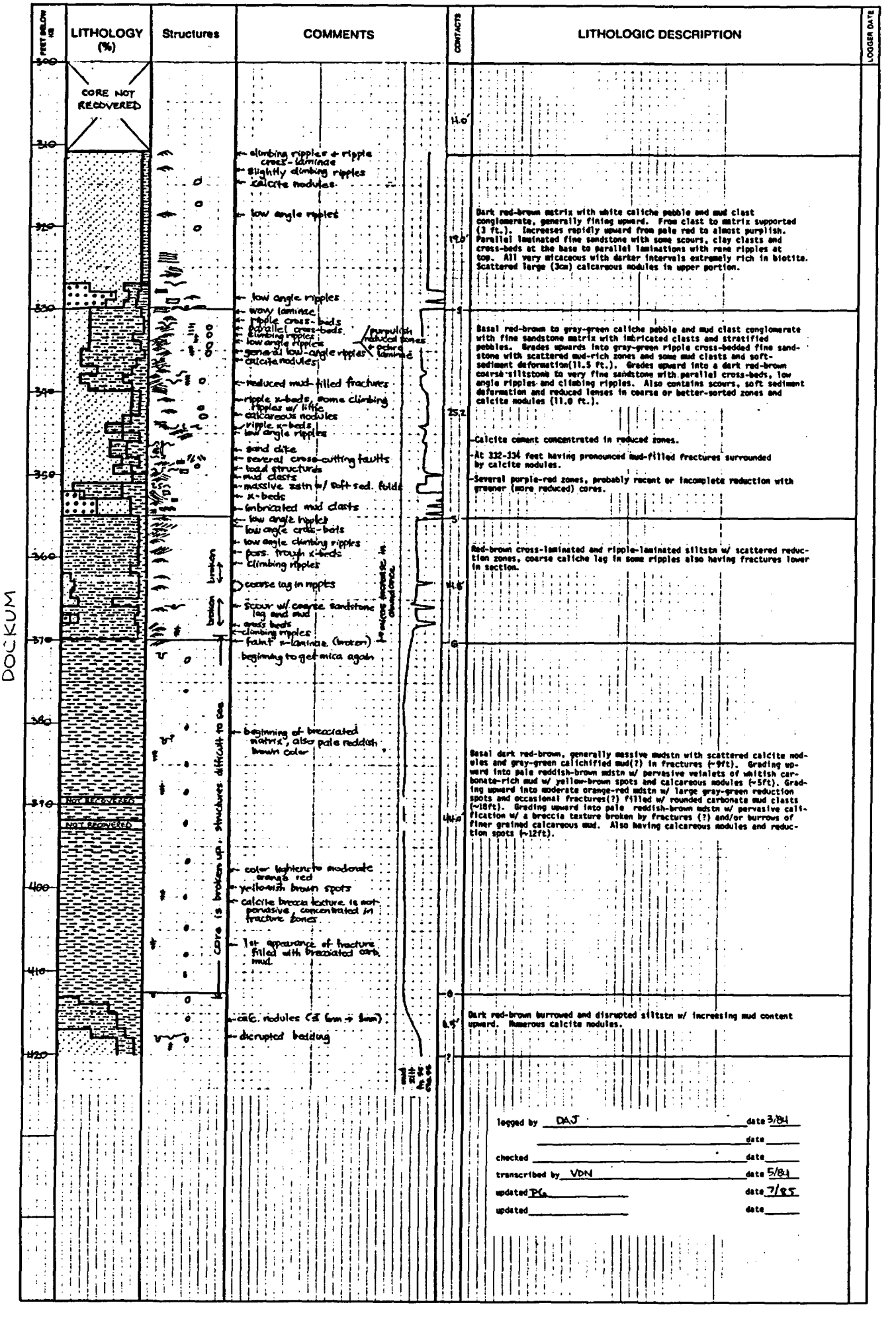
transcribed by VDN date 5/84

updated TG date 7/85

updated date

WELL Grabbe COUNTY Swisher DATE 3/84

INTERVAL 300-420' DOCKUM LOGGED BY DAJ



logged by DAJ date 3/84

date

checked date

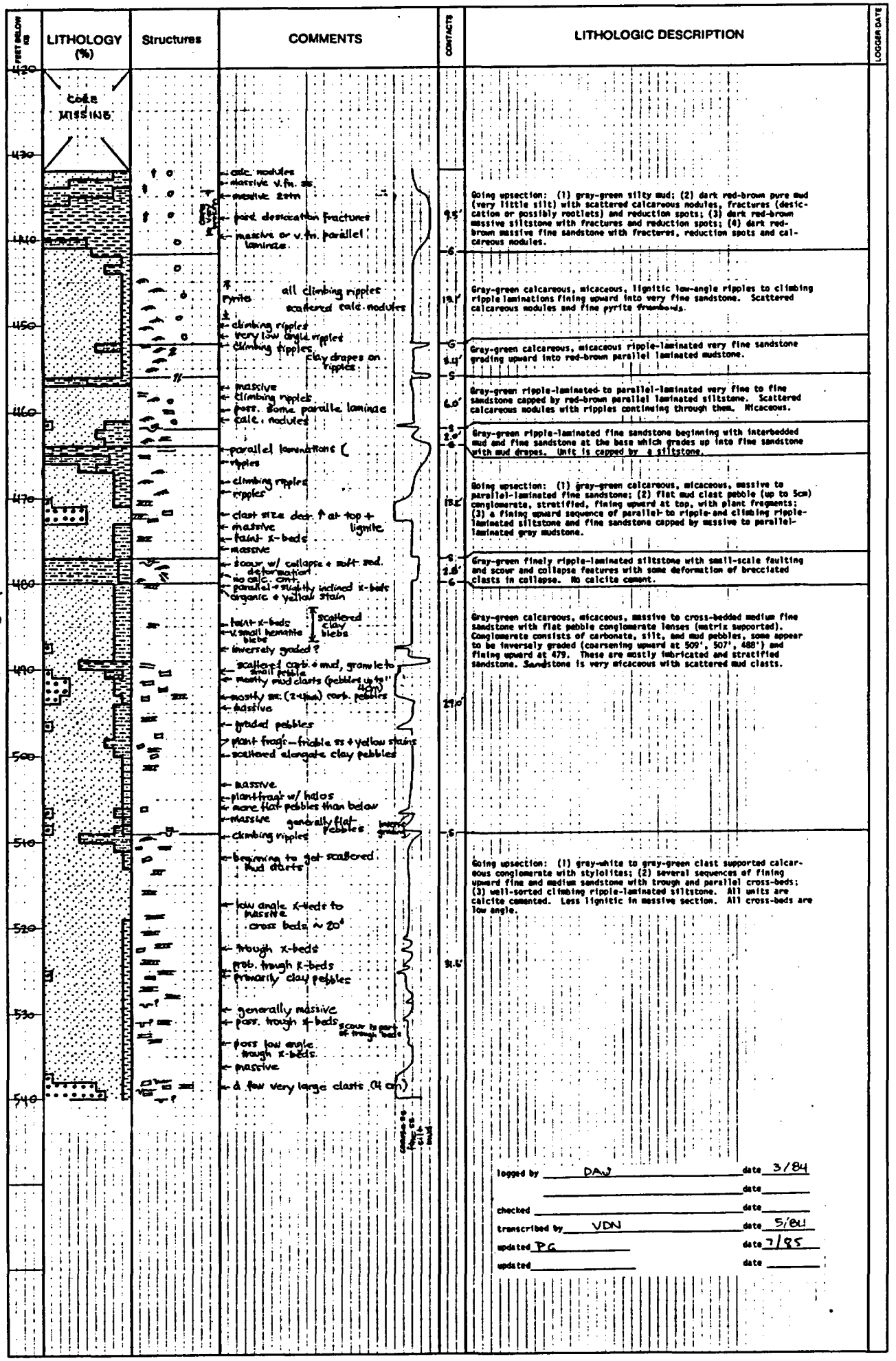
transcribed by VDN date 5/84

updated PK date 7/85

updated date

WELL Grabbe COUNTY Swisher DATE 3/84

INTERVAL 420-540' Dockum LOGGED BY DAJ



logged by DAJ date 3/84

date

checked date

transcribed by VDN date 5/84

updated PG date 7/85

updated date

WELL Grabbe COUNTY Swisher DATE 3/84

INTERVAL 540-660' LOGGED BY DAJ

DOCKUM

FEET BELOW KB	LITHOLOGY (%)	Structures	COMMENTS	CONTACTS	LITHOLOGIC DESCRIPTION	LOGGER DATE
540			climbing ripples clast-supported high angle ripples low angle ripples	S	Going upsection: (1) stratified calcareous granule and pebble congomerate with laminae; (2) coarse to medium sandstone; (3) ripple laminated siltstone with abundant mica and mud laminae; (4) parallel laminated siltstone with mud and ochre colored material along bedding planes; (5) small ripple laminated siltstone; (6) large ripple laminated siltstone; (7) caliche and mud clast conglomerate (clast supported); (8) fine sandstone/siltstone with mud clasts; (9) climbing ripple laminated siltstone. All calcite cemented and micaceous. Color grades from white at base to tan and red-brown at top.	
			parallel laminae large ripples v. small-scale ripples massive - no apparent struct. climbing ripples prominent mud laminae matrix and clast supported	18.4'		
550			poss. v. low-angle trough x-beds trough x-beds + clasts climbing ripples silt drape	S 1.5'	Gray-green to tan-brown medium sandstone with calcite clasts and drapes at base grades upward into parallel laminated (possible low-angle trough cross-beds) sandstone at top. Sandstone is overlain by a thin mud bed (0.1').	
560			climbing ripples low-angle ripples low-angle x-beds	S 5.7'	Going upsection: (1) parallel laminated and very low-angle rippled fine sandstone; (2) climbing ripple laminated very fine sandstone with silt drape at depth 558; (3) low-angle ripple and climbing ripple laminae with scours and increasing silt content upsection; (4) ripple laminated mudstone and siltstone at top. Entire unit is very micaceous and lignitic. Color grades upwards from gray-green at base to tan-green at top.	
570			possible ripples and v.fn to fn. sandstone to silt lence climbing ripples massive to ⅌ lam's plant frags fine horizontal lam's	S 2.7'	A basal tan laminated, micaceous, lignitic coarse sandstone with abundant plant fragments (at base) and scattered mud clasts grades upwards to 0.5' interbedded coarse sandstone and silt which grades upwards to 0.3' of green climbing rippled silt which grades upwards to a brown finely parallel laminated siltstone with possible ripples and burrows.	
580			lg. injection feature thru parallel + horizontal laminae abundant plant debris x-beds ~ 15° matrix-supported, non-stratified matrix-supported, stratified non-stratified — sparry calc	S 12.4'	A gradational upwards fining sequence beginning with (1) a basal whitish tan caliche pebble conglomerate with fine sandstone matrix (2) statified granules and pebbles and fine sandstone (3) nonstratified conglomerate with fine sandstone lenses (4) matrix supported jumble conglomerate (5) parallel laminated, micaceous, lignitic fine sandstone with contorted beds and injection features (6) finely laminated siltstone. NOTE: Conglomerate pebbles are all calcareous; larger ones are flat. Smaller ones are rounded to elongate. One round one has septarian cracks with sparry calcite filling and core around it has sparry calcite cement.	
			massive clast-supported	S 4.7'	Whitish, red-brown pebble conglomerate with a few cobble size material; pebbles are 1.7cm to 5.5cm in size; large ones are flattened and semi-parallel; pebbles are calichified in mudstone and ripple laminated very fine sand and silt. Unit grades rapidly upsection to mudstone and calichified pebbles.	
590			brecciated mud — calc. streaks load casts of fn. ss x-beds w/ clay clasts load casts of crse. ss in silt core broken + no struct. seen low angle x-beds clay drapes and clasts trough x-beds higher angle x-beds (~25°)	S 11.6'	Going upsection: (1) tan cross-bedded medium sandstone with mud clasts and drapes; (2) rippled grayish-green siltstone, 0.3 feet thick; (3) dark brown mudstone; (4) grayish-green cross-bedded coarse sandstone and silt with load features and clay clasts; (5) dark brown ripple laminated to structureless mudstone with calcite streaks; (6) grayish-green medium sandstone with load casts into underlying mudstone; (7) dark brown brecciated to structureless mudstone with calcite streaks parallel to and cross-cutting apparent bedding with wispy ochre colored laminae; (8) grayish-green cross-bedded medium sandstone.	
600						
610	CORE NOT RECOVERED			14.0'		
620			no calcite cmt mud clasts - no carb. clasts (larger clasts at top) carb. clasts, calcite cmt v. fn. ripples ochre color streaks ripples larger than above	S 3.5'	Going upsection: (1) gray-green ripple laminated fine sandstone; (2) coarse cross-bedded sandstone with carbonate pebbles; (3) cross-bedded carbonate granule conglomerate; (4) friable yellow-green cross-bedded medium sandstone.	
			pebble ~.5 cm	S 8.5'	Gray-green conglomerate (0.2ft.) at base grades upsection into a brown ripple laminated mudstone with ochre streaks at top (usually follow bedding planes) and increasing clay content upwards. Conglomerate consists of calcite granules to pebbles--probably caliche.	
630			calc. concretions (sparry) calcite concretions (sparry) begin purplish color	S	Dark brownish-purple mudstone grades upwards into heavily burrowed claystone. Many burrows are seen plunging through older burrows but no critters were found. Unit contains abundant scattered reduction spots.	
640			some calcite cmt.	17.0'		
650			symbols: load cast scour with lag scour w/out lag	S 7.4'	Maroon to white, cross-bedded coarse to medium sandstone. Unit is poorly sorted with subangular to rounded grains, often imbricated. There is a possible mudstone at base.	
660						

logged by DAJ date 3/84

date

checked date

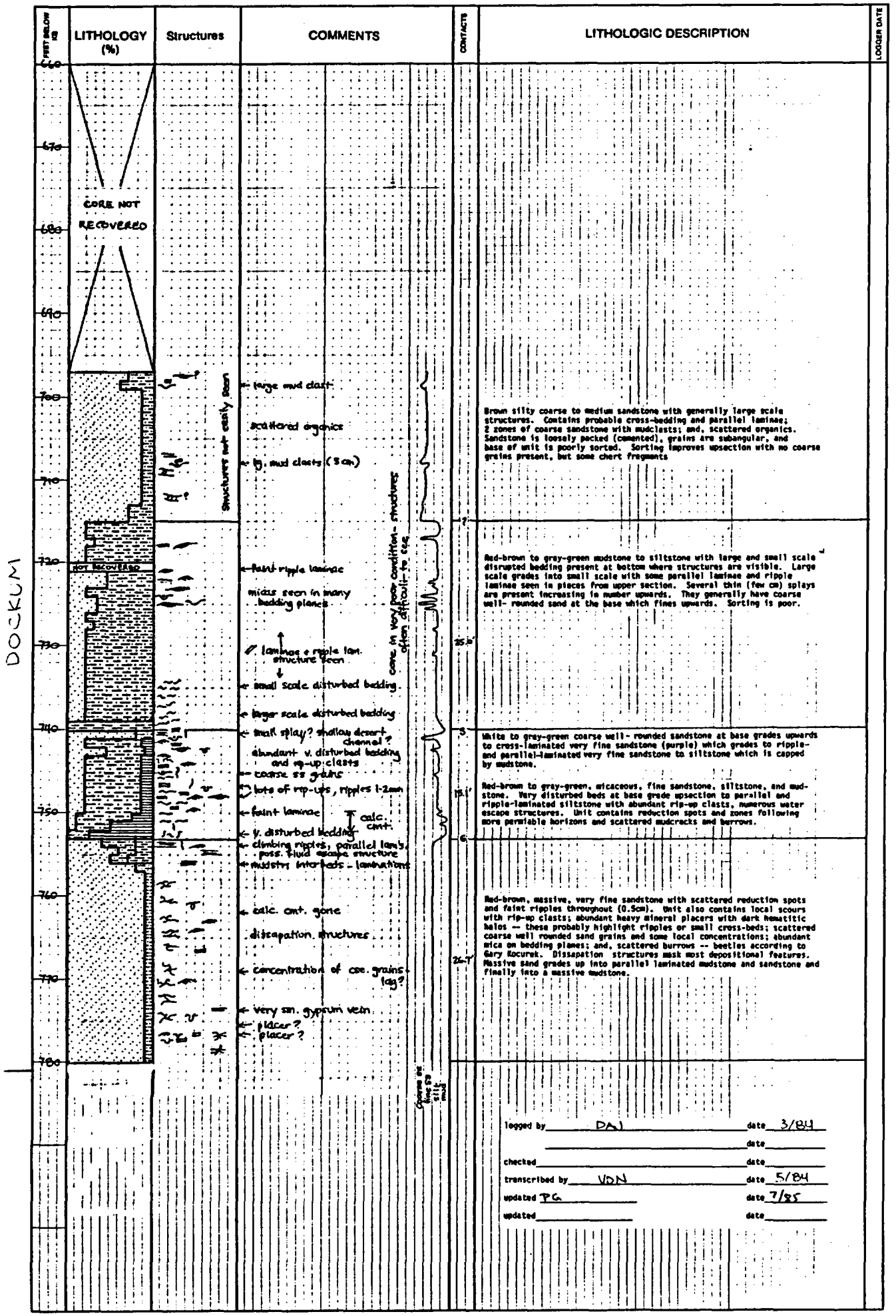
transcribed by VDN date 5/84

updated PG date 7/85

updated date

WELL Grabbe COUNTY Swisher DATE 3/84

INTERVAL 660-780' Dockum LOGGED BY DAJ



logged by DAJ date 3/84

date

checked date

transcribed by VDN date 5/84

updated PG date 7/85

updated date

WELL #1 GRABBE COUNTY SWISHER DATE 5/79

INTERVAL 780 - 900 DEWEY LAKE LOGGED BY WPJ, KAM, PF, SH

DEWEY LAKE

FEET BELOW KB	LITHOLOGY (%)	Structures	COMMENTS	CONTACTS	LITHOLOGIC DESCRIPTION	LOGGER DATE
780	CORE NOT RECOVERED					
790						
800			lenticular, swirled intraclasts; climbing ripples, convolute bedding; disrupted bedding; climbing ripples; load casts, clay drapes; disrupted, initially laminated beds	stacked channel sequence		
810						
820			clay-chip conglomerate; bimodal ss	channels		
			disrupted; fluid escape			
830						
			BROKEN CORE			
840			small scours and ripples, coarse clay nodules, small clay intraclasts; fluid escape; climbing ripples; small scale nodules, scours, drapes, 1/2 disrupted			
850						
860			nodular anh; load casts			
870			disrupted; intraclastic ANH; small intraclasts and scours; small ripples, clay drapes			
880						
890				channel		
900						

logged by WPJ, KAM, PF, SH date 5/79

date

checked date

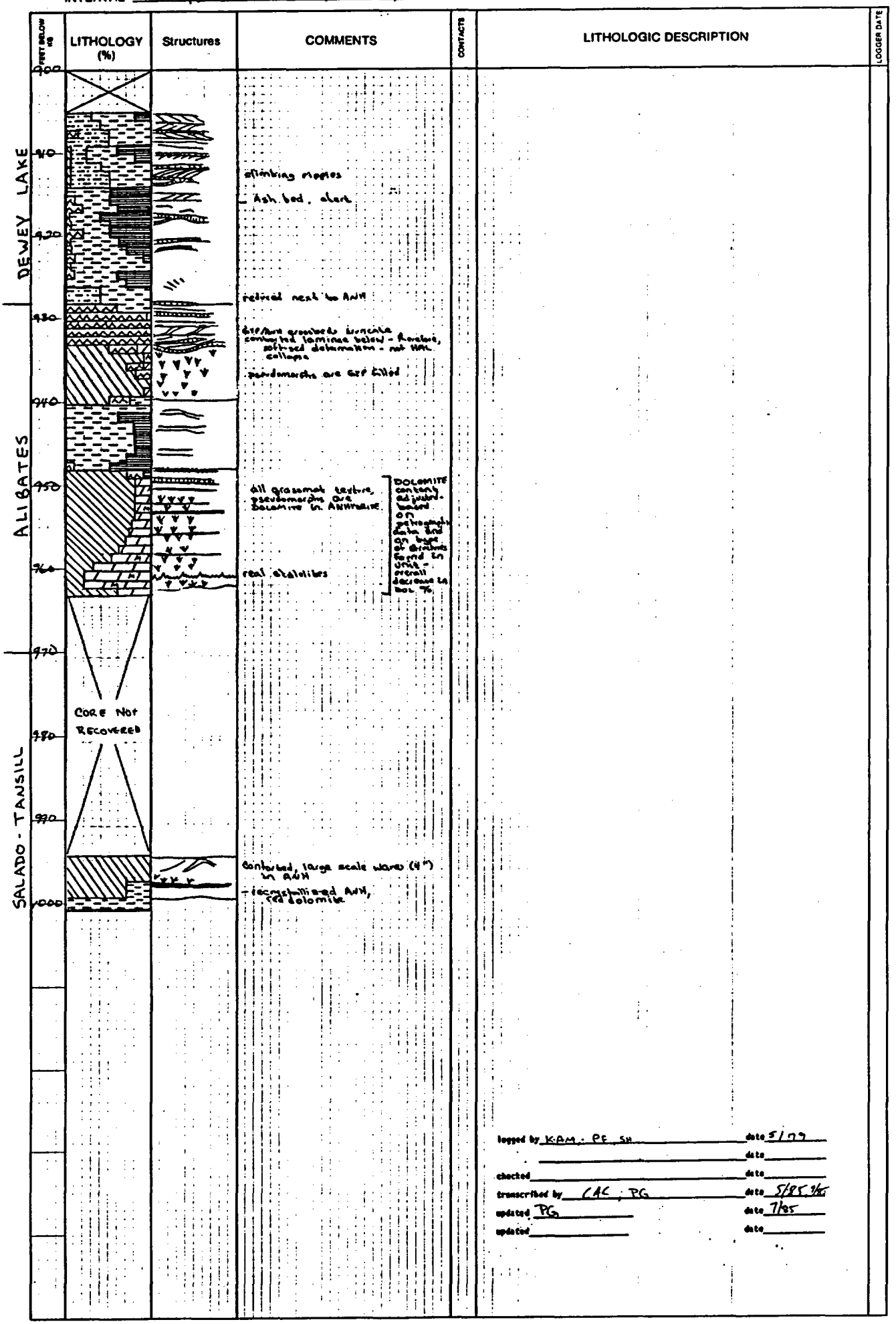
transcribed by CAC, PG date 5/85, 7/85

updated PG date 7/85

updated date

WELL #1 GRABBE COUNTY SWISHER DATE 5/79

INTERVAL 900 - 1000 DEWEY LAKE, ALIBATES, SALADO-TANSILL LOGGED BY KAM, PE, SH



logged by K.A.M., PE, SH date 5/79

date

checked date

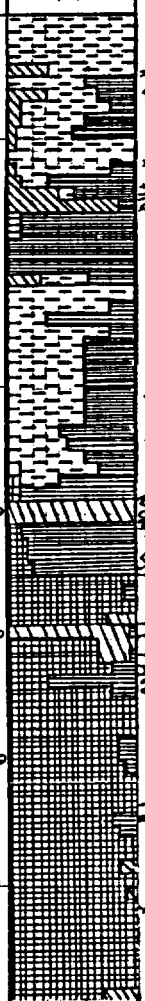
transcribed by CAC, PG date 5/85 9/85

updated PG date 7/85

updated date

WELL #1 GRABBE COUNTY SWISHER DATE 5/79

INTERVAL 1000-1079 SALADO-TANSILL LOGGED BY PC, KAM, WPJ, SH

FEET BELOW KB	LITHOLOGY (%)	Structures	COMMENTS	CONTACTS	LITHOLOGIC DESCRIPTION	LOGGER DATE
1000			ANH intraclasts "sanbursts" in chinsectum			
1010			disrupted - originally well-sorted			
			diagonal bedding, soft-sed shear - collapse breccia? contorted, lam. ANH ANH tubes cracks			
1020			disturbed bedding	SLUMPING		
1030			reduction spots have dark centers			
			real soft-sed deformation, microfaults, fluid escape, DOL nodules (after ANH, like Alibates?)	ABUNDANT		
			voids and palisadin of ANH - after HAL?			
1040			recrystallized ANH, stylolites clayey matrix			
			sharp contact w/ insoluble residue	S		
			recrystallized HAL, diagonal fabric abundant, with slender ANH, and micro. stops			
1050			crit bed in ANH			
1060			extremely coarse HAL, crystals, ANH stops			
1070			geopetal ANH, and micro chert			
			chevron within recrystallized HALITE			
1080						

SALADO-TANSILL

logged by PC, KAM, WPJ, SH date 5/79

date

checked date

transcribed by CAC, PG date 5/85, 7/85

updated PG date 7/85

updated date

WELL #1 GRABBE COUNTY SWISHER DATE

INTERVAL 1077 - 1190 YATES, UPPER SEVEN RIVERS LOGGED BY SN

FEET BELOW KB	LITHOLOGY (%)	Structures	COMMENTS	CONTACTS	LITHOLOGIC DESCRIPTION	LOGGER DATE
1080			BRECCIATED W/SMALL XYLS OF HAL DISSIPATION STRUCTURES			
			BRECCIATED & V. DIST. RIPPLES			
1090			SEAY DIDN'T FINISH THIS DUE TO MOVING WSL - COULDN'T GET BOXES LAC			
1100			DISSIPATION STRCTRS FEW POORLY DEFINED RIPPLES			
1110			BROKEN			
1120			SLIGHTLY DIST. RIPPLES IN FINER MATRIX			
1130			DISSIPATION STRTS & FEW POORLY DEFINED RIPPLES DISSEMINATED ANH GRAINS THROUGHOUT.			
			SMALL (1mm-2cm) DISSEMINATED ANH GRAIN + SURLY DIST. RIPPLES			
1140			DISSIPATION STRTS			
			DIST. RIPPLES (DIST. DECR DP) DISSIPATION STRS + POORLY DEFINED RIPPLES			
			DISPLACIVE HAL XLS (1-5cm) SMALL RIPPLE TRAIN			
1150			BROKEN			
			DISSIPATION STRTS			
			BRECCIATED W/DIST. RIPPLES, SMALL HAL XLS			
1160			VERT FRAX FILLED W/ HAL (EN ECHELON?)			
			V. DIST. RIPPLES IN HALITE MUDSTONE			
			IRREG. SEDIMENT. CONTACT BTW. SALT & CLASTICS (FRACTUR)			
1170			V. DIST. RIPPLES SMALL (1-2mm) HAL XYLS.			
			DISSIPATION STRS			
1180			INTRACLASTS (MUD) 1mm-4cm			
			vert. frax (17cm) filled w/HAL			
1190						

YATES

UPPER SEVEN RIVERS

logged by SN. date

date

checked date

transcribed by CAC date 5/85

updated PG date 7/85

updated date

WELL #1 GRABBE COUNTY SWISHER DATE

INTERVAL 1190 - 1260 UPPER SEVEN RIVERS LOGGED BY

UPPER SEVEN RIVERS

FEET BELOW KB	LITHOLOGY (%)	Structures	COMMENTS	CONTACTS	LITHOLOGIC DESCRIPTION	LOGGER DATE
1190			SMALL (1-2cm) IRREG MASSES OF ANH			
1200			BROKEN			
			STRINGERS AND SMALL DISSEMINATED MASSES OF ANH			
1210			ABUNDANT HAL PSEUDOMORPHS AFTER GYPSUM			
			BROKEN			
			SMALL / INTERNAL MASSES OF ANH			
1220						
			Good intercrystalline texture			
1230			IRREG. SUB-VERT. BOUNDARY BETW. HALITIC ANH & MOSAIC ANH NODULES - 8 FT			
			SMALL IRREG MASSES OF ANH			
1240			SMALL IRREG MASSES OF ANH			
1250			vertically oriented bedding semi-fibrous texture in HAL filled vert. fractures			
1260						

logged by date

date

checked date

transcribed by CAC, PG date 5/85 7/85

updated PG date 7/85

updated date

WELL #1 GRABBE COUNTY SWISHER DATE 3/85

INTERVAL 1260 - 1381 UPPER SEVEN RIVERS LOGGED BY SN

UPPER SEVEN RIVERS

FEET BELOW KB	LITHOLOGY (%)	Structures	COMMENTS	CONTACTS	LITHOLOGIC DESCRIPTION	LOGGER DATE
1260			SMALL STRINGERS AND IRREGULAR MASSES OF ANH			
1270			SMAL STRINGERS & IRREG. MASSES OF ANH			
1280						
1290						
1300						
1310			Vertically oriented HAL outlined in ANH. Many original structures preserved in HAL - chevrons			
			↑CU very coarse HAL			
1320			some primary texture			
			wide crack (2") with fibrous HAL			
1330			coarse crystals			
			VERT FRAX FILLED W/HAL (2cm) intraclastic texture			
1340			SMALL (1-3 cm) EQUANT ANH MASSES geopetal? inclusions rounded? shape HAL			
1350			HAL FILLED VERT FRAX			
			SMALL (1-3) cm irregular mass of ANH			
			VERT FRAX IN MDSTN 12cm LONG FILLED W/ FIBROUS HAL ⊥ TO WALL			
1360			VERT (PRIMARY) FABRIC VISIBLE IN CONTORTED ANH BEDS			
1370						
1380			ANH IN SMALL INTERSTITIAL IRREG. MASSES ~ 1 cm IN SIZE			

logged by SN date 3/85

date

checked date

transcribed by CAC date 3/85

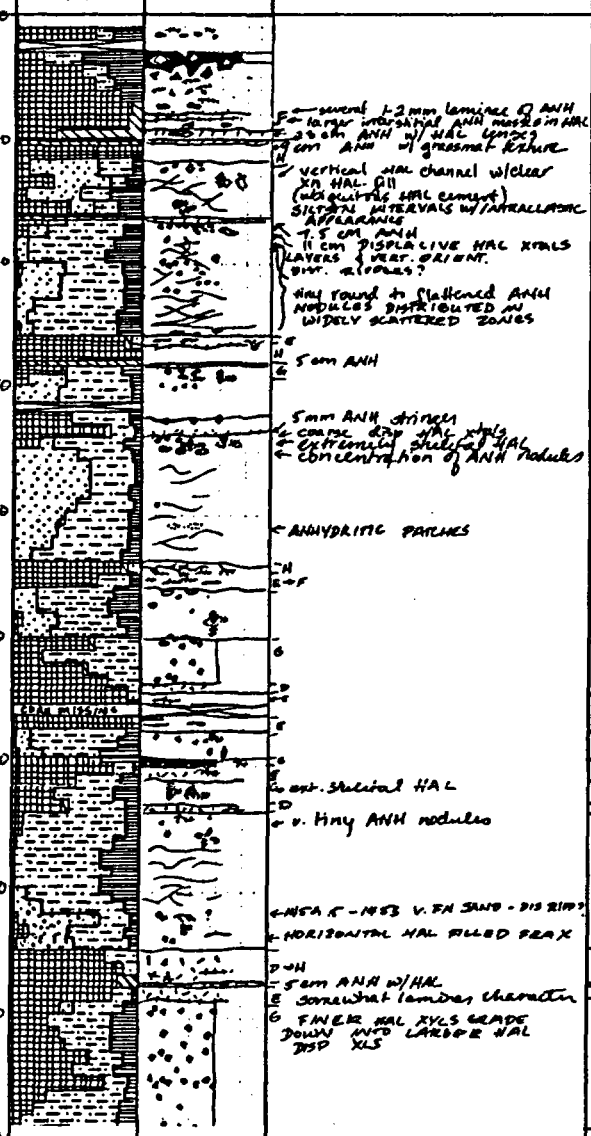
updated TG date 7/85

updated date

WELL #1 GRABBE COUNTY SWISHER DATE NOV. 1984

INTERVAL 1381-1469 LOWER SEVEN RIVERS LOGGED BY VDN

LOWER SEVEN RIVERS



LITHOLOGIC DESCRIPTION

Clear, coarsely xln hal with abundant instl anh as both thin laminae and irregular, flattened masses plus minor instl RB mud; sparse relict chevrons abundant in lowest 7 cm of hal.

Pinkish to yellowish, lt Gy, vaguely lam anh with irregular, flattened hal lenses and nodules; remnant grassmat texture in the more bedded hal.

White, mod xln hal with minor instl anh, rare remnant chevrons.

Dk RB, coarse siltstn with displacive hal in patches, uppermost 12 cm "clotted" hal and siltstn, grading down into less abundant fine, displacive hal; at 1393.5', a vertical channel with clear, xln hal-fill appears, also patches of coarse, displacive hal-filled fractures, small hal xls and tiny anh nodules, irregularly scattered in section, small Gy-Gn reduction spots scattered throughout.

Reddish Gy anh, lower 1 cm with abundant RB muddy material, granular appearing.

RB, med to coarse siltstn and very fine ss with abundant disturbed texture of clay dissipation features; 1396.8-1397.2' has thin stringers of hal with some vertically oriented, single xls associated, also thin vertical hal-filled fractures; small hal xls and tiny anh nodules irregularly scattered in section; small Gy-Gn reduction spots scattered throughout.

Upper .9', a large, chaotic mudsalt-filled pit in muddy hal; thin (1-3 mm) anh laminae at 1406.9'; lower 1.2' clear coarse xln hal with minor instl anh and mdstn.

Reddish to lt Gy anh (5 cm thick), lower contact slightly interbedded with mdstn.

Dk RB, med to coarse siltstn, coarse silt in flattened patches, disturbed ripples(?) in upper .5', large displacive hal xls grading down into extremely skeletal hal hoppers then tiny hal xls, lowermost .5' with increasing hal, disturbed texture and grading into chaotic mudsalt topping next unit.

Upper .4' of chaotic mudsalt overlying clear, coarsely xln hal with instl mud increasing in abundance toward the bottom, 5 mm of contorted anh at base.

Upper 1.6' of unit has large irregular hal xls, stringers and masses grading down into extremely skeletal hal hopper xls, rest of unit RB coarse siltstn to very fine ss with abundant clay dissipation features, and numerous small Gy-Gn reduction spots; anh nodules at 1415' and anhydritic patches at 1420.9' and 1421.8', lowermost .6' with intraclastic texture.

Chaotic mudsalt-filled solution pit (minor anh in floor) at top of unit; underlain by .8' clear coarsely xln hal with minor RB mud associated; the lowermost 1' of chaotic mudsalt with minor anh, grading from somewhat laminar to more chaotic downward.

Dk RB med to coarse siltstn and very fine ss, basically structureless, tiny to large anh nodules (less than 1 mm to 3 mm) widely scattered throughout; extremely skeletal hal from 1428.4 to 1429.3', small Gy-Gn reduction spots common.

Clear, coarse displacive hal xls in RB, silty mdstn with associated minor anh as flattened nodules and discontinuous stringers; increasing hal content and larger xls downward in section, grading into unit below.

Clear, coarse hal xls with abundant instl RB mdstn and minor hal.

Dk RB med to coarse siltstn and very fine ss with abundant small hal xls, few larger hal masses, rare tiny anh nodules; slightly coarser-grained at top.

Upper .6' of coarse displacive hal in a silty, RB mdstn, minor anh, underlain by .3' of clear, coarsely xln hal in a solution pit; the remaining .9' of rexlz hal with interstitial RB mdstn and minor hal.

Dk RB, coarse siltstone with extremelt coarse, skeletal hal xls, disturbed texture and tiny anh nodules.

Chaotic mudsalt of RB silty matrix, flattened anh mass at 1443.7'.

Dk RB, coarse siltstn with extremelt fine, skeletal hal hoppers and small hal xls, texture at top of section vaguely laminar, grading down into more disturbed texture, coarses and silt concentrated in patches (ripples?); rare small reduction spots, lowermost 2.5' has increased hal content, cwrdled patchy area at 1452.4', 1453.1-1453.5', and coarser patch at 1454.0-1454.3', abundant clay dissipation features.

Chaotic mudsalt with minor associated anh grading downward into cleaner, more coarsely xln hal with instl RB mdstn and minor anh, grading into unit below.

Lt Gy anh, 5 cm thick with hal xln entrained.

Fine to coely grained hal with fine blebs to thin stringers of RB mdstn and minor anh, grading into unit below.

RB siltstn to very fine ss with displacive hal, xls finer and more abundant at top of unit, becoming larger and more widely spaced down into unit; skeletal hal xls throughout, clay dissipation features common.

logged by VDN date 11/84

date

checked SH date 11/84

transcribed by CAC date 5/85

updated PG date 7/85

updated date

WELL #1 GRABBE COUNTY SWISHER DATE 10/84

INTERVAL 1469 - 1570 LOWER SEVEN RIVERS LOGGED BY SW, VDN

LOWER SEVEN RIVERS

FEET BELOW KB	LITHOLOGY (%)	Structures	COMMENTS	CONTACTS	LITHOLOGIC DESCRIPTION	LOGGER DATE
1470			← cm ANH nodules 1-4mm ← cm ANH nodules 1-4mm	G	Dk RB cse silt to v fine sa, basically structureless with few dath rpls (preferential hal cementation?) and abdnt brighter R clay dissipation features, also abdnt tiny Gy-Gn reduction spots scattered throughout, few v small anh nods and hal xls scattered within, entire section hal cemented lowermost 6" of mdstn with slotted appearance due to inc hal, grades into unit below.	
1480			← "slotted" mud w/ heavy HAL cmt G D-E	G G G	Chaotic mudsalt with RB silty mdstn instlly. Dk RB silty mdstn with mod-large disp hal xls and skeletal hal hoppers, min anh blebs. Cse xline clear hal with abdnt instl RB mdstn and lt Gy anh, largely dissolution pit fill with chaotic mudsalt.	
1490			G D-E, F /ANH'dic nodule at 1495.7 Lg HAL hoppers /ANH'dic irregular flattened masses @1498.5-9' extremely skeletal HAL hoppers cm flattened ANH nodule	G G S G G G	Dk RB silty mdstn with large disp hal xls and small vert hal-filled fracs, small flattened and reduced siltstn clasts at top, scattered reduction spots. Cse xline clear hal with small instl RB mdstn and anh, largely dissolution pit fill(?), 6 cm layer of anh at 1487.6', upper part lt Gy, lower 3-4 cm very RB mud-rich, sharply bounded both contacts. Dk RB silty mdstn with disp hal hoppers, small reduction spots. Clear, cse xline hal with abdnt instl RB mdstn and min anh, largely dissolution pit fill with chaotic mudsalt(?).	
1500			1501-1507 ← 7 clay-rich interval (12cm) ? v. narrow vertical HAL - filled fractures clay rich interval (61 cm)	G	Dk RB silty mdstn with slightly (upper part) to extremely (lower part) skeletal hal hoppers, min anh in irr to mod masses, intermittent small reduction spots, occasional irr silt-rich lenses, dath rpls?, clay dissipation features throughout. Dk RB cse silt to v fine sa, basically structureless with abdnt clay dissipation features and occasional silt-rich lenses - dath rpls(?), scattered Gy-Gn reduction spots. Brighter RB clayey, fine silt mdstn at 1503.4-1503.9' and 1506.1-1508', lower interval with vert hal-filled fracs (1-2 mm wide), few silty (preferentially hal cemented) lenses, dath rpls(?) and clay dissipation features.	
1510			D	G	Chaotic mudsalt of large clear hal xls with abdnt instl dk RB mdstn.	
1520			} cm HAL xtals + masses, silty lenses } cm HAL xtals + masses, silty lenses ← 7 cm. ANH layer D-G ← more clay-rich @ bottom "1" cm ANH layer, w/HAL + red clay stains } cm poorly developed ANH nodules good chicken wire appearance of HAL + MDSTN	G S G G G	Dk RB mud to cse siltstn to v fine sa, basically structureless, especially in coar intervals, some silt-rich lenses (dath rpls?) in finer intervals; scattered tiny to large coalesced Gy-Gn reduction spots, locally abdnt to rare, replacement hal as small to mod xls or narrow preferentially hz masses at 1522-1523' and 1524.1-1525', section generally coarsens upward. Mod Gy anh layer from 1527-1527.6', tilted contact top and bottom. Chaotic mudsalt with abdnt RB silty mdstn instlly, hal xls 3 mm to 4 cm. Dk RB silty mdstn with few large hal xls + min hal frac fill. Clear v coaly xline hal with minor RB mdstn instlly. Mod Gy anh from 1531-1531.7', small amount intergrown hal + RB mdstn, faintly lam with pair Yiw lam.	
1530			← v. sm. ANH + HAL xls found rarely ← cm vert. HAL filled fractures D-F interstitial HAL MDSTN + ANH blebs ← anhydritic(?) cmt'd; slt sed. deformation ← 5 cm horizontal layer, reduced 94-5'	G G G G G	Dk RB v fine sa to brighter RB mud to cse siltstn, structureless with abdnt clay dissipation features, upper 2.5' with small hal xls + blebs and several poorly defined anh nods, hal stringers in mud giving good chicken-wire structure here, otherwise rare small anh and hal xls, scattered Gy-Gn reduction spots, locally more abdnt in coar intervals, rather abrupt grain size change (including coarsen of hal cement) at 1541.2', patchy coar hal cement. Chaotic mudsalt with abundant squeezed + dist anh nods and instl dk RB silty mdstn. Dk RB mud + cse siltstn to v fine sa, more clay-rich at top and bottom, mot + dath anhydritic(?) nod at 1544.4-1545.2', flattened anh nods (2 mm to 5 cm) in uppermost finer section, clay dissipation features throughout, also small Gy-Gn reduction spots, few large hal xls in lower fine interval (as noted at left).	
1540			← Lg displacive HAL xtals 1548.3-5' ← 8 cm slightly silty clay intvl ← 6 cm pit w/ chaotic mudsalt + interst HAL, ANH	G G G G G	Dk RB silty mdstn with large disp hal xls and narrow vert hal-filled fracs. Dk RB cse siltstn with abdnt clay dissipation features and small Gy-Gn reduction spots scattered within. Dk RB silty mdstn with large disp hal hoppers, silty lenses with reduction spots. Brighter RB cse siltstn with abdnt clay dissipation features, few large disp hal xls + small reduction spots. Clear coaly xline hal with small amount of instl RB mdstn grading downward into cse hal with instl anh as residue in broad soln pits, at 1567.1' hal becomes less coaly xline with abdnt dk RB mdstn instlly, v minor anh.	
1550						
1560						
1570						

logged by SW, VDN date 10/84

date

checked date

transcribed by CAC date 5/85

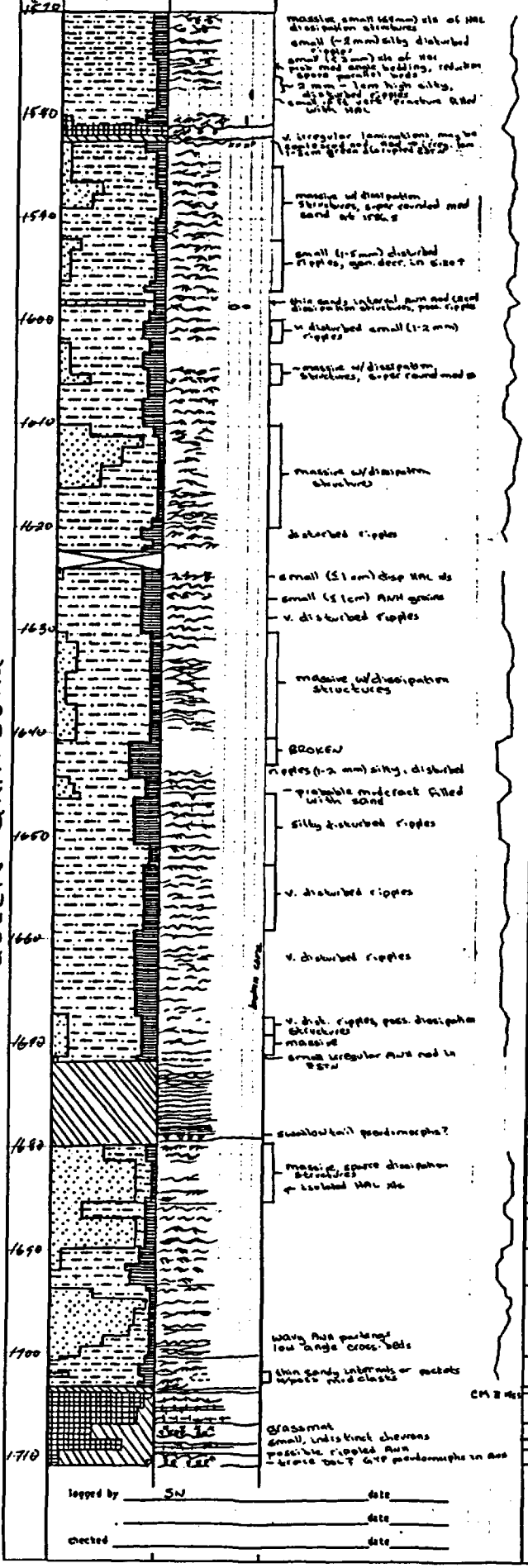
updated PG date 7/85

updated date

WELL #1 GRABBE COUNTY SWISHER DATE

INTERVAL 1570 – 1710 QUEEN - GRAYBURG LOGGED BY SN

QUEEN - GRAYBURG



CONTACTS	LITHOLOGIC DESCRIPTION
6	RB massive coe siltstn with dissipation structures and scattered small xls of displacive hal.
	RB silty clayey coe-med siltstn with silty dsth poorly defined rpls, (about 2 mm) to sandy coe siltstn with poorly defined rpls and low-med angle bedding, small (23 mm) hal xls scattered at about 1574.5', 0.5' vert frac filled with hal at 1578'.
6	RB chaotic hal mdstn with scarce chevrons near base, grading into RB mdstn to clayey siltstn with disp hal (cubes less than 2.5 cm).
5	Gy, RB irr anh lam.
6	RB sandy coe siltstn with poorly defiend rpls (2-3 mm), silty dsth.
	RB, generally massive, sandy to v sandy coe siltstn, sand fraction is v fine sand at about 1586.5', super round frosted med sand grains, dissipation structures may incompletely define some indistinct rpls.
6	RB sandy coe siltstn to clayey coe-med siltstn with poorly defined rpls, between 1592-1597' rpls (1-5 mm) dec in size upward, rpls 1599.5-1602' about 1-2 mm, v dsth, generally massive with dissipation structures from 1597-1599' and small (less than 2 cm) anh nods at about 1598-1599'.
6	RB massive sandy coe siltstn with dissipation structures, super round med sand at about 1605.5'.
6	RB clayey coe-fine siltstn with silty dsth rpls (about 1-5 mm), rpls inc in size upward.
6	RB v sandy coe siltstn grading upward to slightly silty v fine ss with generally massive appearance and dissipation structures, sand percent inc upward to about 1611' where it grades into overlying siltstn.
6	RB coe siltstn with massive appearance and dissipation structures.
6	RB coe-fine clayey siltstn with small v dsth rpls in lower 5' and poorly defined silty dsth rpls in upper 5' (2' core missing 1622-1624'), small (greater than 1 cm) disp hal xls at about 1624.5' and small (less than 1 cm) anh grains at about 1626.5'.
6	RB massive sandy coe siltstn with dissipation structures, sand (v fine) percent maximum 1631-1634' and 1637-1640.5'.
	RB mdstn, upper 2.5' crumbled in box, lower 1' has dsth rpls 1-2 mm high.
6	RB sandy coe siltstn with poorly defined rpls, probable undercut filled with v fine sand at 1645.5'.
6	RB v clayey coe-med siltstn with silty dsth rpls.
6	RB clayey mdstn-fine siltstn with v dsth rpls visible in places, rpl wavelength about 1 cm.
	RB sandy coe siltstn with poorly defined rpl to massive appearance, rpls dsth with possible dissipation structures.
5	Wht to Gy to RB anh with irr bs lam about 1 mm to 1 cm thick, Wht nod anh at 1672.8', possible primary structures (anh after gyp swallowtails) at about 1679'.
5	RB silty clayey fine-v fine ss with massive texture and sparce dissipation structures, becomes finer grained immediately beneath overlying anh.
6	RB clayey sandy siltstn with v dsth rpl texture.
6	RB slightly muddy v fine ss with probable poorly defined rpls incompletely outlined by dissipation structures.
6	RB clayey siltstn with v dsth rpl texture, interval coarsens upward, grades into overlying interval.
6	RB silty sandy siltstn to silty clayey fine to v fine sandstone with dissipation structures at 1695', 1696' and 1698'; interval coarsens upward to 1694.5', then fines upward, lower part is gradational from underlying siltstn interval and upper part is gradational to overlying clayey siltstn, dissipation structures probably incompletely outline poorly defined rpls, rest of interval massive.
6	RB clayey siltstn with v dsth rpl texture.
5	Pale Gn to Purple wavy lam anh.
5	Wht to pale RB rexlized hal with cont and disc irr lam of anh.
5	Wht to pale Purple anh/hal rock with probable hal pseudomorphs after gyp.
5	Wht to pale RB hal with possible chevrons and cont/disc lam of anh.
5	Pale Gn to Purple lam anh with hal pseudomorphs after gyp at base and possible rpls at 1709.7'.

logged by SN date

date

checked date

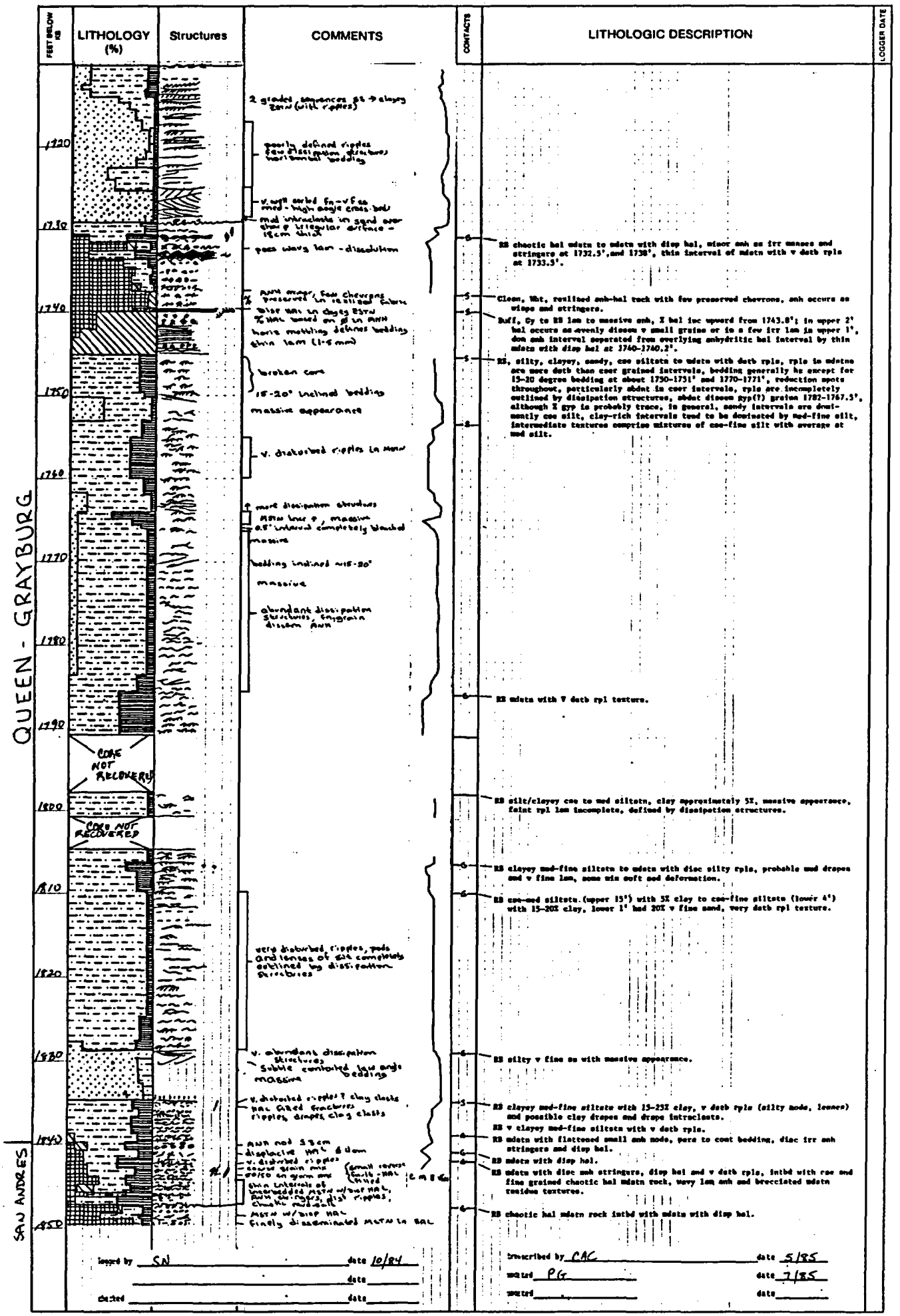
transcribed by EAC date 5/85

updated DG date 7/85

updated date

WELL #1 GRABBE COUNTY SWISHER DATE 10/10/84

INTERVAL 1710 - 1850 QUEEN-GRAYBURG, UPPER SAN ANDRES LOGGED BY SN



logged by SN date 10/84

date

checked date

transcribed by CAC date 5/85

edited PG date 7/85

edited date

WELL #1 GRABBE COUNTY SWISHER DATE 10-24-84

INTERVAL 1950-1990 UPPER SAN ANDRES LOGGED BY JV

UPPER SAN ANDRES

FEET BELOW KB	LITHOLOGY (%)	Structures	COMMENTS	CONTACTS	LITHOLOGIC DESCRIPTION	LOGGER DATE
1950	CORE NOT RECOVERED		MISSING FOOTAGES 1852-1857'		Banded hal with trace insol mud + anh, missing footage from 1852-1857'.	
					Anhed hal with trace insol mud.	
1960			interbed apparent from backside of core	c	Anhed hal with insol silt + anh → silty mdstn intbd (0.5') with small anh clasts → anhed hal with abdnt patches of siltstn → banded hal with insol mdstn within pipes → anhed hal with minor insol mud → anhed hal with patches of silty mdstn → silty mdstn intbd (0.4') with insol hal.	
1970			curved slickenslide surface	s	Anhed hal with insol mud + silt and with an area of vert stacked large patches of RB silty mdstn presumably associated with a large pipe → thin clastic interval with patches of anh + mdstn → mdstn + siltstn intbd with abdnt disp hal and minor hal frac fill, intbd changes from massive silty mdstn at base up into a chaotic siltstn + mdstn fabric with abdnt small anh clasts, then up into a doth rpl lam muddy siltstn.	
1980			1 cm banded ZSTN/ANH interbed caps	s	Anhed hal with minor insol mud + silt inc upward → anhed hal with abdnt small patches of muddy siltstn → banded hal with subvert xls and minor insol mud + anh; unit capped by 5 thin (1 cm) siltstn intbd, large pit with little mud residue occurs in lower portion of unit.	
			coarse xyls			
1990				s	Anhed hal with min insol mud + anh → thin clastic mdstn/hal interval → banded hal with occasional chevron structures → anhed hal with patches of anhydritic mdstn along disc intbd and with min insol mud and anh → muddy siltstn intbd (0.3') with abdnt disp hal.	
			1.5' long vertical fx 1.5-2 cm wide. Fx in interbed filled W fibrous HAL.	s	Anhed hal with insol anh + mdstn → RB silty mdstn intbd (1.6') with a long vert frac filled with fibrous hal, upper part of intbd is v anhydritic, overlying this is banded hal with minor insol anh + mud and interrupted by a thin mdstn intbd and a chaotic mdstn/hal interval → muddy siltstn intbd (1.5') with doth structures and disp hal in upper part.	
2000			cm scale xbedding near top of interbed and also some dissolution w/in sediment	s	Anhed hal with abdnt patches of muddy siltstn and clastics content inc upward → muddy siltstn intbd (about 4.0') with com disp skeletal hal hoppers and small clasts of anh + mdstn; intbd lows are usually bdoth with patchy preservation of original sed structures, especially at top of intbd where siltstn hal well-developed rpl lam.	
			1-2% ANH			
2010				s	Anhed hal with abdnt clasts of RB silty mud + containing a 4 cm thick silty mdstn intbd → silty mdstn intbd (0.5') with minor disp hal + frac fill → anhed hal with minor insol mud and silt → anhed hal with abdnt silty mdstn patches → silty mdstn intbd with disp hal.	
			1% ANH			
	CORE NOT RECOVERED		core missing 1916.0-1916.9'	m	Anhed hal with insol silt + trace mud + anh → anhed hal with abdnt small patches of muddy siltstn + minor anh → muddy siltstn intbd with vert frac filled with fibrous hal → another siltstn intbd with rpl lams + a small cont anh clast → anhed hal with abdnt patches of muddy siltstn inc upward → siltstn intbd interrupted by missing footage.	
2020			large vertical fx w/HAL cont cuts through interbed	s	Anhed hal with insol silt and anh with a thin interval containing abdnt well-developed chevron structures → RB muddy siltstn intbd (1.0') with several anh clasts and a long, near-vert hal-filled frac cutting across; thin anh lam caps intbd, intbd has doth rpl lam structures, dissolution features occur in lower part of section.	
2030				s	Anhed hal with insol silt and trace anh → anhed hal with abdnt patches of doth lam muddy siltstn and anhydritic siltstn, clastics content inc upward throughout unit, several dissolution features, especially pits, occur in lower part of section.	
			1% ANH			
2040				c	Anhed hal with minor insol silt + trace mud → thin zone of anhed hal with abdnt patches of RB muddy siltstn → anhed hal with insol silt → anhed hal with abdnt patches of siltstn which quickly grade upward into a chaotic siltstn intbd with abdnt disp hal + com small clasts of mud + anh, dissolution features are com, especially in lower part, upper contact is gradational with overlying B hal, beginning of cyclic nature of clastics.	
			1% ANH			
			slickenslides in MDSTN			
2050			pipe outlined by sinuous frac of v. small clasts of ZSTN & ANH	s	Anhed hal with min insol mud, silt and trace anh → anhed hal with abdnt small patches of muddy siltstn + containing a thin (0.2') irr rpl lam to doth silty mdstn intbd → RB silty mdstn intbd (0.7') with disp hal, core missing from 1955-1958'.	
	CORE NOT RECOVERED					
2060					Anhed hal with insol mud → anhed hal with abdnt small patches of muddy siltstn → rpl lam muddy siltstn intbd.	
				c	Intbd of interlam siltstn + anh with minor disp hal → anhed hal with abdnt patches of muddy siltstn + anhydritic mdstn.	
			0.5' thick interlam ANH & ZSTN interbed w/ horizons of disjunctive HAL / ANH at base	s	Banded hal with minor insol hal + mdstn, unit has several pipes and pits resulting in areas of anhed hal with insol mud (B hal), hal morphology is usually gradational between subvert and anhed.	
2070			pink irregular interbed of MDSTN & ANH clasts			
				s	Anhed hal with minor insol mud + anh and occasionally patches of siltstn in upper portion → doth to rpl lam muddy siltstn intbd with disp skeletal hal hoppers, a frac filled with fibrous hal near the top, and occasional small clasts of mdstn scattered throughout.	
2080			6.8 cm tall xyls irregular interbed of ANH & mdstn	s	Banded hal with minor insol anh, large pit cuts across upper part.	
				s	Mdstn intbd with large hal filled frac and skeletal hal hoppers, intbd grades upward into siltstn → anhed hal with min insol mud → lt colored silty anh intbd (2.1') with frac in lower part + disp hal in upper part, anh consists mostly of very small nods, upper part is rpl lam, sharp dissolution upper contact.	
			slickenslides fx	s	Banded hal with minor insol mud, lower part contains a thin siltstn intbd and occasional patches of muddy siltstn.	
2090			1.5 cm thick ZSTN interbed			

logged by JV date 10/84

date

checked SH date 10/84

transcribed by CAC date 5/85

checked PG date 7/85

checked date

WELL #1 GRABBE COUNTY SWISHER DATE 10/84

INTERVAL 1990'-2110' UPPER SAN ANDRES LOGGED BY JV

UPPER SAN ANDRES

FEET BELOW KB	LITHOLOGY (%)	Structures	COMMENTS	CONTACTS	LITHOLOGIC DESCRIPTION	LOGGER DATE
1990			6cm THICK MUDDY SILTSTN RIPPLE LAM INTERBED 1% ANH INTERSTING DOUBLE PIT IN BACK SIDE OF CORE	S	Anhed hal with minor instl mud + silt and trace anh, several dissolution features present, unit capped by rpl lam siltstn intbd, missing footage from 1994-1997?.	
			4% MUD 1% MUD	S	Anhed hal with minor instl anh + trace of RB mud, chevron structures occur locally near the base and top of the unit, unit capped by a 1 cm thick felted anh intbd.	
2000			DISSOLUTION BOUNDARY	S	Anhed anhydritic hal with occasional chevron structures —> thin chaotic mdstn/hal rock —> thin zone (about 0.4') of banded hal with subvert xls and a chevron structure —> anhed hal with abdnt small patches of muddy siltstn.	
			DISSOLUTION CONTACT	S	Bedded hal with abdnt small vert gyp pseudomorphs with hal cement which originate from bedding planes (about 2.5') —> mixture of anh + hal that becomes chaotic near the top of the unit, upper contact is a dissolution surface with anh residue.	
			TR DOLO? TRUNCATION SURFACE			
2010			0.35' RIPPLED, INTERLAM RB MDSTN / SHOWN CLOSER OF 1-2cm; RIPPLE LAM MODERATELY INT SOMEWHAT CHAOTIC MIXTURE OF A ANH, HAL, MUD	S	Chaotic anh + hal mixture (0.7') —> anhed hal with occasional patches of RB muddy siltstn and several intbds of rpl lam RB muddy siltstn intbds, 0.2' thick interlam mdstn + siltstn intbd caps unit.	
			18-20 cm THICK DISTURBED SILTSTN INTERBED W/ SOME RIPPLE 1 cm THICK ANH INTERBED W/ RB RED EDGE	S	Anhed hal with several large patches of muddy siltstn and thin anhydritic mdstn and anh intbds in lower part, an 18-24 cm thick dolo muddy siltstn intbd with some disp (?) hal occurs at top of unit.	
			5mm THICK WAVY ANHYDRITE RB MDSTN INTERBED PSEUDOMORPH OF GYP. SUBLAYERS SLOPING IN CORE	C	Anhed hal with minor instl mud and silt and occasionally anh; small pit occurs in lower part.	
2020				S	Silty RB mdstn intbd (0.5') —> rpl lam silty anh (0.5') with well-developed rpl foresets —> anh with large chaotically oriented gyp pseudomorphs with red stained rims and filled with hal (about 4') —> mixture of crinkly lam anh and gyp pseudomorphs (about 3.5') —> crinkly lam anh with occasional gyp pseudomorphs (about 1.5') —> wavy lam anh with small gyp pseudomorphs, originating from bedding planes (about 1.5') —> anh with v large, generally vert gyp pseudomorphs (about 3') —> massive anh (0.25') that caps the unit with a sharp, irr upper contact with overlying hal.	
			VERY CLOSELY LAMINATIONS W/ 1-3% SOL BRIGHTLY LAMINATIONS CUT 1 RIPPLE W/OUT PSEUDOMORPH			
2030			PSEUDOMORPHS OF GYP SUBLAYERS 4-20 cm ALONG OR GYP PSEUDOMORPHS HAVE RED STAIN BEAUTIFUL SILTSTN RIPPLE FORESETS WITHIN SOL MUDSTN INTERBED & RIPPLE LAM WAVY ANH			
			1-2% ANH 1-2% ANH	S	Anhed hal with abdnt, usually hz oriented, patches of RB silty mdstn, instl mud + occasionally anh in also abdnt, unit appears to have originated from bedded hal, sharp contact with overlying clastic intbd.	
			WAVELY BLUE WHITE HAL (SUBVERTICAL STRUCTURES)	C	Banded, clear hal with minor instl anh and abdnt chevron structures —> dk banded hal with instl Bk muddy silt and minor anh, vert oriented hal xls, though not well developed, are present throughout the section, occasional pipes also occur in unit, banding within hal occurs on a 2.5-3.0 cm scale.	
2040			MISSING PORTION 2041-2043' MDSTN INTERBED BEGINNING AT TOP OF CORE			
			0.25' THICK INTERBED W/ REPLACIVE HAL & MDSTN AT LOWER PART & MASSIVE SULFUR IN UPPER PART	S	Anhed hal with abdnt patches of RB mdstn and muddy siltstn, amount of instl clastics inc steadily upward, number of rpl lam clasts also inc upward, upper contact marked by intbd of mdstn with disp hal —> siltstn.	
2050				C	Anhed hal with instl anh + minor mud, basal portion above contact is v clean.	
			INTERSTING VERTICAL DISSOLUTION BOUNDARY	S	Bl-Gy anh with occasional nodu and hints of wavy bedding where former dolo matrix is mostly replaced by anh —> anh with abdnt gyp pseudomorphs filled with hal cement, pseudomorphs grade from rather large chaotically oriented xls at base into smaller xls that originate from wavy (gyp sand(?)) bedding planes, upper 1.4' contains a vert dissolution boundary between anh with pseudomorphs and anhed hal with abdnt patches and instl muddy anh + anhydritic mud, upper contact is an irr, hz dissolution boundary between anh with pseudomorphs and anhed hal with abdnt patches and instl muddy anh + anhydritic mud, upper contact is an irr, hz dissolution boundary which cuts across the earlier dissolution event.	
2060						
			RED STAIN ON ANHYDRITE INTRACLASTS ALONG BOTTOM CONTACT LARGE VERT FRAC FILLED W/ FISSILE HAL LOCALIZED PATCHY ANH, MINOR RED STAIN ALONG HORIZON IN MASSIVE ANH	S	Dk RB claystn/mdstn (1.2') with few % patchy anh —> 1.0' Gy mdstn that becomes rpl interlam siltstn/mdstn upward —> 0.35' dolo mdstn with large vert hal-filled frac, upper contact marked by a horizon of desiccated(?) dolo mdstn intraclasts.	
2070				S	Bl-Gy mod anh with dolo mdstn matrix, at 2079' the mod texture begins to disappear as hal becomes the instl component, hal inc upward up to 2079', then dec; the fabric in this section is a somewhat chaotic mixture of anh + hal, the upper 1' is massive anh with some red stain and possible irr-shaped nodu, the upper contact is sharp with the overlying RB claystn.	
2080						
			THOUSANDS OF VERY SMALL HAL CUBE MOLDS ALONG BEDDING PLANES	S	Rpl lam dolo mdstn with abdnt v small hal cube molds along bedding planes.	
			FINE CLASTICS SIMILAR TO AT MARKER RESIDUE 6cm. RB SILTY MDSTN LAM MDSTN INTERBED	S	Both to cont lam RB siltstn with abdnt clasts of RB mud + some anh —> similar Gy siltstn —> 0.3' thick Gy fissile muddy siltstn with several small flattened anh nodu.	
				S	Anhed hal with abdnt patches of cont lam muddy siltstn and anh, several silty mdstn intbds occur in the interval.	
2090				C	Anhed hal with instl and occasional patches of anh + minor mud, mud content inc upward, portions of section appear banded as in B hal, but hal, though similar in xl size, is anhed; missing footage from 2096-2097'.	
			2096 - 2097' MISSING			
			A 3cm THICK RB RIPPLED TO CONTORTED LAM ANH SILTY MDSTN INTERBED TO 8' HALO 1.5cm THICK SIMILAR INTERBED	S	Anhed, milky Wht hal with minor instl anh + mud with abdnt vert oriented chevrons, mud inc upward to where it outlines 3 cm thick beds of hal.	
2100			1-2% SILT <1% ANH 3cm THICK ANH MDSTN INTERBED	C	Anhed hal with RB mud and silt and minor anh.	
				C	Anhed, milky Wht hal with instl anh + vert chevron structures, upper contact is gradational with overlying mdstn intbd.	
			1-3% MUD	S	Anhed hal with instl anh and RB mud and silt, relative proportions vary upward.	
2110						

logged by JV date 10/84

date

checked SH date 10/84

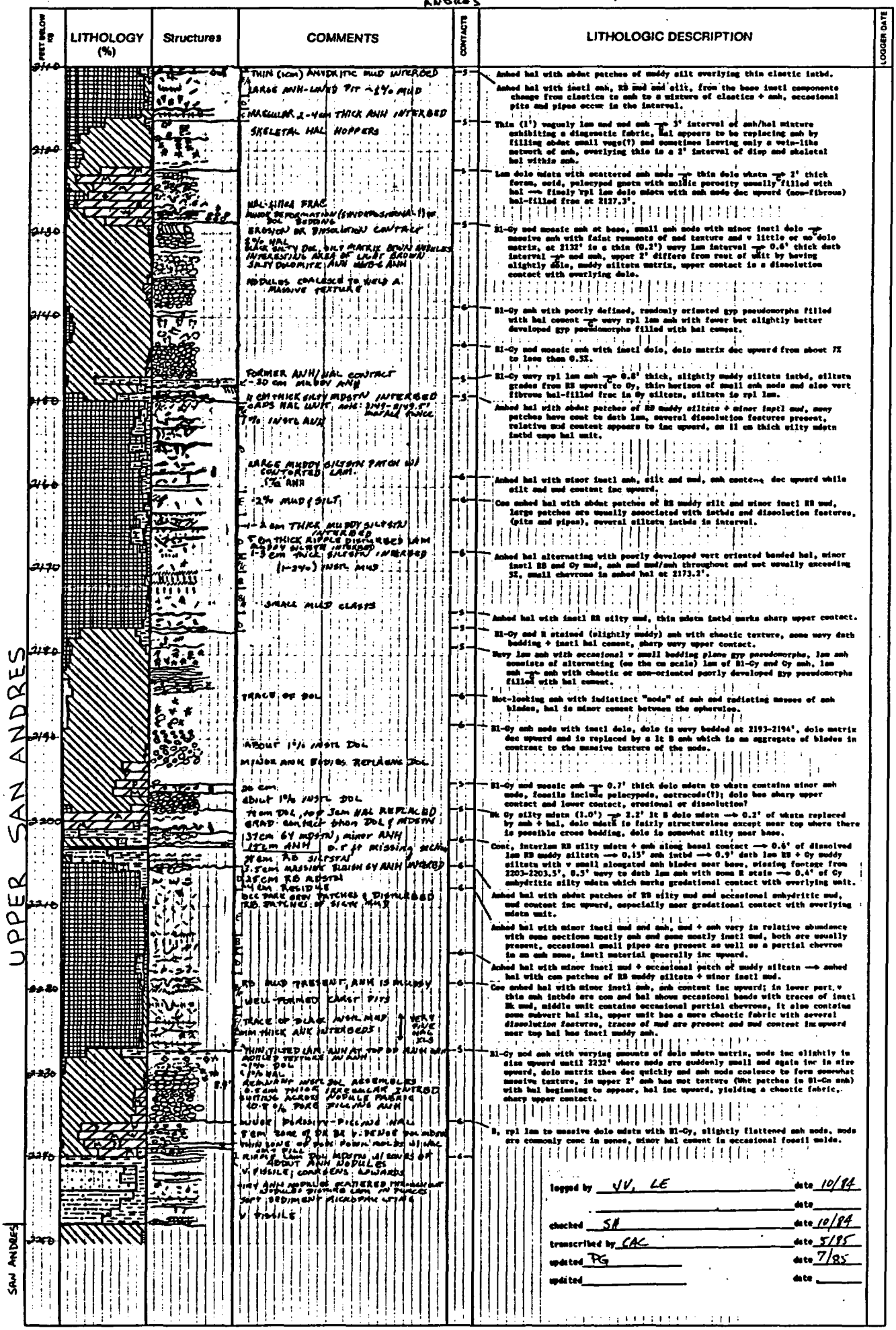
transcribed by CAC date 5/85

updated PG date 7/85

updated date

WELL #1 GRABBE COUNTY SWISHER DATE 10/84

INTERVAL 2110-2250 UPPER SAN ANDRES, MIDDLE SAN ANDRES LOGGED BY JV, LE



logged by JV, LE date 10/84

checked SA date 10/84

transcribed by CAC date 5/85

updated PG date 7/85

updated date

WELL #1 Grabbe COUNTY Swisher DATE 9-84

INTERVAL 2250' - 2345' MIDDLE SAN ANDRES LOGGED BY PG
LOWER SAN ANDRES - UNIT 5

FEET BELOW KB	LITHOLOGY (%)	Structures	COMMENTS	CONTACTS	LITHOLOGIC DESCRIPTION	LOGGER DATE
2250			dolomite interbeds tan intraclast grainstone dolomicrite breccia with anhydrite cement	S	Bk anhydritic siltstn, dsth bedding grades upward into silty dolo gnstn. Dolo is shelly with anh-filled moldic porosity and anh replacement of dolo, anh nods present below missing core are large - 4 cm - and random. Above missing core bedded nod anh with abdnt instl dolo and intbd dolo, from 2261-2250' dolo with scattered rare anh nods and occasional silt partings. Dolo mdstn with wispy organic-rich lam, intbd with pkstn with anh-filled moldic porosity, massive Gy-B anh with dolo intbds and wispy lam within anh.	
			silt partings			
2260			silt partings			
2270			anhydrite after skeletal halite rippled fabric modified by wispy laminat; on/microstylolitization micrite drapes packstone/grainstone layer fissil claystone	S	Bk siltstn, wisps of dolo + anh, disrupted texture grading to intbd anh + siltstn, fissile from 2279-2276', becoming more indurated as dolo inc. dolo is lt B with dk B lam, rpl and burrowed (minor). Anh-filled skeletal hal molds in upper dolo section. Bl-Gy anh, mod, bedded, grading to massive anh at top.	
2280			bedded dolomitic anhydrite	S	Bk Gy anh with wisps of siltstn, grades to Bk siltstn with anh nods and stringers, dsth, irr bedding to 2291'. Anh nods with instl dolo and dolo intbds, dk Gy bedded nods with Bk or lt B instl matrix; nods grade to massive anh with indistinct bedding. Dolo beds have extensive anh replacement of allochems.	
2290			anhydrite-cemented dolograinstone dolomitic mudstone 2290.4-2291.0 missing gradational anhydrite/mudstone transition, compressed nodules	G	Bk, fissile anh mdstn grading to dolo in basal 1', dolo gnstn has hal + anh-filled moldic porosity similar to below, anh nods with instl dolo, dk Bl-Gy, becomes lighter upward with dec dolo, mod dec in size and grade to bedded, massive anh.	
2300			light brown dolomite black anhydritic mudstone anhydrite with disrupted texture dolomitic anhydrite laminated anhydrite + dolomite truncated by anhydrite nodules pseudomorphs? dolomite bed brecciated gradational top dolomite bed rippled grainstone/pack subhedral nodules may be pseudomorphs after gypsum	S	Bk, fissile mdstn with small anh nods at base - becoming dolo toward top, grading to dolo at 2317', rpl lam gnstn, anh-replaced allochems in dolo, dolo grades into mod bedded anh - Bl-Gy anh with instl lt B dolo. 1215.5-1211.5' Gy-B-Wht anh, not with relict B bedding, grades vert to hal-anh intbds, xlotopic anh in hal, grades to B-Gy bedded hal, becoming more mod with instl dolo. Dolo beds have hal + anh-filled moldic porosity. 2305-2300', bedded massive anh with dolo intbds.	
2310				S	Gradation of dolo into clastics, inc clastics and dec dolo upsection with anh cement + beds, grades to dolo anh, massive bedded with dolo stringers, becomes mod at top with instl dolo.	
2310			*See detail below	G	Lt B dolo, wispy to well lam, cross bedding and burrows at 2327-2328', Bl-Gy anh nods at 2326, top 1' is interlam anh and dolo in irr 2-10 mm lam, hal-filled moldic porosity.	
2330				G	Bl-Gy bedded mod anh with instl lt B dolo, irr mod contacts.	
				G	Lt B dolo gnstn, cross bedded + plane lam, hal-filled moldic porosity, irr throughout dolo, two mod anh beds, silty rpl dolomicrite at base.	
2340				S	Dist lam to massive siltstn, Bk with wispy RB lam(?), grades to massive bedded anh, top 1' Bk siltstn with anh nods, hal-filled pores.	
				G	Hal, cycle 5.	

MIDDLE SAN ANDRES

5

Lithology

* 2322.0 - 2323.2

2322

2323

- wispy clay stringers
- enterolithic ANH
- fluid escape?
- interbedded ANH/DOL

Inc in clastics vert, anh cement and rare nods or beds, dolo throughout, intbd siltstn + claystn.

logged by PG date 9/84

date

checked SH date 9/84

transcribed by CAC date 5/85

updated PG date 7/85

updated date

WELL #1 GRABBE COUNTY SWISHER DATE 8/83

INTERVAL 2345 - 2460 LOWER SAN ANDRES - UNIT 5 LOGGED BY S. THOMAS

LOWER SAN ANDRES - UNIT 5

FEET BELOW KB	LITHOLOGY (%)	Structures	COMMENTS	CONTACTS	LITHOLOGIC DESCRIPTION	LOGGER DATE
2345						
2350						
2360		NOT RECOVERED				
2370				S	Primarily bedded B-type hal with numerous mdstn intbds, pipes and pits become more numerous and extensive upward, chevron hal above first intbd grades upward to B-type hal.	
2380				S	A gradational sequence of recrystallized anh hal with remnant chevrons to chevron hal to recrystallized muddy hal with some primary bedding features present, mud present throughout, inc upward.	
				S	Chaotic mixture of hal, anh and mdstn, xln anhed-euhed to 1.5 cm, anh and mdstn as large irr instl bodies.	
				S	Hal replacing gyp pseudomorphs, mats becoming contorted, grading upward to finely disseminated hal/anh mixture.	
				S	Typical recrystallized muddy hal becoming inc muddy upward, xln anhed-euhed, ave 1x1 cm.	
2390				S	0.2' recrystallized muddy hal with some vert oriented xln, B-type sharply overlays.	
				S	Both mixture of hal and anh with hal replaced gyp pseudomorphs, anh dec upward.	
				S	Recrystallized anh hal, pinkish, hal replaced gyp pseudomorphs in basal 0.3'.	
				S	Chevron hal, grades to bedded B-type hal, becoming inc doth, pitted and recrystallized upward.	
2400				S	Clear, cse cavity fill sharply separates recrystallized P-type hal from mod doth B-type, chaotic mudcrk caps interval.	
				S	Recrystallized anhydritic hal and cse cavity fill, in irr pitted contact with anh below, grades upward to bedded B-type hal.	
2410					Hal pseudomorphs after gyp, grassmat texture, pseudomorphs from less than 1 mm to 6 cm, bottom 1.5' contains nice hr repeating couplets (i.e. sequences) of gyp blade growth overlain by a clastic drape (rpl and cross lam, clay, mud and ss), couplet thickness inc upward from 2 mm to 6 cm.	
				S	Doth, contorted mod dk BR mdstn (insoluble residue).	
				S	Two cycles of A-type chevron hal sharply overlain by doth B-type bedded hal, grading upward to chaotic mudcrk, instl anh and dk organics concentrated on bedding surfaces (given banded appearance) are predominant impurities, A-type hal, mud and anhydritic mud common in B-type.	
2420						
				S	Hal replacing grassmats, pseudomorphs small, ave less than 1 mm, skeletal hal frame zoned with anh top 0.5'.	
2430				S	Typical cse clear cavity fill hal, minor disseminated anh.	
				S	Hal replacing gyp pseudomorphs in finely disseminated mix of hal and anh grading upward to felty-like anh with hal cement.	
				S	Mod to mod-mosaic anh.	
				S	Anh cemented dolo gnstn - fossil hash.	
2440				S	Burrowed, wispy lam, hal cemented dolo/mdstn.	
				S	Bedded, mod anh grading upward to mod-mosaic anh with instl dolo throughout, nodn inc upward in size to 9 cm.	
2450						
				S	Interlam, doth mdstn, anh and Bk claystn.	
				S	Extremely dk Bk banded hal.	
2460						

logged by ST date 8/83

date

checked SH date 8/83

transcribed by CAC date 5/85

updated PG date 7/85

updated date

WELL #1 GRABBE COUNTY SWISHER DATE 8/83

INTERVAL 2460 - 2580 LOWER SAN ANDRES - UNIT 5 - UNIT 4 LOGGED BY S. THOMAS

FEET BELOW KB	LITHOLOGY (%)	Structures	COMMENTS	CONTACTS	LITHOLOGIC DESCRIPTION	LOGGER DATE
2460					Chevron hal in varying degrees of disturbance and recrizlization.	
2470				S	Mot R, Gy, Orng and Bl contorted anh with hal stringers, anh structures resemble carbonate fabric.	
				S	Med anh with instl Bk clay and dolo grading upward to mot Gy and R cont anh with disseminated hal.	
2480				S	Anh with large instl voids filled with hal.	
				S	Hal replacing grassmats after gyp, pseudomorphs 1 mm to (17 cm!), grades to med/med-mosaic anh (mats to 6 cm), grading back to grassmat texture, replaced with hal.	
2490						
				S	Finely lam anh and Bk clayste/mdstn, becoming anhydritic upward.	
				S	Chevron hal, no vert oriented xls above mdstn intbds.	
2500				S	Alternating R mdstn and disp hal beds topped by 0.3' D-type hal.	
					Hal replacing grassmats after gyp, grades upward from large (5 cm) to small (3 mm) pseudomorphs to unusual contorted anh/hal mixture.	
2510				S	E/D-type hal with large RR mdstn instl bodies, xls anhed to cubic to 2 cm, ave less than 1 cm, capped by R-type hal, xls anhed, greater than 4 cm.	
				S	Typical D-type hal, inc pitted and dstb upward, grading to E/D hal, dk anh gives hal dk color, minor R mdstn introduced from above through pipes.	
2520				S	Gradational sequence of hal types, instl anh and mdstn in roughly equal proportions throughout except top 0.4', capped by frac mdstn intbd, entire unit appears highly dstb, coa xls at base.	
				S	Typical E-type hal, xls anhed to 1 cm.	
2530				S	Slightly banded bedded hal with zones of chevron growth (A), recrizlized zones consist of polygonal hal xls 3-5 mm in size, instl mud and anh highly disseminated and outlines xl growth.	
2540				S	Generally typical chaotic mudcrack with zones and pockets of primary bedding, coarsest xls below major intbd, xls up to 3 cm, instl mud is highly disseminated and occurs as instl bodies and stringers.	
				S	Faulted anh with instl hal bodies and zones.	
				S	Gy anh with hal pseudomorphs after gyp.	
2550				S	Coa D-type hal with R-type top 5 cm, instl mud less than 1%, xls anhed 1-1.5 cm.	
				S	A and B-type hal with high % of finely disseminated material, chaotic zones associated with mdstn intbds.	
				S	Predominantly E-type hal with zones and pockets containing primary bedding features, xls anhed, range from 2-10 mm, finest xls top 1', capped by rpl lam intbd.	
2560				S	Classic A-type hal cut by thin organic partings, becoming inc pitted and dstb upward, beds range from 1-5 cm.	
				S	Bedded hal cut by numerous ropey-like anh partings with minor clastic component, hal is dk Gy-Bk due to impurities.	
2570				S	Bedded B-type hal with high % of finely disseminated instl RR mdstn, capped by RR dstb, intraclastic mdstn/siltstn intbd.	
				S	Highly recrizlized zone with some primary bedding features in upper 1', hal coarsest in B-type interval but ave 1x1 cm and polygonal in shape, smallest xls in upper 1', ave 5x5 mm.	
2580				S		

LOWER SAN ANDRES - UNIT 5

LOWER SAN ANDRES - UNIT 4

logged by S.T. date 8/83

date

checked SH date 8/85

transcribed by CAC date 5/85

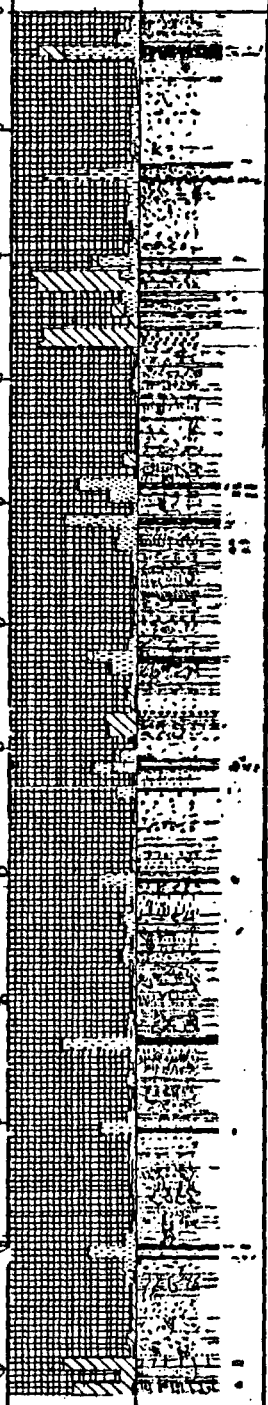
updated PG date 7/85

updated date

WELL #1 GRABBE COUNTY SWISHER DATE 8/83

INTERVAL 2580 - 2692 LOWER SAN ANDRES-UNIT 4 LOGGED BY S. THOMAS

LOWER SAN ANDRES- UNIT 4

FEET BELOW KB	LITHOLOGY (%)	Structures	COMMENTS	CONTACTS	LITHOLOGIC DESCRIPTION	LOGGER DATE
2580				S	Slightly banded A-type hal, becoming inc pitted and dath upward, capped by an interval of typical D-type hal associated with the mdstn intbd, mud is reduced above intbd.	
					Two successive hal units grading from chaotic mudcalt to partially rexlized A-type hal, xln anhed-subhed, ave 1x1 cm, each unit capped by dath mdstn/siltstn intbd of which the upper ½ is reduced.	
2590						
2600				S	Gy anh, bottom 8 cm is massive, becomes bedded hal, pseudomorphed and felty upward.	
				S	Intbd, rexlized hal capped by A-type zone, mud content sharply inc upward above 2605'.	
				S	Gy anh with bedded hal pseudomorphs after gyp, uppermost 17 cm is felted anh in hal.	
				S	Rexlized B and E-type hal, grades to bedded hal with vert oriented xln and scattered chevron zones, bedded hal varies from mod to heavily rexlized.	
2610						
				S	B-type hal in varying degrees of disturbance, cut by mdstn intbd, inc in anh upward.	
2620				S	A and B-type hal with well developed banding, bands grade from Bk/Wht to Orng/B, hal becomes inc dath upward, capped by frac siltstn/mdstn intbd.	
2630				S	Bedded hal becoming inc dath upward, grading to E-type hal.	
				S	Chevron hal cut by mud-filled pipes, inc muddy and dath upward.	
				S	Typical E-type hal, becoming free of mud and cut by anh beds 2634.7-2635.7'.	
				S	Unusual felty drape-like anh intbs in clear cnc hal.	
2640				S	Rexlized F-type hal grades to E-type with inc in mud upward (xln anhed, greater than 1 cm).	
				S	Orng-B banded hal with vert oriented xln capped by series of mdstn intbds.	
				S	Rexlized (anhed/polygonal, about 1 cm in size) hal grades upward to chevron hal, sharply capped by a mdstn intbd.	
					Well-intbd A and B-type hal, anh intbds often contain Bk organic debris staining the hal.	
2650				S	Alternating units of B and D-type hal, boundaries associated with mdstn intbds, mud content inc upward.	
				S	Dath B-type hal, common pits and instl anh stringers.	
2660				S	Minor to mod pitted B and A-type hal, rexlized zones of F, B, and E-type hal associated with mdstn intbds.	
2670				S	Generally a highly dath B-type hal capped by a 9 cm mdstn drape, best original hal bedding texture at 2673-2674.5', B-type hal associated with mdstn intbds.	
2680				S	Chaotic mudcalt cut by thick mdstn intbds, mdstn instl bodies small (up to 2x2 cm) but numerous.	
				S	Banded hal with anh intbds becoming inc dath upward.	
				S	B-type hal showing varying degrees of rexlization.	
2690						

logged by S date 8/83

date

checked SH date 8/83

transcribed by CAC date 5/85

updated FG date 7/85

updated date

WELL # 1 GRABBE COUNTY SWISHER DATE NOV / 84

INTERVAL 2692 - 2800 LOWER SAN ANDRES - UNIT 4 - UNIT 3 LOGGED BY Lureau, Elliott

FEET BELOW KB	LITHOLOGY (%)	Structures	COMMENTS	CONTACTS	LITHOLOGIC DESCRIPTION	LOGGER DATE
2690						
			HAL is conc in horizontal disc beds - intraclasts in dolo lam. - selenite xyls are truncated by laminated terr. MDSTN & ANH	S	Bk Bl-Gy interlam anh, terrig mdstn, hal + dolo, hal intbds are thin and disc, dolo intbds are intraclastic.	
				S	Bl-Gy anh pseudomorphs after large vert oriented selenite xln.	
2700			strong lacy texture in ANH HAL blebs in thin zones - some show remnant strs. of sm selenite xyls - enterolithic anh. in terr MDSTN matrix	S	Bl-Gy para + wavy lam anh, lower 2' is gradational with interlam dolo mdstn + dk terrig mdstn. Interval from 2700.5-2702.0' is cont to enterolithic in a terrig mdstn matrix, upper 4' is composed of alternating zones of lam, nod to lacy texture + concentrations of small hal blebs in anh, zones of hal blebs are texturally similar to the pseudomorphs after gyp above, zones of lacy texture are wet lt B + Gy, origin is unknown.	
			silt/sh layer - salt sol. deformation	S		
			pseudobrecciated texture produced by partial ANH replacement of dol	S	Tlw-B dolo mdstn, framework of tiny, irr shaped coated grains + intraclasts, pinpoint anh replacement + anh infilling allochem molds, 2706.0-.3' appears bedded or cross bedded, otherwise unit is structureless, local zones of pseudobrecciated texture produced by partial replacement of dolo by anh.	
2710			- foss. mudcrack ass w/ small intraclasts - hal filled fr w/ANH & anh nodules - lg intraclast (5cm) subrounded - foss. mudcrack? - chert replacement of ANH nodule - lg. vug infilled w/coarse X'ln HAL (rimmed by chert & ANH/6cm)	S	Tlw-B anhydritic dolo mdstn, wispy lam to microstylolitic, possible burrows or soft sed dfmtn in lower 3-4', anh is more abdnt in upper 4' as scattered small nodu and bed beds, possible mudcracks at 2714.3', width inc toward top and is infilled with dolo + nodu of anh (0.3' long), another possible mudcrack at 2712.0', large subrounded intraclast (0.3') + disc beds at 2713.3', narrow hal-filled fracs are rimmed with anh, some anh nodu are partially replaced by chert, chert sometimes appears lam, one 0.7' bed of nod anh at 2711.6'.	
2720			- lg cephalopod - 3 8" bedded HAL is misplaced	S	Tlw-B foss limestn gnstn, allochems include coated grains, girvanella-like tubes + mollusca (including cephalopods), mollusca are well-preserved, coated grains are moldic, structureless - caused by burrowing, upper contact is sharp with 2 cm zone of fissile mdstn.	
				S	Tlw-B-Gy limestn wkstn, the only identifiable allochems are girvanella tubes which appear to float in the mud matrix, unit is characterized by a strange diagenetic fabric similar to wkstns below with dk Gy calcite nodu, surrounding poorly cemented zones are wispy lam to microstylolitic and appear to be displaced around nodu during growth or compaction.	
2730			- possible burrows? or irregular zones of HAL replacement, rimmed w/ calcite	S	Tlw-B foss limestn gnstn/pkstn, v diverse fossil assemblage includes girvanella-like tubes, oolites + coated grains, crinoids, bryozoans, mollusca (pelecypods + gastropods) and brachiopods; grains are poorly sorted with local concentrations of large whole fossils, tubes are hollow with porcelainous outer walls, coated grains are preserved or moldic, mollusca are filled with coa xln spar, bryozoans, crinoids + brachiopods, structures are v well preserved, upper half of unit is better preserved than lower half, structureless bedding has beds largely destroyed by bioturbation, amount of mud inc in upper 2' + is gradational to unit above.	
2740						
			- HAL filled vertical fr.	S	Gn-Tlw-B sparsely foss limestn wkstn, fossils are small and difficult to identify, unit is wispy lam with an abundance of organics, strange diagenetic fabric of dk Gy calcite nodu displace and replace lam, hal-filled vert fracs at 2747.0'.	
2750				S	Tlw-B limestn mollusc gnstn, fossils include large pelecypods, gastropods, crinoids + girvanella-like tubes, mollusca are infilled with calcite spar, girvanella tubes are preserved or moldic, unit is structureless with possible large vert burrows which are differentially cemented.	
			- allochems are being replaced by ANH, some grains show only partial replacement	S	Gn-Tlw-B limestn brachiopod wkstn, fossils are well preserved with some partial or whole replacement of grains by anh, fossils include brachiopods, bryozoa and possible girvanella-like tubes, unit is wispy lam with a strong diagenetic fabric of dk Gy calcite nodu which appear to displace some lam, 2756.0-2757.0' contains pods of packed grains which may represent burrows.	
2760			- small rhombs or laths of ANH in muddier zone - lg. high spired gastropod (3cm)	S	Gn-Tlw-B limestn fossiliferous packstn/gnstn; v diverse fossil assemblage includes small girvanella-like tubes, coated grains + oncolites, mollusca (pelecypods + high-spired gastropods), bryozoa, brachiopods + forams; lower 1' is bioturbated with wispy lam and is gradational to unit below, 2768.0-2769.5' is a gnstn with only small pods of mdstn, most allochems are moldic or infilled with hal, preservation inc upward, girvanella-like tubes are pervasive in the upper 5' and are found as single tubes, clumps of tubes and as filamentous coatings around allochems, coatings are thickest at 2766.5', unit is gradational to the unit above.	
2770			- possible bryozoan?, thick algal coating, oncolites - burrows, replaced by HAL & rimmed w/calcite - possible phylloid algae	S	Tlw-B-Gn limestn mdstn, 2770-2781' is lam to rpl lam with patchy zones of calcite cementation, flattened calcite nodu have hairline fracs radiating inward, 2770-2777' is wispy lam with small bx burrows cross cutting lam, allochems are sparsely present and unidentifiable, upper zone is almost completely calcite cemented with occasional large elncite nodu, 1' of wkstn at 2776-2776.1' contains small bivalve molds which are infilled with hal.	
			- vert fr filled w/clean HAL - crystallotopic ANH (<1mm) - ass pyrite, 1 lg nodule (3mm) filled w/lg ANH xyls - crystalloptic ANH (<1mm) - hairline fr radiating inward to center of calcite nodu - euhedral anh laths (2mm)	S	Tlw-B dolo mdstn, wispy lam with small bx burrows cross cutting lam, lower 0.4' contains small intraclasts of dk mdstn from unit below and other tiny allochems left as molds and is bioturbated, local concentrations of organics are fissile.	
2780			- fissil dark shale (9cm)	S	Bl-Gn-Bk terr mdstn + anh, upper 3.5' is composed of fairly well defined thin beds of dk mdstn + anh, mud-rich zones are fissile, a high organic content is inferred from the dk color of the mdstn, lower section is a composite of dath intraclastic mdstn and disc + cont beds of anh + mdstn, beds are parallel to wavy + contorted, thickest anh intbd is 4 cm, three hal-filled cavities are rimmed with anh spherules at 2797.5', one cavity contains a lam mdstn intraclast.	
2790			- thick ANH interbed (4cm) about ANH clasts or nodules replaced to wavy lam silt - HAL filled cavity (3cm) rimmed by ANH spherules and contains lam mdstn clasts - abundant (1cm mdstn clasts (4-10 m)	S S	F-type hal, anhed xln with instl anh.	
2800						

LOWER SAN ANDRES - UNIT 4

logged by BL, LE date 11/84

date

checked SH date 11/84

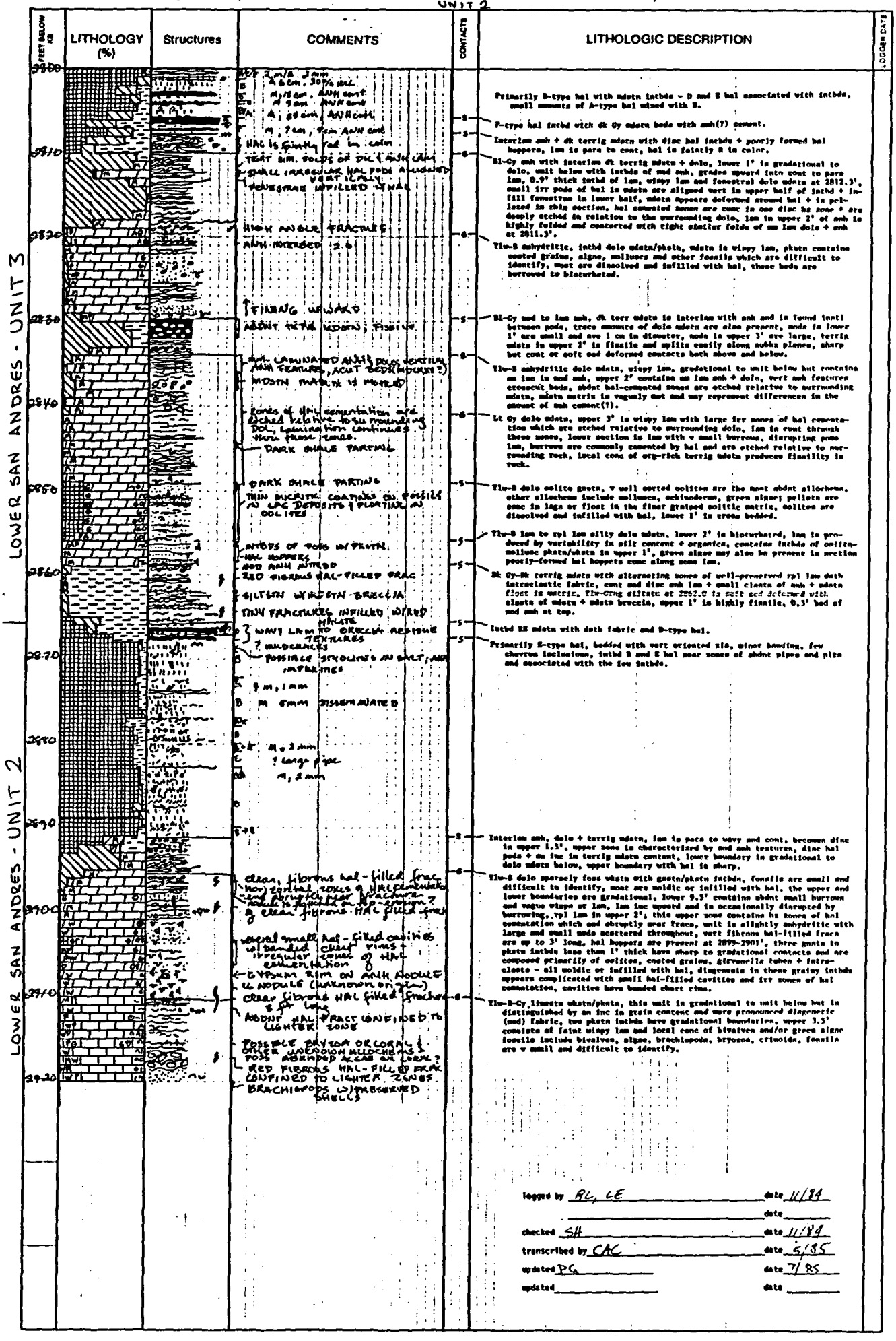
transcribed by CAC date 5/85

updated PG date 7/85

updated date

WELL #1 GRABBE COUNTY SWISHER DATE Nov. 1984

INTERVAL 2800 - 2920 LOWER SAN ANDRES - UNIT 3 LOGGED BY Luneau, Elliott



Primarily B-type hal with mdstn intbds - D and E hal associated with intbds, small amounts of A-type hal mixed with B.

F-type hal intbd with dk Gy mdstn beds with anh(?) cement.

Interlam anh + dk terrig mdstn with disc hal intbds + poorly formed hal hoppers, lam is pars to cont, hal is faintly R in color.

Bl-Gy anh with interlam dk terrig mdstn + dolo, lower 1' is gradational to dolo, unit below with intbds of nod anh, grades upward into cont to pars lam, 0.9' thick intbd of lam, wispy lam and fenestral dolo mdstn at 2812.3', small irr pods of hal in mdstn are aligned vert in upper half of intbd + infill fenestrae in lower half, mdstn appears deformed around hal + is pelleted in this section, hal cemented zones are conc in one disc hz zone + are deeply etched in relation to the surrounding dolo, lam in upper 2' of anh is highly folded and contorted with tight similar folds of mm lam dolo + anh at 2811.3'.

Tlw-B anhydritic, intbd dolo mdstn/pkstn, mdstn is wispy lam, pkstn contains coated grains, algae, molluscs and other fossils which are difficult to identify, most are dissolved and infilled with hal, these beds are burrowed to bioturbated.

Bl-Gy nod to lam anh, dk terr mdstn in interlam with anh and in found intl between pods, trace amounts of dolo mdstn are also present, mdst in lower 1' are small and ave 1 cm in diameter, mdst in upper 3' are large, terrig mdstn in upper 2' is fissile and splits easily along subhz planes, sharp but cont or soft sed deformed contacts both above and below.

Tlw-B anhydritic dolo mdstn, wispy lam, gradational to unit below but contains an inc in nod anh, upper 2' contains mm lam anh + dolo, vert mdst features crosscut beds, abdnt hal-cemented zones are etched relative to surrounding mdstn, mdstn matrix is vaguely dst and may represent differences in the amount of anh cement(?).

Lt Gy dolo mdstn, upper 3' is wispy lam with large irr zones of hal cementation which are etched relative to surrounding dolo, lam is cont through these zones, lower section is lam with v small burrows, disrupting some lam, burrows are commonly cemented by hal and are etched relative to surrounding rock, local conc of org-rich terrig mdstn produces fissility in rock.

Tlw-B dolo oolite gnstn, v well sorted oolites are the most abdnt allochem, other allochems include molluscs, echinoderm, green algae; pellets are conc in lags or float in the finer grained oolitic matrix, oolites are dissolved and infilled with hal, lower 1' is cross bedded.

Tlw-B lam to rpl lam silty dolo mdstn, lower 2' is bioturbated, lam is produced by variability in silt content + organics, contains intbds of oolite-mollusc pkstn/wkstn in upper 1', green algae may also be present in section poorly-formed hal hoppers conc along some lam.

Dk Gy-Bk terrig mdstn with alternating zones of well-preserved rpl lam dsth intraclastic fabric, cont and disc anh lam + small clasts of anh + mdstn float in matrix, Tlw-Org siltstn at 2862.0 is soft sed deformed with clasts of mdstn + mdstn breccia, upper 1' is highly fissile, 0.3' bed of nod anh at top.

Intbd BB mdstn with dsth fabric and D-type hal.

Primarily E-type hal, bedded with vert oriented xln, minor bending, few chevron inclusions, intbd D and E hal near zones of abdnt pipes and pits and associated with the few intbds.

Interlam anh, dolo + terrig mdstn, lam is pars to wavy and cont, becomes disc in upper 1.5', upper zone is characterized by nod anh textures, disc hal pods + an inc in terrig mdstn content, lower boundary is gradational to dolo mdstn below, upper boundary with hal is sharp.

Tlw-B dolo sparsely foss mdstn with gnstn/pkstn intbds, fossils are small and difficult to identify, most are moldic or infilled with hal, the upper and lower boundaries are gradational, lower 9.5' contains abdnt small burrows and vague wisps or lam, lam inc upward and is occasionally disrupted by burrowing, rpl lam in upper 2', this upper zone contains hz zones of hal cementation which and abruptly near fracs, unit is slightly anhydritic with large and small nods scattered throughout, vert fibrous hal-filled fracs are up to 3' long, hal hoppers are present at 2899-2901', three gnstn to pkstn intbds less than 1' thick have sharp to gradational contacts and are composed primarily of oolites, coated grains, girvanella tubes + intraclasts - all moldic or infilled with hal, diagenesis in these grainy intbds appears complicated with small hal-filled cavities and irr zones of hal cementation, cavities have banded chert rims.

Tlw-B-Gy limstn wkstn/pkstn, this unit is gradational to unit below but is distinguished by an inc in grain content and more pronounced diagenetic (nod) fabric, two pkstn intbds have gradational boundaries, upper 3.5' consists of faint wispy lam and local conc of bivalves and/or green algae fossils include bivalves, algae, brachiopods, bryozoa, crinoids, fossils are v small and difficult to identify.

logged by RL, LE date 11/84

date

checked SH date 11/84

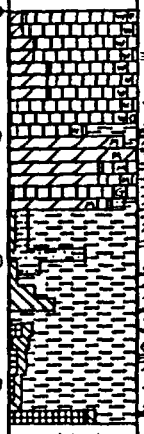
transcribed by CAC date 5/85

updated PG date 7/85

updated date

WELL #1 GRABBE COUNTY SWISHER DATE 11/84

INTERVAL 2920-3040 LOWER SAN ANDRES - UNIT 2, GLORIETA LOGGED BY LE

FEET BELOW KB	LITHOLOGY (%)	Structures	COMMENTS	CONTACTS	LITHOLOGIC DESCRIPTION	LOGGER DATE
2920			diagonal open fracture large, gray calcite cemented nodule	8	Tlw-B limestn mdstn, faintly lam to wispy lam, small burrows disrupt lam, fossils are small and difficult to identify, unit has not diagenetic fabric caused by differential cementation, this cementation appears to be controlled by burrowing in the same location.	
2930			Red fibrous hal filled fracture lots of fine terrigenous matrix fine fracture - hal cement selective hal cementation on replacement abrupt color change upon, w/ underlying change abrupt irregular contact with clasts of terrigenous matrix	9 5 8	Tlw-B wispy lam dolo mdstn, + small burrows disrupt lam, tiny hairline fracture cuts unit. Dk Gy-Gn to Gy rpl lam carbonate mdstn/gnstn, upper 1' is composed of oolites and pelecypods, zones of selective hal cement or replacement at 2934-2934.5'.	
2940			Red fibrous hal filled fracture		Dk Gy-RB terrig mdstn with dath intraclastic fabric, lower contact is gradational to unit below but is characterized by color change and der in salt upward, anh nods, blebs + disc and cont contorted anh + mdstn, intraclasts in a mdstn matrix, lam preserved at 2938' and 2940' but appears soft sed deformed, red fibrous hal-filled frac at 2938', poorly cemented and fissile, splits easily along anhs partings.	
			very hard, massive, unbroken	8	RB terrig mdstn with dath intraclastic fabric, small anh nods, blebs and cont to disc contorted anh interbeds, large poorly-formed hal hoppers are present, R fibrous hal fracs sometimes appear to radiate outward from these hoppers, unit is poorly cemented and splits easily along anhs partings, trace amounts of calcite cone along edges of anh blebs adjacent to hal-filled cavities.	
2950			Red fibrous hal filled fractures - cont are vertically oriented Relaxation seams	5	Uppermost bedded salt of Glorieta.	
2960						
2970						
2980						
2990						
3000						
3010						
3020						
3030						
3040						

LOWER SAN ANDRES - UNIT 2

GLORIETA

GLORIETA
TO BE RELOGGED
BEFORE
DRAFTING
2953-3270

logged by LE date 11/84

date

checked SH date 11/84

transcribed by CAC date 5/85

updated RG date 7/85

updated date

WELL #1 GEORGE COUNTY SWISHER DATE

INTERVAL 3040-3160 GLORIETA LOGGED BY

FEET BELOW KB	LITHOLOGY (%)	Structures	COMMENTS	CONTACTS	LITHOLOGIC DESCRIPTION	LOGGER DATE
3040						
3050						
3060						
3070						
3080						
3090						
3100						
3110						
3120						
3130						
3140						
3150						
3160						

GLORIETA

WELL #1 GRABBE COUNTY SWISHER DATE

INTERVAL 3160-3270 GLORIETA LOGGED BY

FEET BELOW KB	LITHOLOGY (%)	Structures	COMMENTS	CONTACTS	LITHOLOGIC DESCRIPTION	LOGGER DATE
3160						
3170						
3180						
3190						
3200						
3210						
3220						
3230						
3240						
3250						
3260						
3270						

GLORIETA

WELL GRABBE COUNTY SWISHER DATE 2/85

INTERVAL 3270 - 3380 GLORIETA, UPPER CLEAR FORK LOGGED BY PG

FEET BELOW KB	LITHOLOGY (%)	Structures	COMMENTS	CONTACTS	LITHOLOGIC DESCRIPTION	LOGGER DATE
3270			- coarse Xline HAL bed, 13 cm thick - coarse Xline HAL bed 5 cm thick			
					B-Gy muddy dolo with disp hal, anh-filled molds, rpl lam mdstn, dolo dolo interlam with anh, anh with hal nods - replacing gyp(?), anh in lam to nod, inthds with hal, becomes slightly muddy and stained R near top.	
3280			- interlam ANH & DOL vugs and fractures with dolomite and anh filled skeletal grains amount of carbonate mixed in gray mudstone not clear fossil dark mudstone			
				S	Jumbled core of RB and Gy dsth mdstn, rpl lam dolo with hal replacing dolo, interlam dolo and anh, replaced hal.	
3290						
3300						
			dolomite abundant rimming mud			
3310			- thin enterolithic ANH bed		RB siltstn - rpl, plane lam with mdstn and no stringers and inthds, anh nods and enterolithic lam, some disp hal; dsth and brecciated fabric near top with inc hal, top of unit is chaotic mudsilt with mdstn inthds and disp hal, mdstn is massive to dsth, brecciated fabric, RB mdstn grades to rusidue-like Gy-Gn dsth mdstn with wispy anh beds and flasile Bk clay-rich mdstn, lleneegang banded.	
			- thin enterolithic ANH bed - thin enterolithic ANH bed			
3320						
			core appears to be jumbled			
3330				S	Chaotic mudsilt with RB mdstn inthds, inthds have cubic hal, some anh nods, dsth bedding, fluid escape; hal is chaotic or replaced with thin zones of bedded hal near bottom of section.	
3340						
3350						
3360						
3370						
3380						

GLORIETA

UPPER CLEAR FORK

logged by PG date 2/85

date

checked SH date 2/85

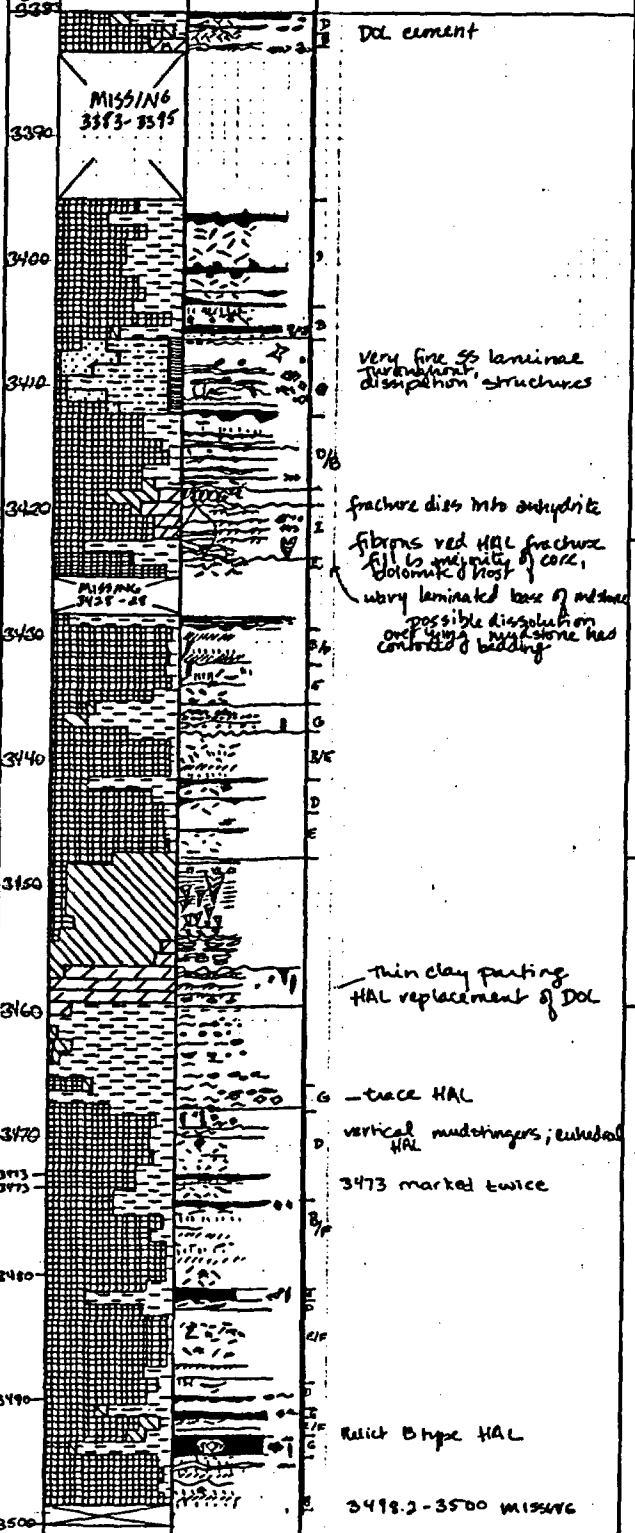
transcribed by CAC date 5/85

updated PG date 7/85

updated date

WELL # 1 GRABBE COUNTY SWISHER DATE 2/85

INTERVAL 3380 - 3500 UPPER CLEAR FORK LOGGED BY PG



CONTACTS	LITHOLOGIC DESCRIPTION
	Interlam dolo mdstn + hal with disp hal in dol, overlain by bedded hal and chaotic mudcalt.
?	V large R fibrous hal-filled frac running length of dolo and into anh at 3418.5', dolo is B-Gy with rpl lam and hal replacement of dolo.
	Interlam anh, dolo + hal make lam, mound shaped unit with poorly preserved gyp pseudomorphs.
	Chaotic mudcalt with relict bedded textures, underlies RB siltstn with fine sand lam and clastn breccia, lam is dstb with secovrs, fluid escape and syndep microfaulting.
	Siltstn is sharply overlain.
?	Chaotic mudcalt with thin sections of bedded hal, RB mdstn inthds with disp hal, anh nods, beds, RB at top of unit, becomes dolo and has large fracs filled with R fibrous hal.
?	Lt B rpl dolo mdstn, hal replacing dolo along bedding planes, clay partings every few cms.
	Anh mud with dolo instl at 3456.5', losing dolo upward, anh becomes lam with dstb texture, hal replacement.
	Hal defines large swallowtail gyp pseudomorphs.
	Top of anh is lam to contact with overlying hal.
?	Dominantly chaotic mudcalt with realized hal, RB mdstn, mdstn inthds with dstb bedding, anh mud, disp hal, some units of B-type hal - dark bands are mud-rich - vert aligned embed xls.
	Occasional pits and pipes.
	RB mdstn at top with relict hal in rounded, elongate masses, anh nods, dstb and brecciated bedding, fissile - swelling clays.
	Grade from RB to dk Gy lam, fissile at top.

logged by PG date 2/85

date

checked SH date 2/85

transcribed by CA+ date 5/85

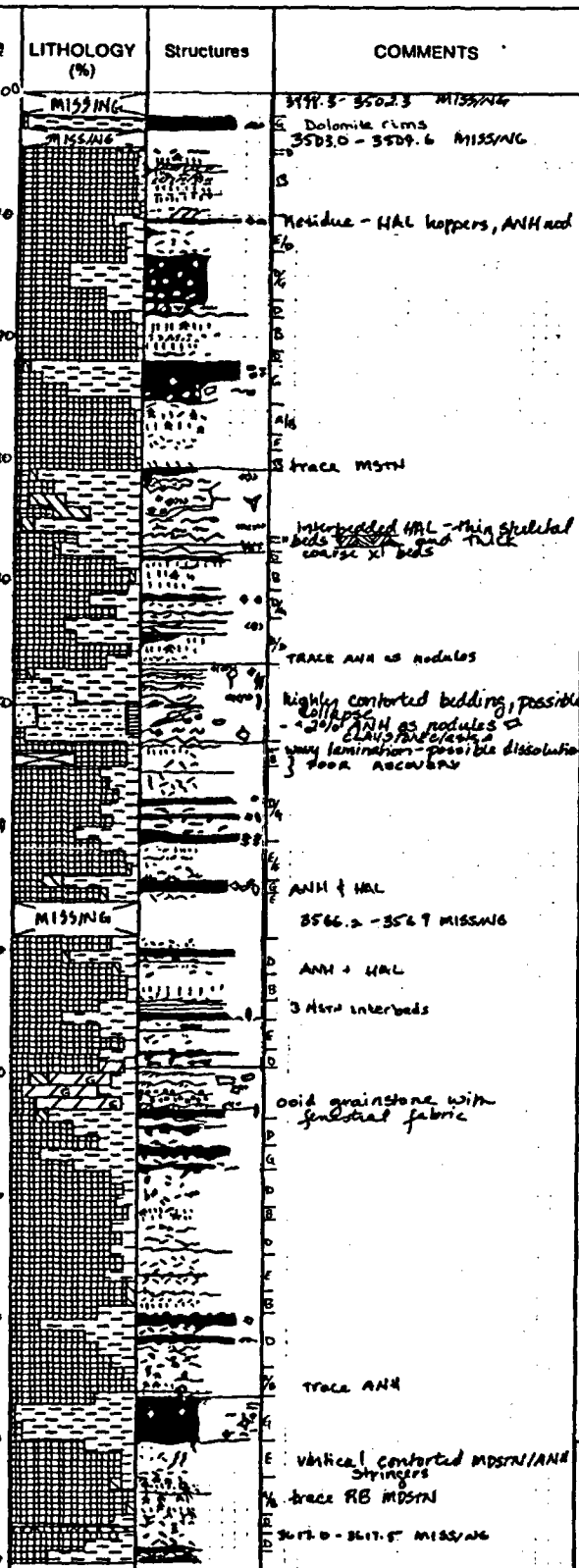
updated PG date 7/85

updated date

WELL #1 GRABBE COUNTY SWISHER DATE 2/85

INTERVAL 3500 - 3620 UPPER CLEAR FORK LOGGED BY PG

UPPER CLEAR FORK



CONTACTS

LITHOLOGIC DESCRIPTION

Interlam RB mdstn, hal, anh, thin wispy lam with zones of brecciated mdstn.

Hal is dominantly bedded with some textized and chaotic textures near mdstn beds.

Residue-like mdstn at 3510.5' is B-Gy, not with disp hal and wispy to nod clastic(?) anh, immediately overlain by v contrasty alins hal, then by bedded B-type hal.

RB mdstn with disp skeletal hal at 3502-3503'.

S — RB siltstn with claystn clasts, v fine sand lam and pockets, lam is v dist with flame structures and fluid escape, top is Gy mdstn with slightly dist lam, dath by disp hal growth, hal-filled fracs.

Hal has frequent mdstn intbds, some chaotic mudcalt near intbds, short units of bedded hal.

S — Lt B dolo mdstn + gnstn, rplo, allochems are oolites, 3581.9 to 3582.4' is oold gnstn with hal-filled lam, fenestral fabric, above 3581.9' is interlam dolo mdstn + gnstn with skeletal hal hoppers and anh intbds, dolo is sharply overlain by chaotic mudcalt, hal is dominantly textized and chaotic within zone of vert aligned xl - bedded B-type hal.

Mdstns are RB with anh nod + hal hoppers, anh nod in hal at 3564' have discrn stringers at contact with hal.

S — Thick brecciated not wispy lam RB mdstn with disp hal to 3606.5', overlain by bedded hal, then chaotic mudcalt.

Mdstn intbds typically overlain by 2-3' of B-type hal, then 3-8' of chaotic mudcalt.

S — Anh sharply overlies mdstn, lam with poorly preserved grainst texture and calcite xls in hal - gives fine lacy texture, RB mdstn with large hal cubes overlies anh - intbd chaotic mudcalt and mdstns.

Hal is bedded with minor anh above 3616', textized hal with mdstn + anh from 3614' to top.

logged by PG date 2/85

date

checked SH date 2/85

transcribed by CAC date 5/85

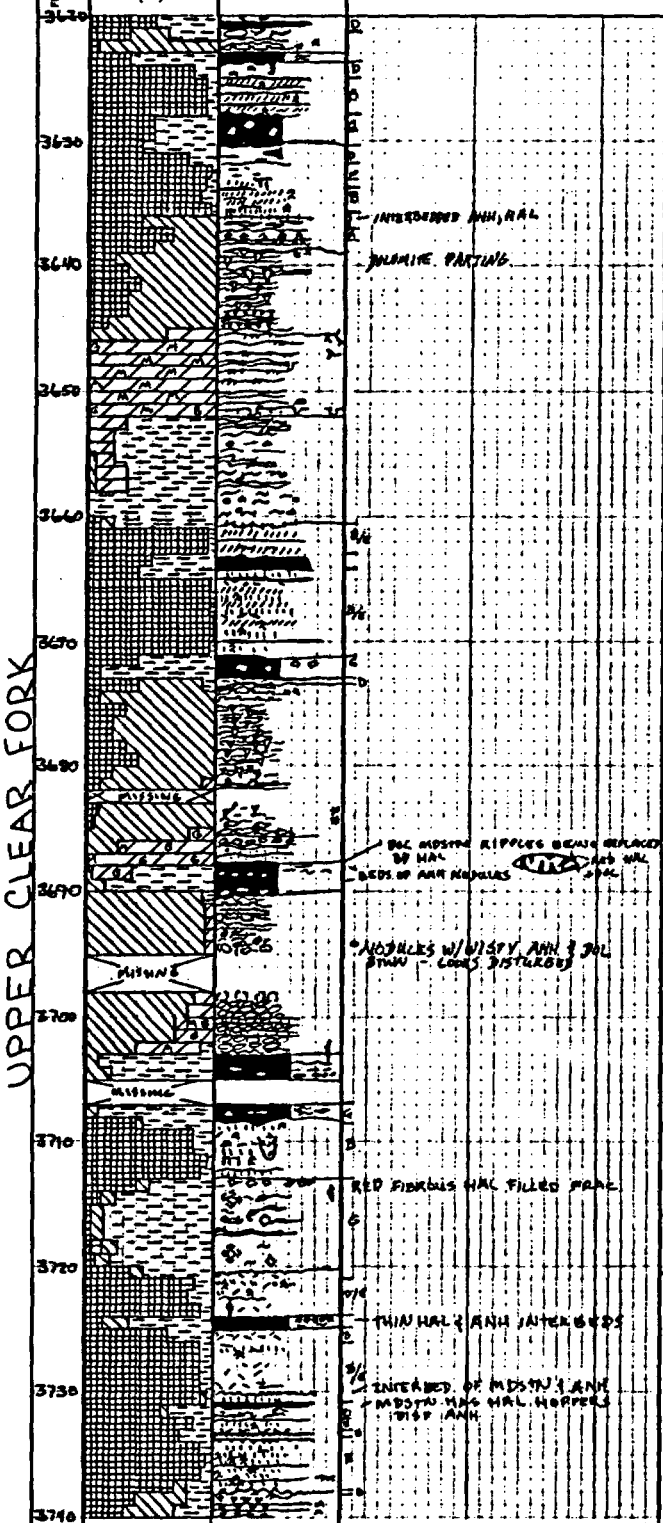
updated PG date 7/85

updated date

LOGGER DATE

WELL #1 GRABBE COUNTY SWISHER DATE 1/85

INTERVAL 3620-3740 UPPER CLEAR FORK LOGGED BY PG



LITHOLOGIC DESCRIPTION

Exceptionally long, well-developed cycle for UCF, base is anhydritic Gy mdstn with wispy-dist bedding, Gy mdstn contacts sharply with RB mdstn, massive to brecciated, dsth lam, dolo above 3658', isolated anh nod, color is olive-Gy above 3656' with Gy and RB mst, grade to clayey dolo.

Dolo is rpl lam with burrows, dsth bedding, lt B gmstn and mdstn with hal-filled molds after grains, Gy mst in B dolo, skeletal hal in top 1' of dolo, sharp contact with anh.

Anh is lam at base with well-developed gyp pseudomorphs preserved in hal, above, single xls as large as 9x2 cm, lam runs through some xls, top 2' is dsth with most anh, hal interlam.

Anh intbds with hal at 3637'-3636'.

Hal is RB banded with Wht vert elongated xls, high mud content for B-type, some chevrons.

Mdstn bed at 3631', has large hal hoppers, disp hal capped by banded hal at series of thin mdstn beds.

RB mdstn bed at 3624.6' sharply overlies hal.

RB mdstn with disp hal, massive, sharply overlain by banded hal with muddy intervals at 3668' and 3665'.

RB mdstn intbd at 3664.6' grades to dk Gy dist anh (minor), minor disp hal.

Banded hal, vert oriented xls, thin mdstn . or anh partings, grades to anh at top.

Gy mdstn with anh nod, friable, grades to RB mdstn then back to dk Gy with anh nod, sharply overlain by rpl dolo gmstn with isolated dolo mdstn rpls, intbds with nod anh.

Nod anh becomes poorly bedded with dsth lam hal after gyp pseudomorphs - poorly preserved - little or no primary texture preserved.

Above 3682' - well-preserved lam anh with grassmat gyp texture, grades to lam anh with large gyp pseudomorphs cutting across lam, pseudomorphs preserved in hal.

Top 1' is lam anh with small gyp pseudomorphs.

Muddy and hal-rich at top.

Lt RB mdstn with wispy anh, breccia, lam clasts, interlam anh; Dk-Gy at top of mdstn.

Dolo overlies mdstn, gradational contact(?), dolo grades to mod anh with insetl dolo and dolo intbds, mode poorly defined above 3698.9'.

Dsth anh dolo between 3694-3693', lam anh with dolo defining lam to top of unit.

RB mdstn with Gy reduced areas, wispy, mot. bedding, rip up clasts, brecciated small anh nod, large skeletal hal hoppers, Gy-Bk lam mdstn at top with frac filled with hal, overlain by chaotic mudcalt, long section of B-type bedded hal with masses of mdstn pods, mosaic hal, thin mdstn intbds.

Lt RB mdstn with wispy lam breccia, skeletal hal overlying anh has well-preserved gyp pseudomorphs and grassmat texture.

Anh grades to hal with thin mdstn bed at 3738', hal is dominantly B-type bedded with aligned vert aligned xls with mdstn lam and insetl, mud-rich B-type zones within B.

B-type hal with relict B below mdstn at 3725', mdstn overlain by muddy bedded hal and chaotic mudcalt.

logged by PG date 1/85

date

checked PG date 1/85

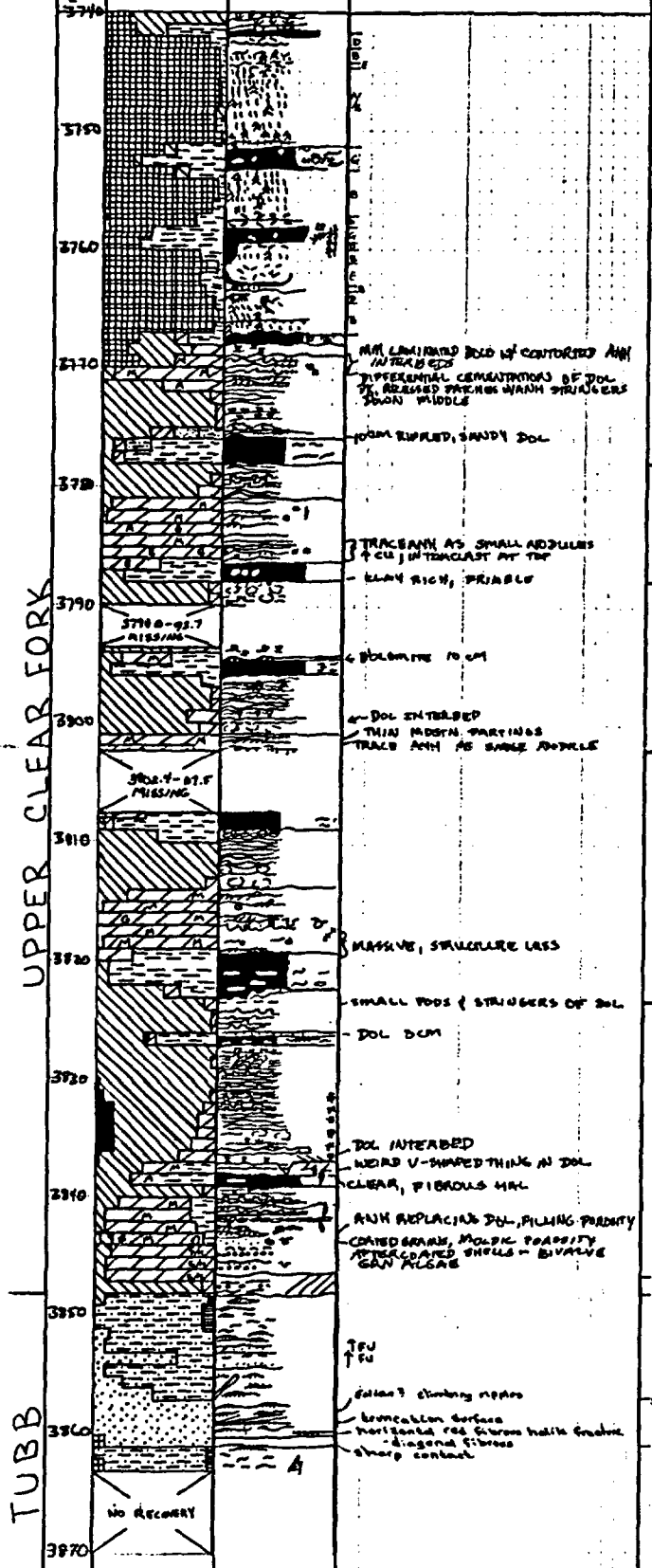
transcribed by CAC date 2/85

updated PG date 7/85

updated date

WELL #1 GRABER COUNTY SWISHER DATE 1/85

INTERVAL 3740' - 3870 UPPER CLEAR FORK, TUBB LOGGED BY PG



CONTACTS	LITHOLOGIC DESCRIPTION	LOGGER DATE
S	RB mdstn with anh nods and hal hoppers - dsth fabric - becomes massive toward top of mdstn with hal cubes, thin anh bed between mdstn and well-developed B-type hal, thin section of recrlized muddy hal at 3744.5', hal is muddy and chaotic below contact with overlying unit.	
S	Basal RB mdstn with wisps of dolo, dist anh, becomes olive Gy with oscillating current rpls in v fine ss, base of anh has well-preserved grassmat texture in siltstn grading to finely lam anh; sharp contact between anh and lt B rpl dolo, dolo has Bk-Gy blobs of differentially cemented areas - probably hal cement, anh forms irr wisps and blobs in center of these Bk, recessed areas; dolo intbds with anh, hal grading to poorly-defined anh lam; mdstn sits between more massive anh and first hal unit, hal is dominantly B-type with large pipes and mdstn intbds, dominantly vert aligned, anhed hal with mdstn + anh, RB mdstn + anh form fine beds in bedded hal.	
S	B-Gy clayey mdstn with anh nods, grades to dolo at 3786.5'; dolo is rpl with thin bioturbated zone at 3783.5', scattered small anh nods; dolo intbd with anh, some gyp pseudomorph preservation, becomes v finely lam at top sharp uneven contact at top.	
S	Rpl lt B dolo gnstn with 2 thin mdstn partings, anh has poorly-developed nods with dolo intbds instl, becomes lam, sharp irr contact with mdstn; Bk + RB dsth mdstn with patchy anh, thin dolo at 3794.6' grades to lam anh with gyp pseudomorphs in dolo; anh above 3790' has patchy dolo with and gyp pseudomorphs.	
S	Bk RB mdstn with wispy + nod anh, wispy dsth lam to structureless, becomes Gy, structureless above 3821'; dolo above 3819' is structureless mdstn with small anh nods, shell and coated grain gnstn above 3817.6' is a dsth bioturbated, becomes rpl lam with disp anh nods above 3817'. Sharp contact with bedded anh - poorly developed nods become finely lam, dk Gy anh with lt B dolo (?) defining lam, top of anh has v small nods (2-5 mm) with instl Bk mdstn, becomes muddier with dist wispy bedding and rare nods of wispy anh; top of mdstn is dolo.	
S	2 subcycles with basal residue or dolstn, bottomost section in dolo gnstn of coated grains and shells, burrowed(?), overlain by rpl and dsth dolo mdstn with anh replacing and disp dolo, some darker lam of differential cement, all dolo is muddy; anh is all interlam with dolo, showing some preservation of gyp pseudomorphs, grassmat and laths within dolo beds; residue-like mdstn at 3739-3838' and 3828-3827', Bk with Gy and some RB mdstn, dist bedding, wispy anh stringers, both mdstns become dolo upward; weird v-shaped structure follows frac at 3838.4' - in dolo with different cement, porous anh with dolo intbds from 3837-3830', pods of dolo sit within topmost part of bedded anh.	
S	laminated DOL.	
S	Gray laminated ANH.	
S	Mixed rippled and disturbed laminated siltstone and sandstone.	
S	RB ripple and cross-laminated med grained sandstone.	
S	see next sheet.	

logged by PG, BL date 12/84, 1/85

date

checked GH date 1/85

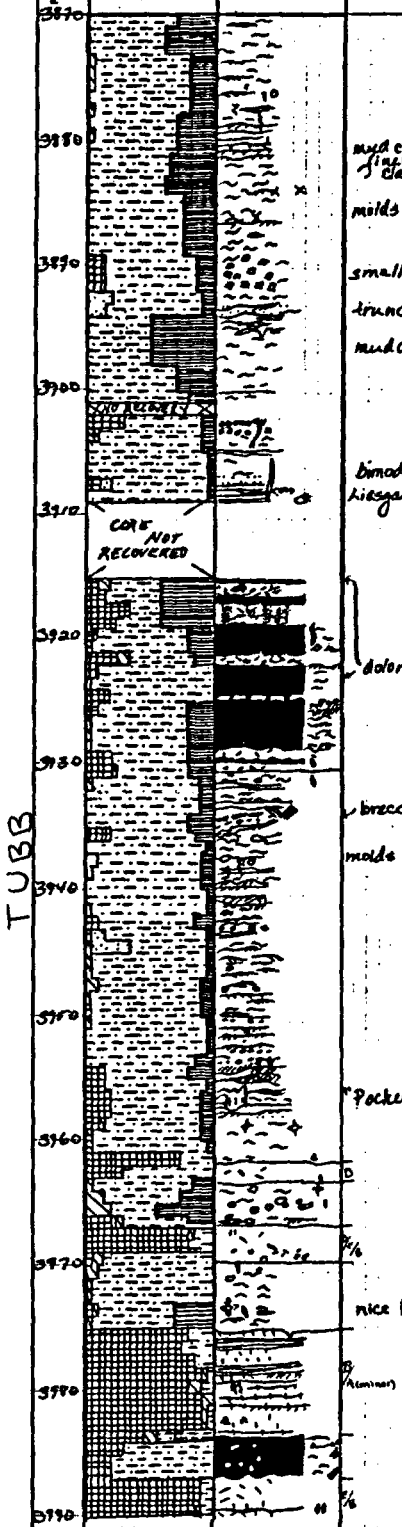
transcribed by CAC date 2/85

updated PG date 7/85

updated date

WELL # GRABBE COUNTY SWISHER DATE 12/84

INTERVAL 3870 - 3990 TUBB LOGGED BY B. LUNEAU



CONTACTS	LITHOLOGIC DESCRIPTION	LOGGER DATE
	Mixed dsth and rpl lsm RB siltstn.	
S	Zones of transitional B to G-type hal intbd with dsth lsm and intraclastic siltstn.	
S	Rpl lsm RB siltstn mixed with dsth and intraclastic texture, becomes inc dsth upward, contains pockets of hal and a zone of breccia near top.	
S	Dsth and intraclastic siltstn intbd with B-type hal.	
S	Hal; primarily bedded B-type with some E at base, associated with molds of intbds, intbd with lsm siltstn and anh.	

logged by BL date 12/84

date

checked SH date 12/84

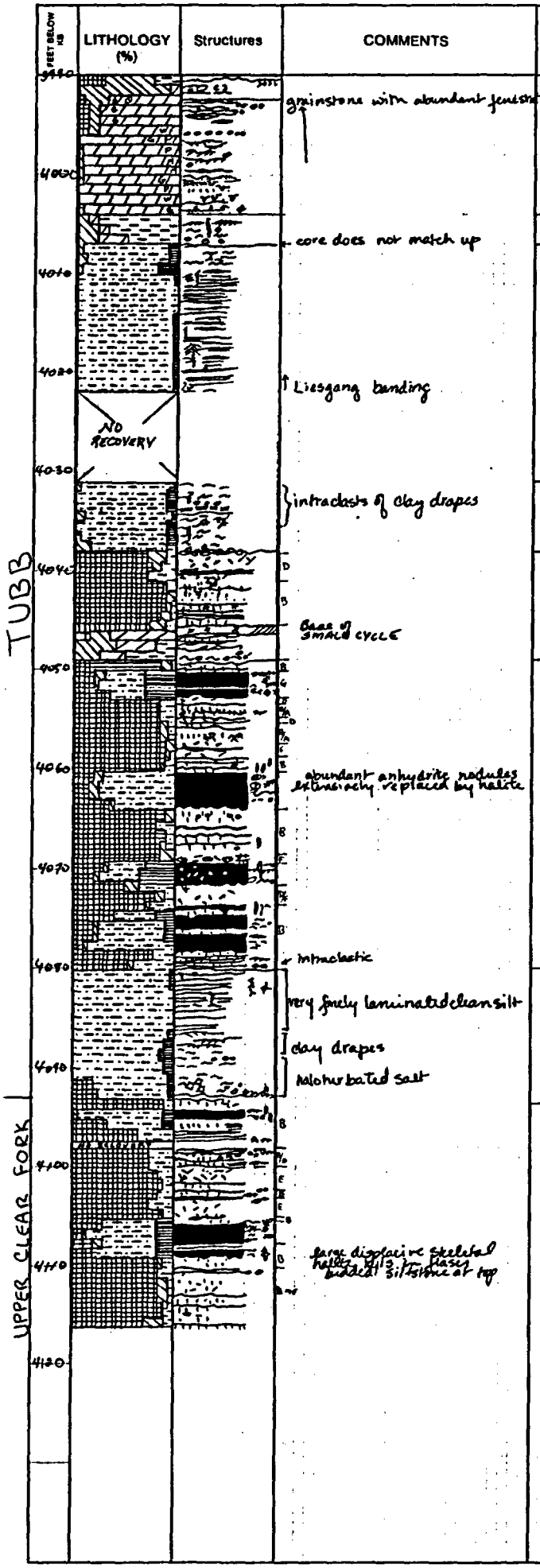
transcribed by CAC date 3/85

updated PG date 7/85

updated date

WELL #1 GRABBE COUNTY SWISHER DATE Dec 1984

INTERVAL 3990 - 4116 TUBB, LOWER CLEAR FORK LOGGED BY B. Lunau



CONTACTS	LITHOLOGIC DESCRIPTION
S	Massive Gy anh.
	Tlw-B dolo gnstn, bioturbated and rpl lam, fenestral porosity at top filled with hal cement.
S	Lt Tlw-B to Gy dsth dolo mdstn with anh nods and R hal veins.
S	Pale Gn with RB mot, finely lam siltstn, contains vert oriented, clay-lined squiggly features and liesegang banding, dsth at top with molds of hoppers.
S	Lt RB lam siltstn with clay drapes, texture is dsth and contains intraclasts of clay drapes.
S	Gy intraclastic and dsth mdstn at the base, grades upward to lam dolostone gnstn overlain by mdstn —> massive Gy anh —> bedded hal intbd with mdstn and anh with runlined texture at top.
S	Hal, B mixed with E, F and D in lower portion and mixed with A in the upper half, intbd with dsth and rpl lam siltstn, D hal associated with base of intbds.
S	Pale Gn to Tlw-B siltstn, dsth, intraclastic texture at base, grades upward to finely lam pale Gn and RB mot siltstn.
S	Hal intbd with lam siltstn, hal consists of B going to E and B-type hal, E and B-type hal are associated with the bases of intbds, intbds have dsth texture at base and are rpl lam at top, also contain skeletal hal nls and hoppers.

logged by BL date 12/84

date

checked SH date 12/84

transcribed by CAC date 5/85

updated PG date 7/85

updated date

LOGGED DATE

WELL #1 GRABBE COUNTY SWISHER DATE 2/85

INTERVAL 4116-4210 LOWER CLEAR FORK LOGGED BY PG

FEET BELOW KB	LITHOLOGY (%)	Structures	COMMENTS	CONTACTS	LITHOLOGIC DESCRIPTION	LOGGER DATE
4120			red and gray mudstone with intercalats of mudstone, skeletal HAL	S	Fissile Gy-B mdstn, calcite cement, sharp contact with dolo gnstn, poorly lam to massive, bivalve shell molds filled with hal, anh replacement of dolo in upper section. Anh is massive to poorly mod. Hal is anhydritic with anh partings and nods. RB + Gy mdstn with disp hal, breccia, poorly lam at 4124-4126', sharply overlain by hal. V coe xline hal above mdstn + anh bed at 4119', anh patches abd intbds. Sharp contact with Gy mdstn, then massive anh with hal-replaced Ryp pseudomorphs.	
4130						
4140			1.3 m dolomicrite, rippled coarse coated grain/intraclast grainstone at top, furrowed coated lgrain/skeletal grainstone at base CALCITE CEMENT	S	Gy fissile mdstn with anh nod at base, becomes dolo at contact with rpl dolo mdstn, anh is poorly lam with some pseudomorphs preserved in interlam anh and dolo or anh and dolo + anh laths, dolo at 4147-4144' is rpl lam with hal replacing dolo along lam and in patches. Anh at top is massive to poorly lam.	
4150			trace HAL replacing Bol well formed, large pseudomorph in laminated Dolomicrite + ANH BOL W/ ANH LATHS			
4160			20cm interlaminated dolomite grainstone and anhydrite with pseudomorphs after gypsum	S	Gy fissile mdstn with anh nod and lam - residue - wispy, dstb; becomes rpl and dolomitic at top. Poorly developed lam and nod textures, appears almost massive, random pores probably hal-filled originally, Bk wispy material defines some nods or lam.	
4170			6cm silty dolomicrite	S	Gy mdstn with anh beds and nods, wispy dstb texture, probably residue; sharp contact with rpl dolo mdstn, pyrite at base gives grainy appearance, replacive and disp anh nods within dolo. Anh is dk Gy, mod with insol dolo, lacks good nod texture above 4176', becomes lam above 4171' with dolo defining wispy, then lam texture.	
4180			42cm rippple laminated coated grns, thick micrite drapes, brecciated in lower part	S		
4190			Relict B-type HAL thin mudstones		Recrystal hal with mod anh patches, thin interline stringers, occasional beds of anh or anh + mdstn, mdstn is Bk-Gy as beds or patches. Thin bedded units are clean with anh stringers between some beds and vert anh-filled pipe at 4203' (10x2 cm).	
4200			ANH filled pipe			
4210			trace Bk mudstone			
	TD					

LOWER CLEAR FORK

logged by PG date 2/85

date

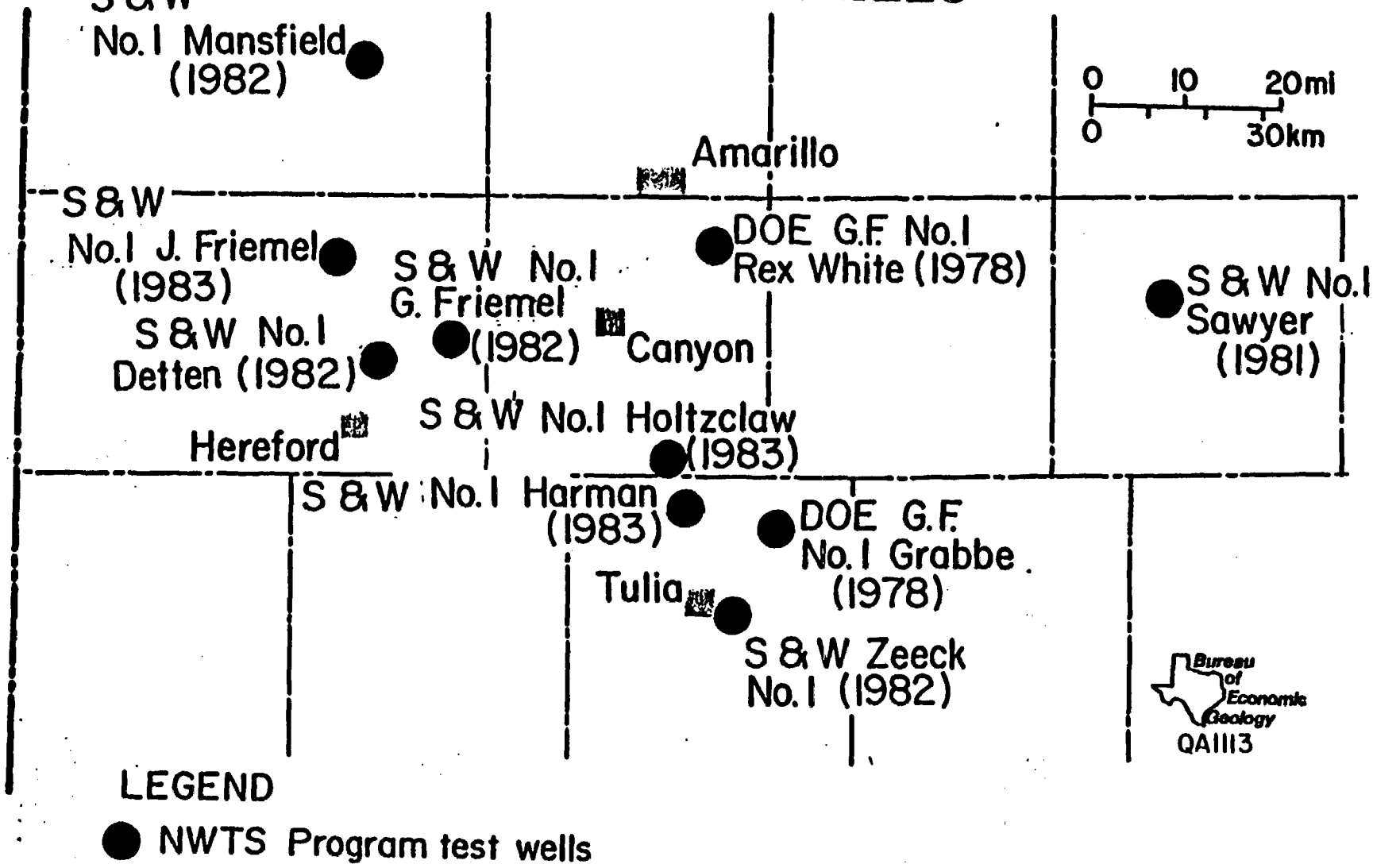
checked SH date 2/85

transcribed by CAC date 5/85

updated PG date 7/85

updated date

NWTS TEST WELLS



LEGEND

● NWTS Program test wells

CORED INTERVALS

FORMATION	MANSFIELD	J FRIEMEL	DETTEN	G FRIEMEL	WOODS-HOLTCLAW	HARMON	ZEECK	GRABBE	REX WHITE	SAWYER
OGALLALA		only 3' of core 391'						0' 96' missing	30'	
DOCKUM	45'							137' missing		
DEWEY LAKE					1080'			30' missing		
ALIBATES		97' missing				1072'	1035'			
SALADO-TANSILL	25' missing		1129'		26' missing	33' missing	1145'	25' missing		
YATES				1141'						80' 20' missing
UPPER SEVEN RIVERS		1464'	1422'	1312'	1399' 55' missing	1302'				30' missing
LOWER SEVEN RIVERS										160' missing
QUEEN-GRAYBURG	92' missing	1846'		1727'		1804'	1295'			35' missing
UPPER SAN ANDRES	25' missing 1240'		1885'							
MIDDLE SAN ANDRES	1280'				2307'					
LOWER SAN ANDRES UNIT 5										20' missing
UNIT 4										
UNIT 3		2820'	2847'	2690'	2884'					
UNIT 2						3049'				
GLORIETA							3102'			
UPPER CLEAR FORK										
TUBB										30' missing
LOWER CLEAR FORK								4210'		
RED CAVE	3340 4026								3991'	
WICHITA	4123' 4393'	5519'					5309'			
WOLF CAMP	4995'	6030'					1372' missing 7388'			3933'
PENNSYLVANIAN		6421' 271' missing 8270'								
total ft core	4062'	4139'	1255'	984'	815'	1477'	2034'	3922'	3961'	3558

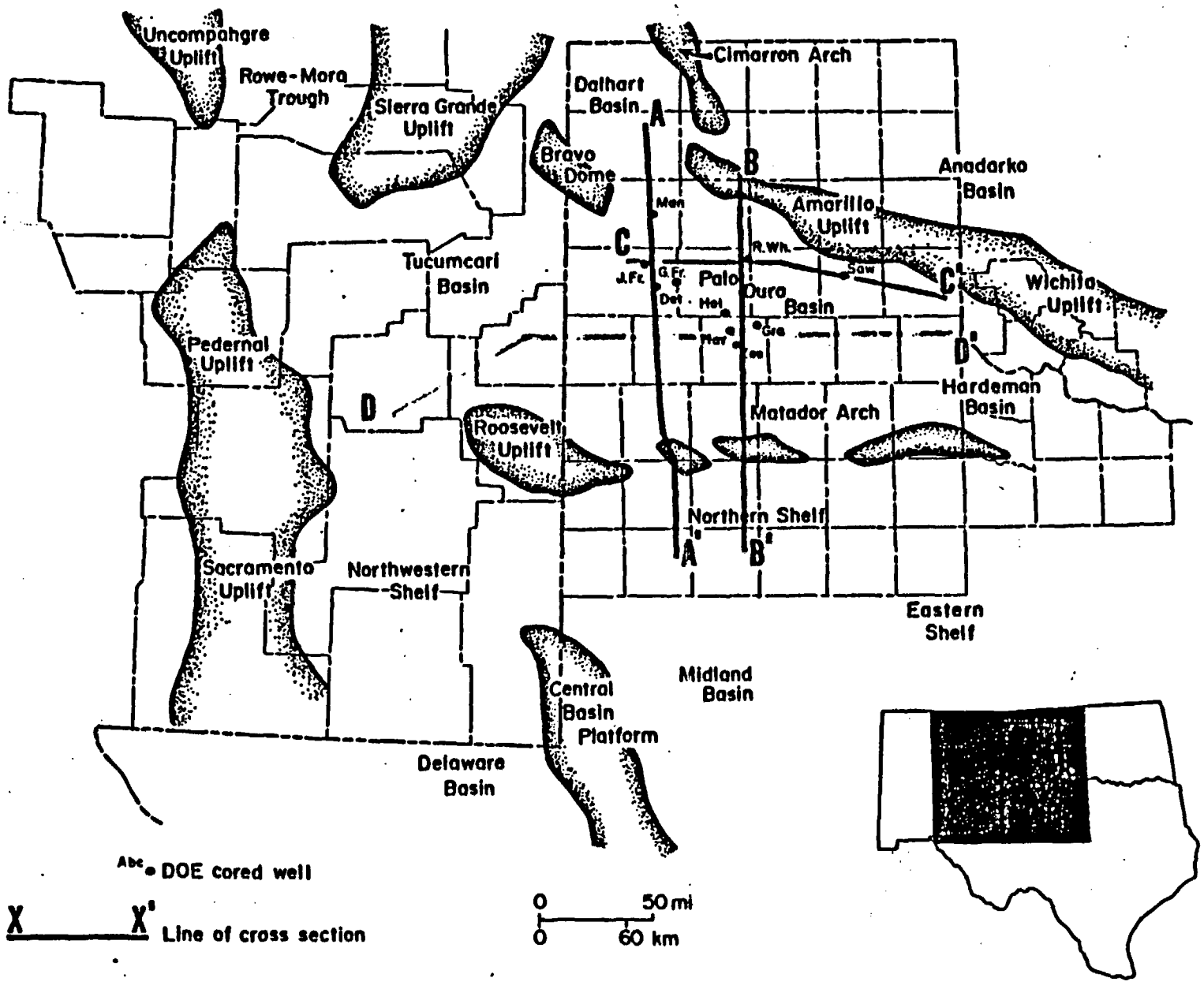
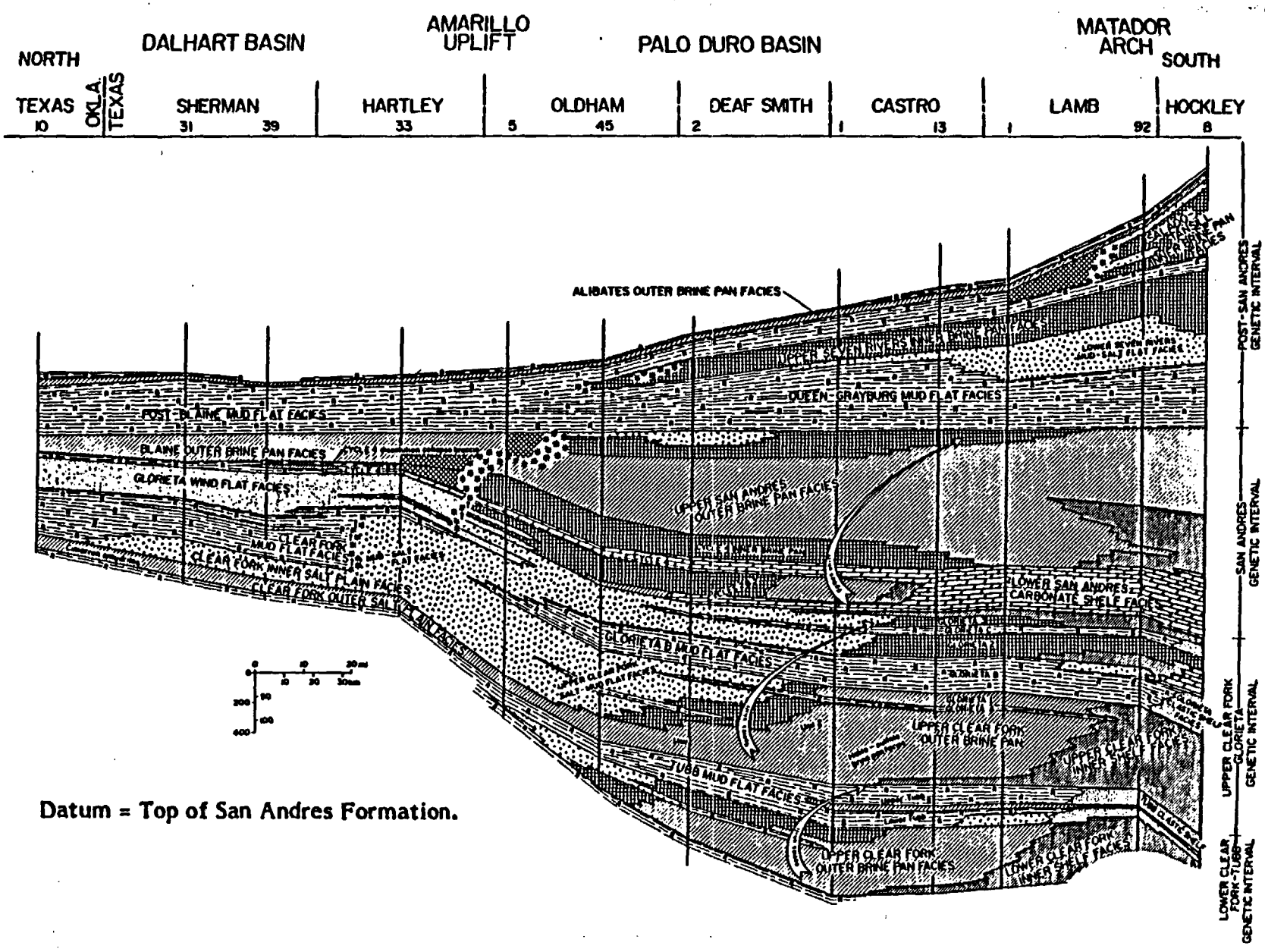

Uncompahgre Uplift
Rowe-Mora Trough
Sierra Grande Uplift
Dalhart Basin
Cimarron Arch
Bravo Dome
Anadarko Basin
Amarillo Uplift
Tucumcari Basin
Palo Duro Basin
Wichita Uplift
Pedernal Uplift
Hardeman Basin
Matador Arch
Roosevelt Uplift
Northern Shelf
Sacramento Uplift
Northwestern Shelf
Eastern Shelf
Midland Basin
Central Basin Platform
Delaware Basin
A
A'
B
B'
C
C'
D
D'
Men
R.Wh.
Saw
J.Fr.
G.Fr.
Det.
Hel
Gre
Abc DOE cored well
X X' Line of cross section
0 50 mi
0 60 km

figure 2



Datum = Top of San Andres Formation.

SYSTEM	SERIES	GROUP	Palo Duro Basin FORMATION	Dalhart Basin FORMATION	General Lithology and depositional setting
QUATERNARY	HOLOCENE		alluvium, dune sand Playa	alluvium, dune sand Playa	
	PLEISTOCENE		Tahoka "cover sands" Tule Blanco	"cover sands"	Lacustrine clastics and windblown deposits
TERTIARY	NEOGENE		Ogallala	Ogallala	Fluvial and lacustrine clastics
CRETACEOUS			undifferentiated	undifferentiated	Marine shales and limestone
TRIASSIC		DOCKUM			Fluvial-deltaic and lacustrine clastics
PERMIAN	OCHOA		Dewey Lake	Dewey Lake	Cyclic sequences: shallow-marine carbonates; hypersaline- shelf anhydrite, halite; continental red beds
			Alibates	Alibates	
	GUADALUPE	ARTESIA	Salado/Tansill	Artesia Group undifferentiated	
			Yates		
			Seven Rivers		
			Queen/Grayburg		
			San Andres	Blaine	
	LEONARD	CLEAR FORK	Glorieta	Glorieta	
			Upper Clear Fork	Clear Fork	
			Tubb	undifferentiated Tubb-Wichita Red Beds	
			Lower Clear Fork		
			Red Cave		
		WICHITA			
	WOLFCAMP		?	?	Shelf and shelf-margin carbonate, basinal shale, and deltaic sandstone
PENNSYLVANIAN	VIRGIL	CISCO			
	MISSOURI	CANYON			
	DES MOINES	STRAWN			
	ATOKA	BEND			
	MORROW				
MISSISSIPPIAN	CHESTER				Shelf carbonate and chert
	MERAMEC				
	OSAGE				
ORDOVICIAN		ELLENBURGER			Shelf dolomite
CAMBRIAN ?					Shallow marine(?) sandstone
PRECAMBRIAN					Igneous and metamorphic

TYPICAL SAN ANDRES CYCLE

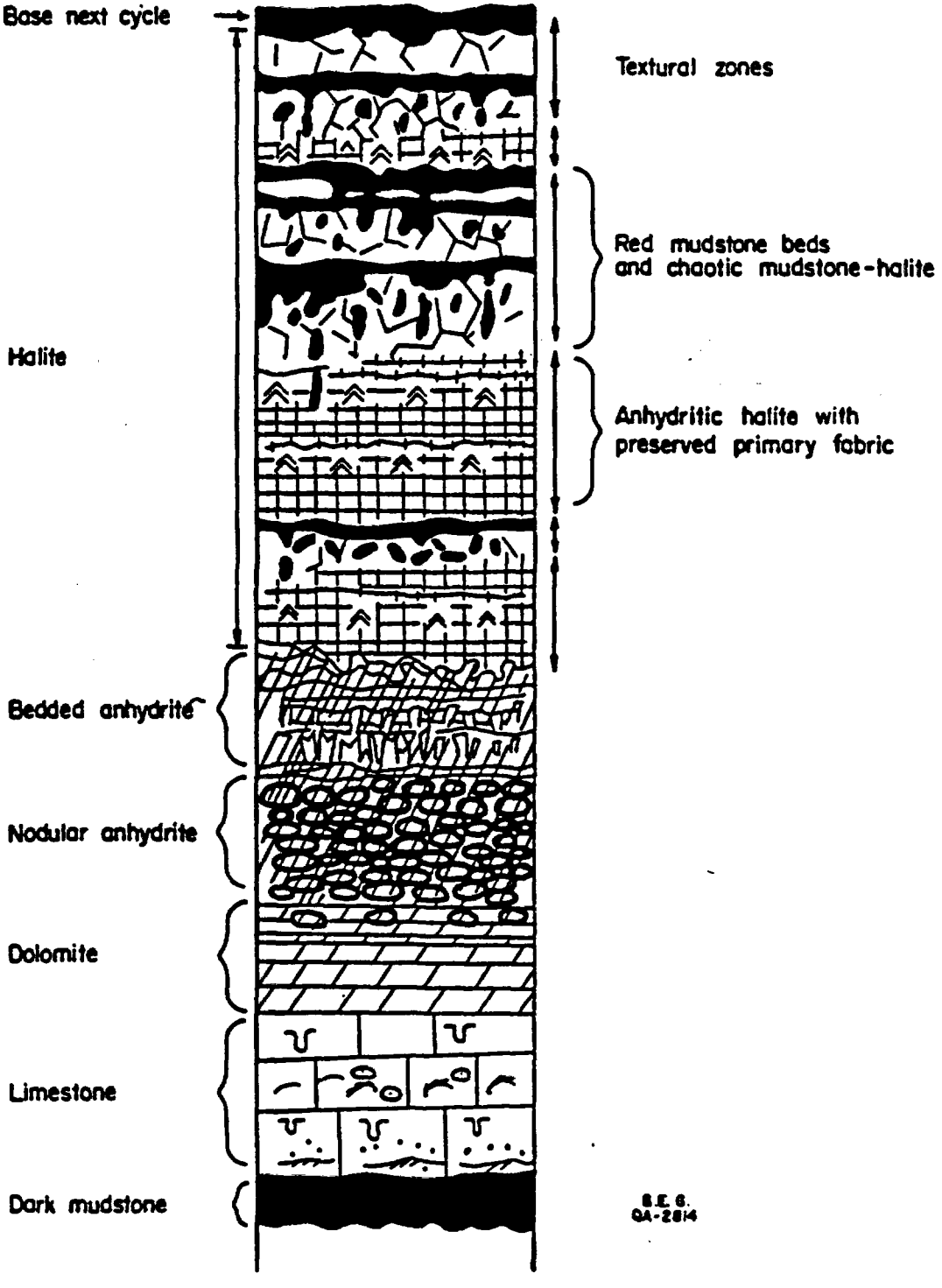
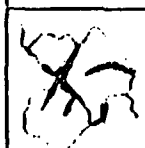
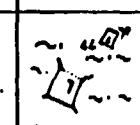


Table 3 Textural classification of halite with genetic significance.

Symbol	A	B	C	D	E	F	G	H	I
halite type	chevron halite rock	color banded/ vertically oriented halite rock	C reserved for another primary fabric not yet recognized	chaotic mud-stone-halite rock	[illegible] muddy halite rock	[illegible] anhydritic halite rock	displacive halite in other sediments	halite cavity-filling cement	fibrous fracture-filling halite cement
halite crystal size	0.5-5 cm tall	0.5-5cm tall		0.3 to 3 cm	1-5 cm	1-5 cm	0.5-3 cm	1 to 20+ cm	.3 to 1 cm
halite crystal shape	subvertical mosaic; L:W= 3:2 to 4:1	subvertical mosaic; L:W= 3:2 to 4:1		equant anhedral to euhedral crystals	equant mosaic	equant mosaic	euhedral cubes or hopper shapes	equant mosaic	fibrous
impurities: composition	anhydrite common; mudstone possible	anhydrite, mudstone, organic[illegible]		mudstone, minor anhydrite	mudstone, minor anhydrite	anhydrite	mudstone; also dolomite, anhydrite	cavity filling halite is clean but is associated with mudstone and anhydrite insoluble residues	trace of hematite present as coloring agent, otherwise pure halite
impurities: %	<1%-5%	1%-5%		10-50%	1-10%	1-25%	50-99%		
impurities: location	anhydrite on grain boundaries, partings, mudstone only in pipe fills	within and between grains, along partings, in pipes		in masses between halite crystals, some also within grains	within grains, minor between grains	along partings, grain boundaries	matrix for halite		
fluid inclusions	abundant, small define relict growth faces	varied		few	varied	varied	few	large and abundant	?
associated with halite types	F along crystal boundaries and pipes, H and/or D in pipes	F & E, H and/ or D in pipes		mudstone beds typically includes remnant B halite	may contain remnant A,B, possible H	may contain remnant A,B possible H	non-halite rocks	all halite types	in non-halite rocks
identifying characteristics	minute fluid inclusions along relict halite growth faces	bedding and/ or vertical orientation of crystals		10-50% mudstone in inter-crystalline masses, chaotic texture	halite colored red brown or black by 1-10% impurities, no bedding	halite with 1-25% anhydrite, [illegible], no bedding	euhedral to sub-hedral halite crystals in sediments	exceptionally coarse clear crystals, fill cavity in other salt type	fibrous halite in fracture, many examples red colored
sketch									

Key to detailed logs, San Andres units 4 and 5 halite

Column 1 Depths in feet below kelly bushing

PC indicates point count of 100 points over 1 foot interval of slabbed core to check estimated percent lithology.

+ and * indicate sampled interval, core not available during detailed logging and checking.

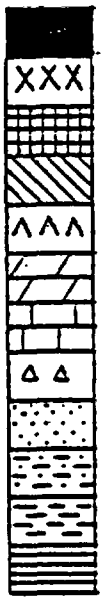
* indicates sample logged by BEG and a detailed description available in BEG files.

+ indicates sample logged, but no detailed description.

Intervals sampled before BEG logging are labeled as "sampled" in column 2

Column 2 Estimated percent lithology

Mineral Composition



Porosity
Potash Salt
Halite
Anhydrite
Gypsum
Dolostone
Limestone
Chert
Sandstone
Siltstone
Mudstone
Claystone

Carbonate Components

G Grainstone
P Packstone
W Wackestone
M Mudstone

Carbonate Components (continued)

- o oolites or coated grains
- intraclasts
- fossiliferous (general)
- molluscs
- crinoids
- forams
- brachiopods
- A phylloid algae
- coral

Column 3 Structures

Sketch of structures in left half of column; interbeds of one lithology in another extend 3/4 of column width; boundaries between lithologies drawn across entire column width.

Halite

- chevrons
- vertically oriented crystals
- dark bands
- pipe, pits (show residue at bottom)
- anhydrite
- chaotic mud salt
- recrystallized halite
- exceptionally coarse halite
- mudstone interbed
- anhydrite interbed
- discontinuous mudstone interbed
- discontinuous anhydrite interbed
- nonhorizontal bedding

Column 3 Structures (continued)

Anhydrite

gypsum pseudomorphs

bedding (schematic)

contorted bedding

nodular

crystallotopic

Carbonates

bedding, scour surface

wispy lamination

ripple lamination

cross beds

intraclasts

coarse grainstone

burrows

stylolites

Clastics

lamination

burrows

ripple lamination

disturbed intraclastic fabric

more disturbed

cross bedding

dissipation structures

Column 3 Structures (continued)

General

o—o	boudinage
⌣	mudcracks
▭	clasts
⁄⁄	faulting
⁄	fractures
ß	birdseye-fabric
⁄⁄	contorted alminae.
⊏	displacive halite hoppers
«ô»	skeletal displacive halite
◊	filled fracture
ooo	nodules (note composition)
*	crystallotopic anhydrite in other lithologies

Column 4 Comments

A. At left edge letters A through F indicate halite rock types.

Halite Types

A bedded halite with chevron fluid inclusions

B bedded halite with vertically oriented crystals

D chaotic mudsalt

E recrystallized muddy halite

F recrystallized halite with interstitial anhydrite

G displacive halite in sediment

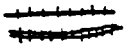
H coarse recrystallized cavity fill halite

I fibrous fracture fill

See table and text for description of halite classification.

B. Location, irregularity and estimated continuity of mudstone and anhydrite interbeds in halite.

mudstone

 anhydrite

 irregular base, flat top

discontinuous beds

C. Comments on interbeds

M indicates mudstone

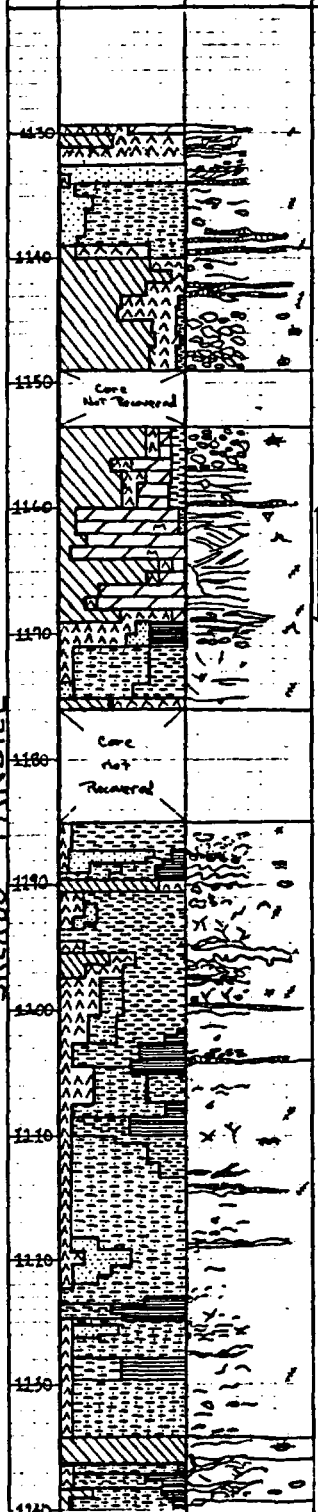
A indicates anhydrite z indicates siltstone

bed thickness shown

5A indicates 5 anhydrite interbeds too closely spaced to show individually, estimated percent impurities shown.

WELL Detten COUNTY Deaf Smith DATE 11-82

INTERVAL 1129-1240' SALADO - TANSILL LOGGED BY ST, DN, BL, MW, DP



COMMENTS	CONTACTS	LITHOLOGIC DESCRIPTION
	1	Alternating layers of tan laminated dol & fibrous fracture fill gyp. Dol laminae filled w/ scattered module like gyp replacing the dol. Bottom .4' contain ghost gyp pseudomorphs after grassmat swallowtail gyp. Dol laminated, ripple ? algal?. Fractures about 4 mm.
		Grassmat; gyp & anh pseudomorphs after gyp, upper .6' & lower .2' fine crystalline gyp; mid .5' fine crystalline mixture of anh & gyp contains fibrous gyp fracture fill. Minor impurities.
Gyp fracture fill	1	Fine grained crystalline gyp (appears replacive) Ghost laminae present. Minor stringers of tan dol & fibrous gyp fracture fill. Impurities (red mud) gives zone a reddish hue. Scattered "rugs" of clear gyp fill.
ripples	1.3	Ripple laminated very fine ss, well preserved cross bedding; subarkose, scale of structures about 7mm decreasing up section; Mod red in color. 4 cm of pure fibrous gyp fracture fill at base. Cross beds low angle, gyp nodules about 2 mm.
	5.3	Moderate reddish brown siltstn/sandy siltstn; Micaceous subarkose; sand size grains in lenses or pods. Low angle to horizontal gyp (up to 15mm). Fracture fill & pore filling nodules, less than 2 mm. Irregular blebs often coalescing reduction zone. Some rounded gyp grains. Basal 3mm is green clay.
Pink stain	2.5	Bedded massive anh laminations parrallel/slightly wavy; being converted to gyp. Gyp nodules scattered (1-5cm) coalescing & cut cross anh laminations. Upper .6' all gyp, fibrous & nodular. Fracture fill common fibrous gyp(3-15mm) nearly horizontal.
Fibrous gyp fracture fill; Patchy gyp replacement nodule; anh; gyp	7	Gray nodular mosaic anh; zones of mosaic to bedded nodular mosaic. Red interstitial mud slightly dolomitic in lower footage; Nodules 1-30mm. Scattered gyp nodules (1-10mm) coalescing into larger nodules & zones. Replacement, stucture (mdstn laminations) disrupted by gyp nodules. Common fibrous gyp fracture fill 2-8mm.
	2.6	Gray nodular mosaic to bedded nodular mosaic anh; nodules less than 1mm up to 10mm; average 3-4mm. Interstitial red mud slightly dolomitic. Coalescing gyp replacement nodules 2-35mm scattered & patchy. Anh nodules appear "fuzzy".
	3.5	Laminated dolomitic red anh; fine parallel intrabeds of red mud less than .1mm & tan dol less than 4mm. Upper 1.5' small displacive anh nodules less than 3mm in mud & laminated dol (algal?) matrix.
	2.5	Green gray dol mdstn w/ green clay laminae parallel to wavy, highly stylotized replacive crystallotopic anh. Dol mdstn may be ripple laminated.
Anh replacing DOL; Gyp + Anh fracture fill	1.7	Gray dol mdstn w/ disturbed & broken bedding; intraclasts; stylotized; green clay laminations & anh & gyp fracture fill.
	1.6	Laminated anh w/ thin interbeds (less than 1 mm) of gray dol mdstn; anh beds .5-1 cm thick, parallel to slightly wavy & lie about 10 degrees from horizontal. Upper boundary stylolitic. Anh replacing dol.
Gyp sand slickensides	1.7	Laminated (algal) dol mdstn, laminations .25 to 7 mm & contain numerous vertically oriented cracks. Interbeds of anh .25-5mm, decreasing up section. Possible ripple laminations. Dol laminations contorted & increasingly broken up section until upper .6' contains no laminations, where is becomes intraclastic.
	2	Laminated anh w/ numerous gyp replacement nodules & 3 large fractures filled w/ fibrous gyp (1 cm thick) thin interbeds of grey dol (less than 1 mm). Zone 2 cm thick of dol mdstn, anh laminations 1-5mm (ripple laminations)
	4.2	Gyp, muddy ss, highly disturbed & reduced; entire layers of mud have beed reduced. Pods (Intraclasts?) & lenses of sand sized detritial gyp grains; reduction spots 1-3mm.
	1	Moderate reddish brown siltstn; subarkose, micaceous; secondary gyp & detritial gyp sparse reduction spots (1-5mm) Low angle fractures filled w/ gyp. Mud intraclasts present.
		Laminated anh (greater than 1 mm to 2 mm) algal? Gyp fracture fill, large vertical gyp replacement crystals growing downward from top of section.
Reduced zone; fibrous Gyp fracture fill slickensides	12	Moderate reddish brown clay rich, sandy mdstn. Varying % sand & clay. Common gyp crystallotopic grains often in stringers. Scattered reduction spots 1-13mm). Interbeds of anh w/ nodular gyp replacement. Upper bed bedded massive lower bed massive w/ thin interstitial mud layers.
	5	Dark reddish brown mdstn. Scattered reductions spots w/ black cores (6-12mm). Contain crystallotopic gyp & fracture fill. Gyp growth coalescing to form gyp stringers.
	2.5	Dark reddish brown claystn/mdstn; gyp fracture fill; widely spaced reduction spots (.5-22mm). Has beginnings of displacive gyp growth.
Gyp sand?	3.5	Moderate reddish brown gypsiferous siltstn/mdstn; displacive crystallotopic gyp crystals coalescing into nodular like morphology. Appears to have contorted possible bedding planes. Nodules about 2-5mm average. Possible detritial gyp.
	1.9	Dark reddish brown claystn/mdstn w/ nodular gyp growth up to 15mm also gyp fracture fill.
Gyp fracture fill slickensides	13	Moderate reddish orange siltstn w/ muddy & sandy zones which contain crystallotopic gyp. Gyp crystals coalescing in bands, nodules & irregular ropey morphologies. Fibrous gyp fracture fill. Gyp grains appear secondary but some maybe detritial.
slightly brecciated	11	Alternating units of dark reddish brown claystn/mdstn w/ wispy bedded micaceous siltstn/sandy siltstn; clay rich units contin minor amounts of gyp via fracture will & widely spaced black centered reduction spots up to 1.5 cm) average 4mm). Siltstns are moderate reddish orange containing lighter colored wispy beds or stringers, possibly containing detritial gyp. Some secondary gyp crystals present. Grains rounded, poor sorting. Numerous reduction spots average 2 mm some w/ black cores. Sedimentary structures, scours, ripple laminations, wispy laminations, deformed beds & rip up clasts.
Fluid escape structures?	2.4	Distorted, bedded nodular grades to massive bedded anh w/ interbeds of thin (less than 1 mm) of red clay/mud. Possible ripple lamination in lower foot. Anh is relatively soft possibly reflection lack of complete dehydration.
	3.6	Highly fractured moderately reddish brown clayey siltstn w/ darker clay/mud zone. Fractures both vertical & nearly horizontal filled w/ gyp. Upper .6' most fractured & contains disturbed & broken bedding, numerous reduction spots up to 1.5cm; clay layer contains few but large reduction spots, (2.5cm).

LOGGER DATE

logged by B. date 11-82

date

checked date

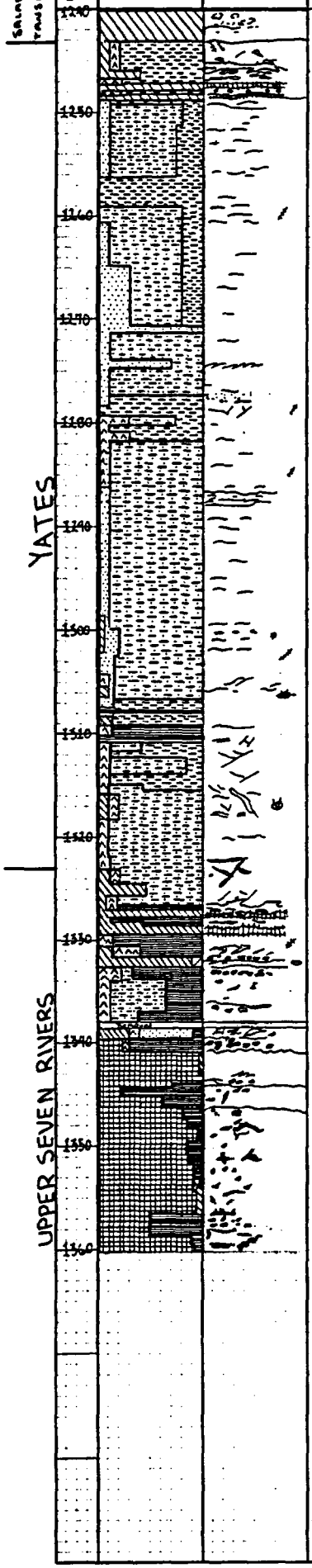
transcribed by T.J. date 1-83

updated date

updated date

WELL Dethan COUNTY Deaf Smith DATE 11-82

INTERVAL 1240-1360' SALADO-TANSILL, YATES, UPPER SEVEN RIVERS LOGGED BY BL, DN, MW, DP, ST



CONTACTS	LITHOLOGIC DESCRIPTION	LOGGER DATE
3	Disturbed bedded mosaic to massive anh; disturbed bedded mosaic contains large amount of anhydritized red mud which gives it a reddish color. Mud decreases down section.	
2.2	Insoluble residue: about 2mm anh nodules; 1-2mm anh fracture fill present, all in mdstn. 5mm average undisturbed reduction spots present 1248.3-1243.0. 50mm	
1.8	w/ black centers.	
	Brecciated mdstn present 1246.0-1245.6. Bedded nodular anh present 1246.2.	
	White gray anh w/ pink laminations at 1245.6.	
	White gray laminated anh.	
	Insoluble residue; mud clasts, disturbed, about 5mm anh nodules, .2mm euhedral gyp crystals present.	
	White gray laminated anh	
	Description 1249'-1333'	
	Red, muddy, sandy siltstn w/ maximum grain size very fine sand. Mdstn & claystn present in distinct intervals & in varying concentrations as disturbed, discontinuous laminae within the siltstn. Silt size & greater clastic grains are predominately gyp. Some (very sparse) metallic oxide minerals present. Reduction spots present in variable concentrations & variable size (.25 mm up to a few cm thick layers) throughout the clastic interval. Mdstn/claystn intervals generally fissile. Minor carbonate cement present throughout.	
	Very porous in this interval. Variations in hematite stain define faint discontinuous laminations. Quartz makes up larger proportion of clastic grains. Clay percentage is much less in this interval.	
	Fine to medium very well rounded quartz grains in muddy coarse silt/very fine sand matrix at 1276.75.	
	Less than 5% .5mm gyp crystals aggregates present in this interval. Interstitial gyp forms layer at 1280.8, 1279.3.	
74	Cementation (hardness) increases up section from 1295.3 to 1290.	
	Very thin clay laminae in mdstn at 1307.7.	
	Mdstn in disturbed laminations/pockets very well defined 1310.7-1311.0.	
	5mm wide, 45° anh veins present at 1319.3 & 1316.3.	
1.1	5mm claystn clasts present. Randomly oriented gyp & anh veins present.	
1.5	Distorted bedded nodular anhydrite.	
1	Mdstn w/ silt size particles predominately gyp. Anh & gyp nodules present.	
3	2cm claystn clasts in claystn matrix. .1mm gyp crystals present in the matrix.	
1.2	Wispy laminated anh, nodular at contact.	
2	Distrupted claystn, anh present as fracture fill.	
	Wispy laminated white/pink anh, "broken up" upper contact.	
1	Red claystn w/ gyp present as green spherical nodules, .1-2 mm crystalline aggregates & crystalline interclay clast fill, all in varying concentrations.	
5	1.5mm distorted gyp anh layer (very finely crystalline) present at 1331.	
5	.3' red disturbed laminated anh, .3' white disturbed laminated anh, .15' crystalline white anh. Grassmat texture present. Distorted mud lamination at upper contact.	
	.15' thick concentration of gyp at 1333.3 clastic grains predominately gyp. Upward increase in clay %. Gyp present as aggregates (.5-2mm) & rare nodules. Red siltstn/ss w/ thin less than .5mm mud drapes exhibiting parallel laminae, small scale ripple structures & containing intraclasts, less than 1% of small (less than 1mm) anh nodules & scattered small scale hal replacement or fill is present. Numerous green reduction spots.	
4		
1		
5		
3	Disruptive nodular (20mm) mildy anh & gyp. Gyp also present as less than 1mm euhedral crystals in veins. Non transported claystn clasts define disrupted beds within very fine ss. Numerous .5mm reduction spots present. Rock texture disrupted insoluble residue.	
3		
	Chaotic mud salt. High proportion of anh/gyp at distorted basal contact.	
	Recrystallized hal, anhedral to subhedral crystals up to 3 cm in diameter. Crystal size increases up section. Very finely crystalline anh nodules (5mm in diameter) nonexistant at base increase up section. Very minor wisps of hematitic mud present at 1342.1-1240.3.	
7.2		
9	Chaotic mud salt, mdstn exhibits remnant bedding. Boundary w/ overlying salt is contorted but sharp. .35 cm nodular mass exhibits abundant cleavage traces & possibly contains a significant amount of anhydrite(?).	
3		
15	Red brown mdstn w/ hal filled cracks at base, filled w/ crystallotopic anh at top.	
6	Clear hal crystals 1-2 cm w/ small bodies of interstitial claystn & anh, interstitial material increases up section.	
	Clear cubic to anhedral hal crystals 1-2 cm w/ interstitial anh becomes muddy up section.	
	Clear anhedral hal w/ interstitial bodies of claystn which become disseminated up section, contains some anh laminations.	
	Clear anhedral hal w/ small interstitial bodies of claystn & anh.	

logged by DP, BL date 11/8

date

checked date

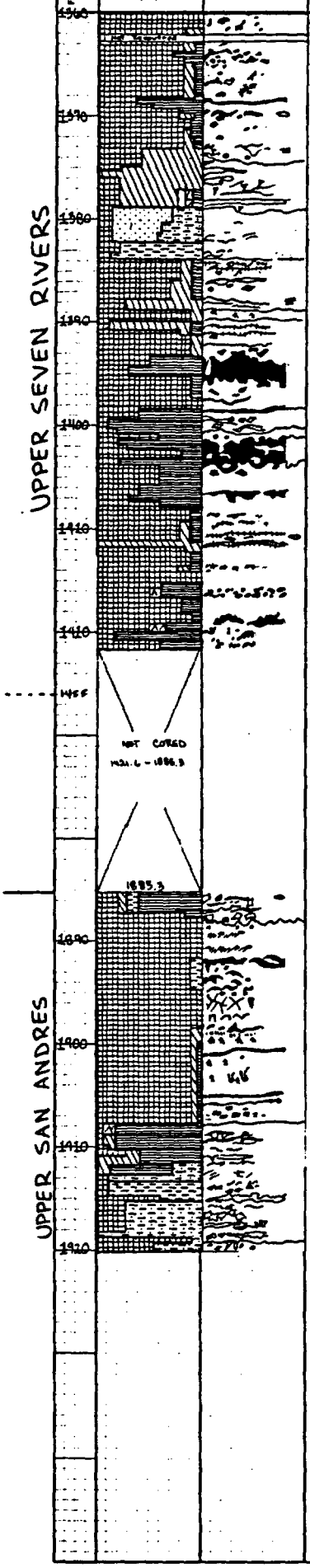
transcribed by date 4/84

updated date

updated date

WELL Detten COUNTY Deaf Smith DATE 11-82

INTERVAL 1360-1920 UPPER SEVEN RIVERS, UPPER SAN ANDRES LOGGED BY DP



COMMENTS	CONTACTS	LITHOLOGIC DESCRIPTION	LOGGER/DATE
	8.	Clear anhedral hal w/ small interstitial bodies of claystn & anh	
	5	Chaotic mud salt, moderate red brown claystn, clear 2cm x 2cm salt crystals, 3 equant 2 x 2 cm anh nodules at 1369.8. 5mm distorted claystn layer defines upper contact.	
	5.6	Milky pink/orange/white anh w/ varying proportions of hal crystals aggregates of inconsistant size & shape. These aggregates are grouped into somewhat horizontal layers with anh crystals penetrating these aggregates. 1mm thick laminations of gyp (& carbonate?) more concentrated lower 3'. Hematite stained clay define wispy laminations.	
	5.2	Moderate red brown siltstn grading to fine ss. Very faint intraclastic appearance, gyp predominate clastic grains. Sparse anh crystals aggregates. Hal & minor carbonate cement.	
	3.6	Chaotic mud salt, anh layers present at 1387.0,1387.1, 1386.5. Large replacive hal crystals up to 3 cm x 3 cm. Anh also present as 1 cm & less nodules & stringers.	
	1	Slightly disturbed .5cm milky orange/white anh laminations & about 25% hal in horizontal layers & salt aggregates penetrated by anh crystal growth.	
	1.5	Sparse horizontal anh layers present. Salt crystals average .75 x .75cm.	
	2.4	Disrupted laminae. Recrystallized salt, occasional 1 cm x .5 cm anh nodules & anh stringers present. Hal crystals up to 3 x 3 cm.	
	2	Hal w/ minor 2 cm x .5 cm anh nodules, very sparse 1 mm gyp nodules present in claystn. Chaotic mixture of gyp, anh & claystn present 1392.7, (insoluble residue?)	
	3	2 cm recrystallized salt crystals grading upward to chaotic mud salt w/ moderate red brown claystn.	
	16.5	Chaotic mud salt grading from minor interstitial claystn to predominately angular claystn clasts in hal. Minor interstitial anh is present throughout interval. Hal crystals up to 3 cm diameter. 1mm gyp nodules present in varying sparse, concentrations. Subhorizontal salt fracture fill occurs at 1399.8. Upper .7' has claystn w/ about 2cm hal crystals overlain by claystn w/ 4mm euhedral/subhedral salt crystals.	
	6	Chaotic mud salt: large clear to cloudy displacvie hal crystals (up to 3 cm). Moderate red brown claystn in angular clasts. Distorted gyp nodule present (2cm) at about 1418.9. Undeformed mud drape present at 1415.3: high mud content below, less mud above.	
	2	Chaotic mud salt. Clear, subhedral hal crystals up to 2cm x 3 cm. Very disturbed laminations & intraclasts in claystn/mdstn defined by variations in hematite stain. Dispersed small (less than 1 mm) anh nodules.	
	11.2	Chaotic mud salt.	
	9.8	Recrystallized salt w/ banding preserved. Hal crystals size variable, up to 2 x 2 cm. Vertically oriented salt crystals present upper .5'. Moderate red brown clay & anh define disrupted laminae & are present interstitially in the salt. 1 to 2 cm claystn layers present at 1900.7, 1898.8. Bands are alternating between rust color & white.	
	7.6	Dark red brown claystn. Excellent ripple w/ cross bedding preserved at 1912.5, about 1 cm high. Laminations defined by variations in hematite stain. Carbonate cemented white disrupted & discontinuous "layer" at 1914.4. Several gyp nodules (up to 3 cm) present, with vugs, at 1911.7. Anh present as .5mm to 8 cm nodules from 1910.8-1909.1. Gyp within gray claystn at 1908.1.	
	3.2	Chaotic mud salt. Claystn defines disrupted laminations & intraclastic texture in moderate red brown spots. Silt sized grains predominately gyp. Very sparse 1mm anh nodules present. Hal crystals, subhedral are 1 cm x 1 cm. Hal cement. One 2 x .5 cm anh nodule present at 1916.3.	
	1.5	Disturbed .1' claystn layer defined lower contact. Hal crystals up to 6cm x 4 cm lower .5'. Very minor anh nodules present.	

logged by DP date 1/84

date

checked date

transcribed by DP date 1/84

updated date

updated date

PALO DURO BASIN STRATIGRAPHIC STUDIES

BUREAU OF ECONOMIC GEOLOGY

UNIT	MAJOR CONTRIBUTORS
Precambrian	Flawn, Budnik
Cambrian, Ordovician	Ruppel
Mississippian	Ruppel
Pennsylvanian	Dutton, S.
Permian	
Wolfcamp	*Handford, Dutton, S., *Herron, Conti, Hovorka, Posey
Wichita	Hovorka
Red Cave	*Handford
Lower Clear Fork	*Handford
Tubb	*Presley
Upper Clear Fork	*Presley, *McGinnis
Glorietta	*Presley, *McGinnis
San Andres	*Presley, *Ramonoetta, *Bein, Hovorka, Fracasso
Queen-Grayburg	*Kolker, Hovorka, Nance
Seven Rivers	*Kolker, Hovorka, Nance
Yates	*Kolker, Hovorka, Nance
Tansill-Salado	*McGillis, *Presley, *Kolker, Nance
Alibates	*McGillis, *Presley, Nance
Dewey Lake	*Kolker, Fracasso, Johns
Triassic	
Dockum	*McGowen, *Granata, Seni, Johns
Teritary	
Ogallala	Seni, Gustavson
Quaternary	
Blackwater Draw, Etc.	Caran, Baumgardner, Gustavson

* No longer with the Bureau of Economic Geology

SYSTEM	SERIES	GROUP	Palo Duro Basin FORMATION	Dalhart Basin FORMATION	General Lithology and depositional setting
QUATERNARY	HOLOCENE		alluvium, dune sand Playa	alluvium, dune sand Playa	
	PLEISTOCENE		Tahoka "cover sands" Tule / "Playa" Blanco	"cover sands" "Playa"	Lacustrine clastics and windblown deposits
TERTIARY	NEOGENE		Ogallala	Ogallala	Fluvial and lacustrine clastics
CRETACEOUS			undifferentiated	undifferentiated	Marine shales and limestone
TRIASSIC		DOCKUM			Fluvial-deltaic and lacustrine clastics
PERMIAN	OCHOA		Dewey Lake	Dewey Lake	Sabkha salt, anhydrite, red beds, and peritidal dolomite
			Alibates	Alibates	
	GUADALUPE	ARTESIA	Salado/Tansill	Artesia Group undifferentiated	
			Yates		
			Seven Rivers		
			Queen/Grayburg		
			San Andres	Blaine	
	LEONARD	CLEAR FORK	Glorieta	Glorieta	
			Upper Clear Fork	Clear Fork	
			Tubb	undifferentiated Tubb-Wichita Red Beds	
			Lower Clear Fork		
			Red Cave		
		WICHITA			
	WOLFCAMP				Shelf and shelf-margin carbonate, basinal shale, and deltaic sandstone
?			?	?	
PENNSYLVANIAN	VIRGIL	CISCO			
	MISSOURI	CANYON			
	DES MOINES	STRAWN			
	ATOKA	BEND			
	MORROW				
MISSISSIPPIAN	CHESTER				Shelf carbonate and chert
	MERAMEC				
	OSAGE				
ORDOVICIAN		ELLENBURGER			Shelf dolomite
CAMBRIAN ?					Shallow marine(?) sandstone
PRECAMBRIAN					Igneous and metamorphic

Figure 26. Stratigraphic column and general lithology of the Palo Duro and Dalhart Basins. After Handford and Dutton (1980).

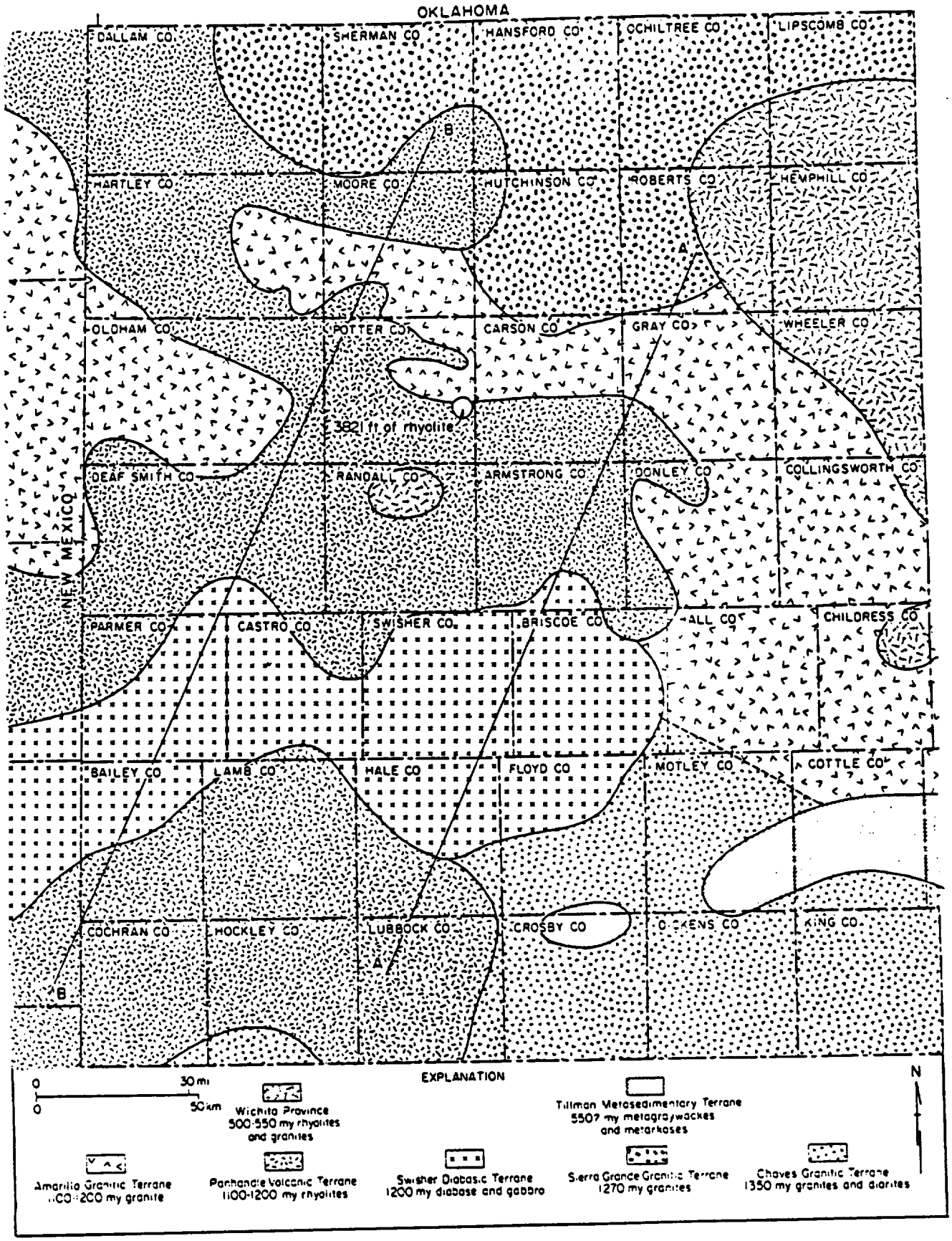
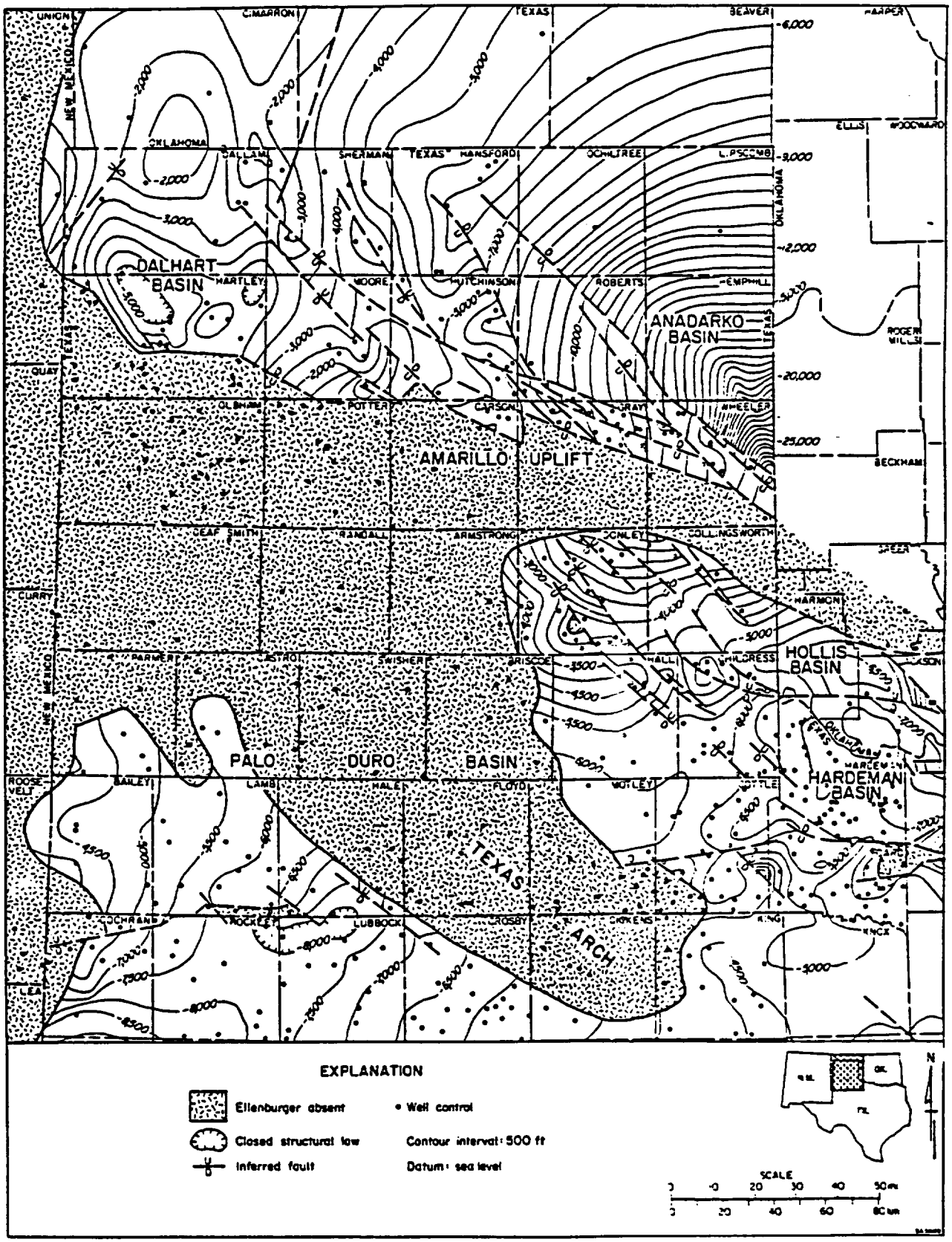
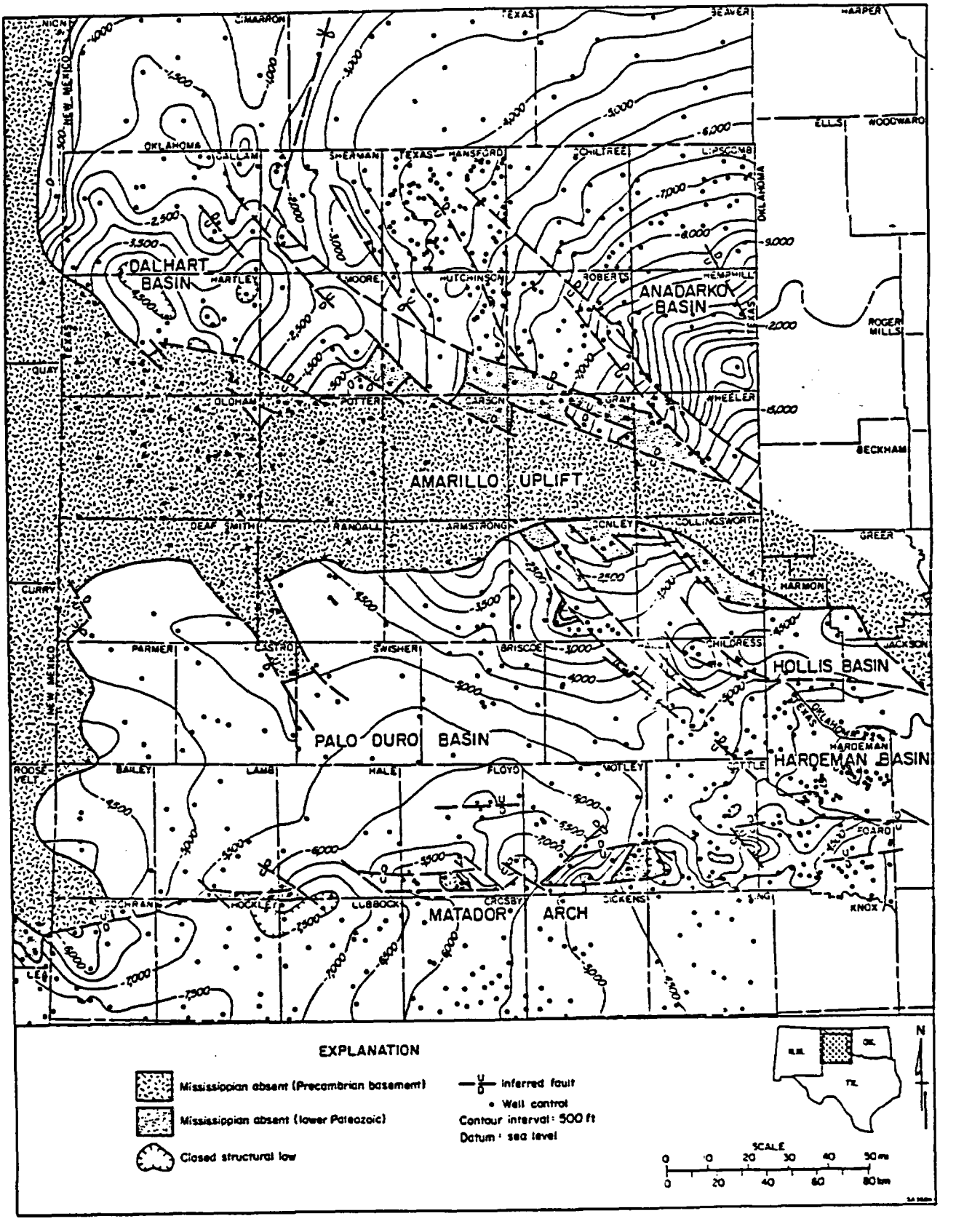


Figure 42. Basement lithologic provinces in the Texas Panhandle (from Muehlberger and others, 1967). A-A' and B-B' are locations of gravity models discussed in this report (see figs. 43 and 44).

ORDOVICIAN ELLENBURGER GROUP: STRUCTURE MAP



MISSISSIPPIAN SYSTEM: STRUCTURE MAP



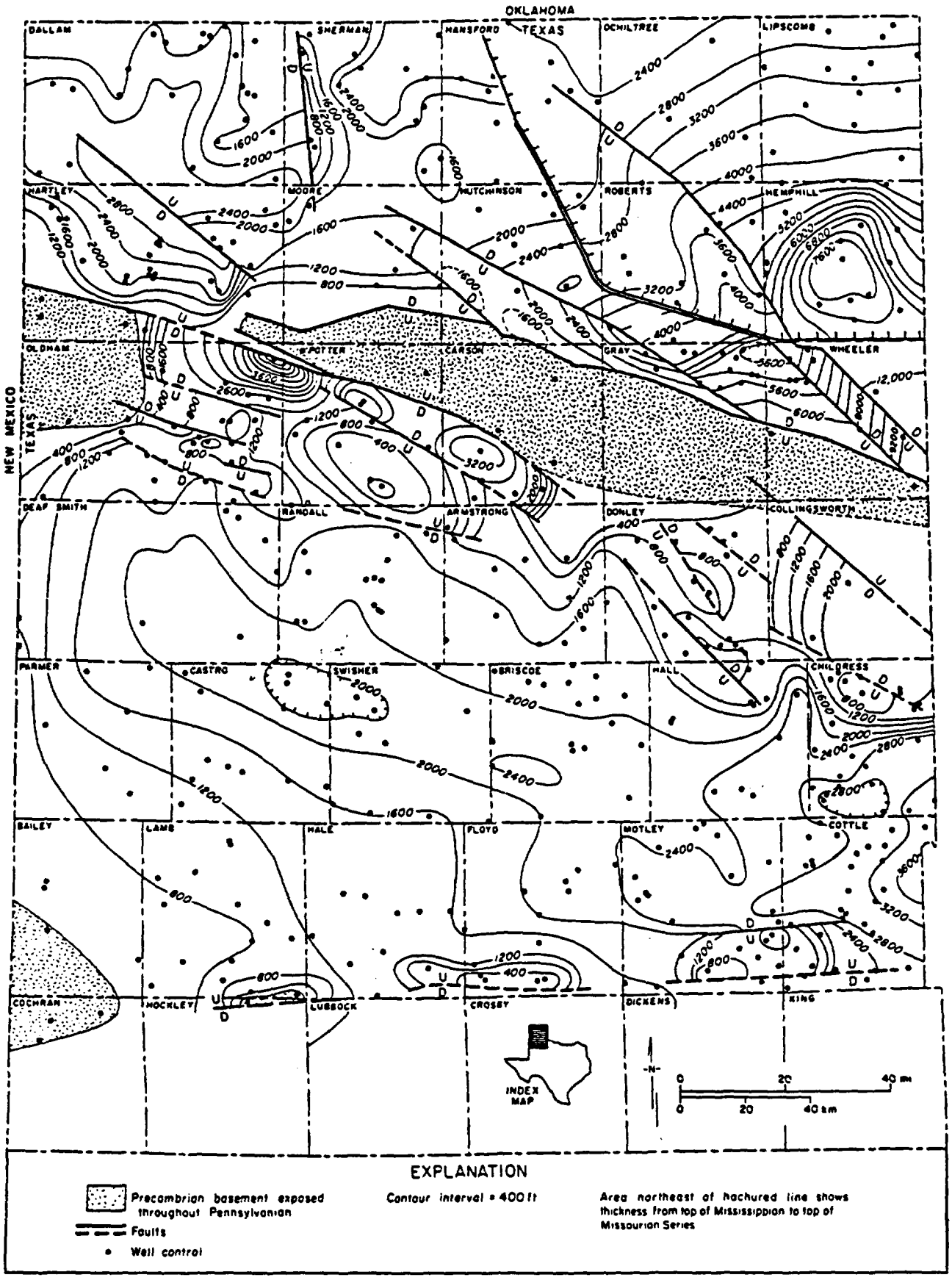


Figure 14. Isopach map of Pennsylvanian System, Texas Panhandle. Sediments thin onto uplifts that were exposed during Pennsylvanian Period.

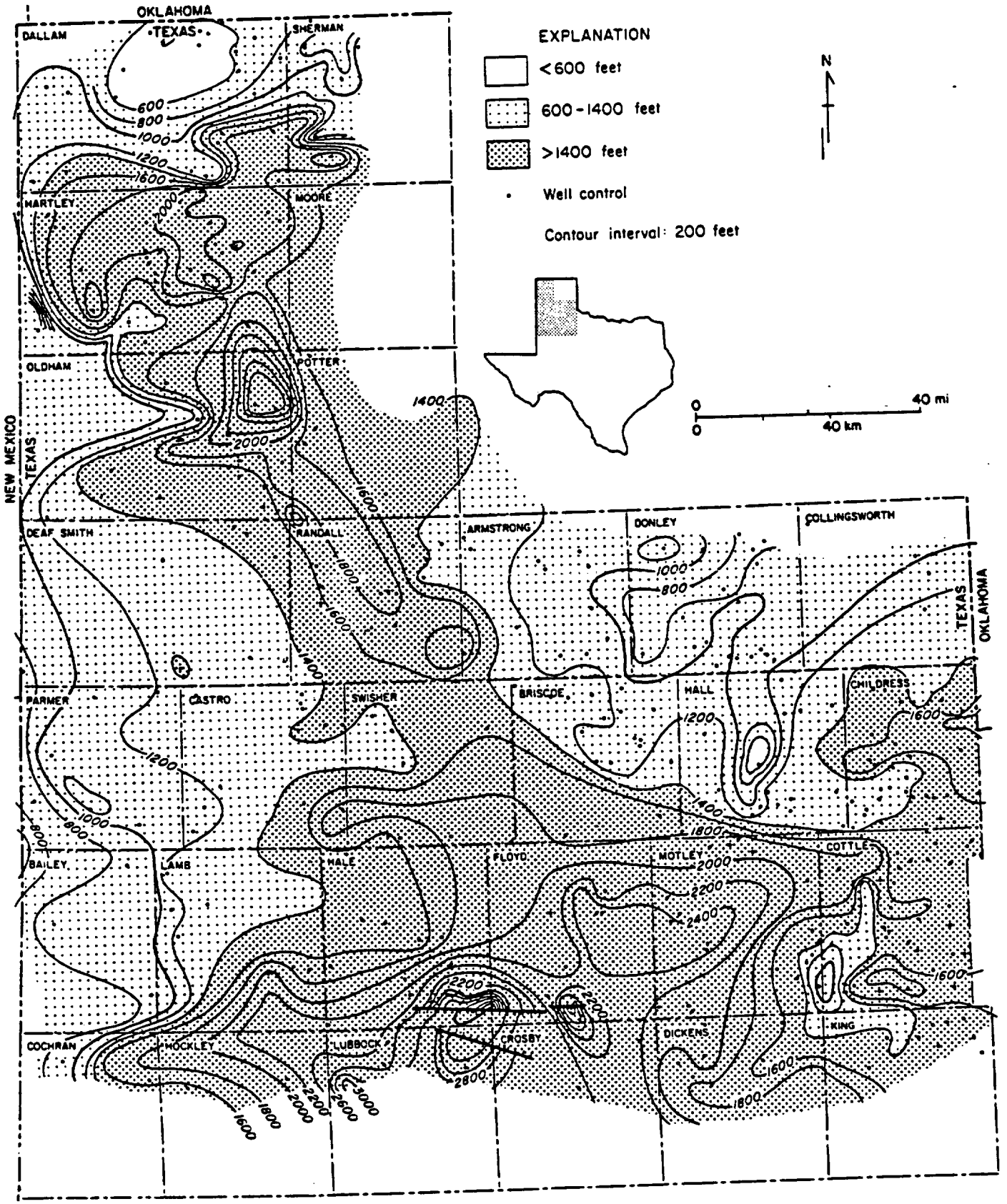


Figure 16. Isopach map of Wolfcampian Series, Palo Duro Basin (Handford, unpublished data).

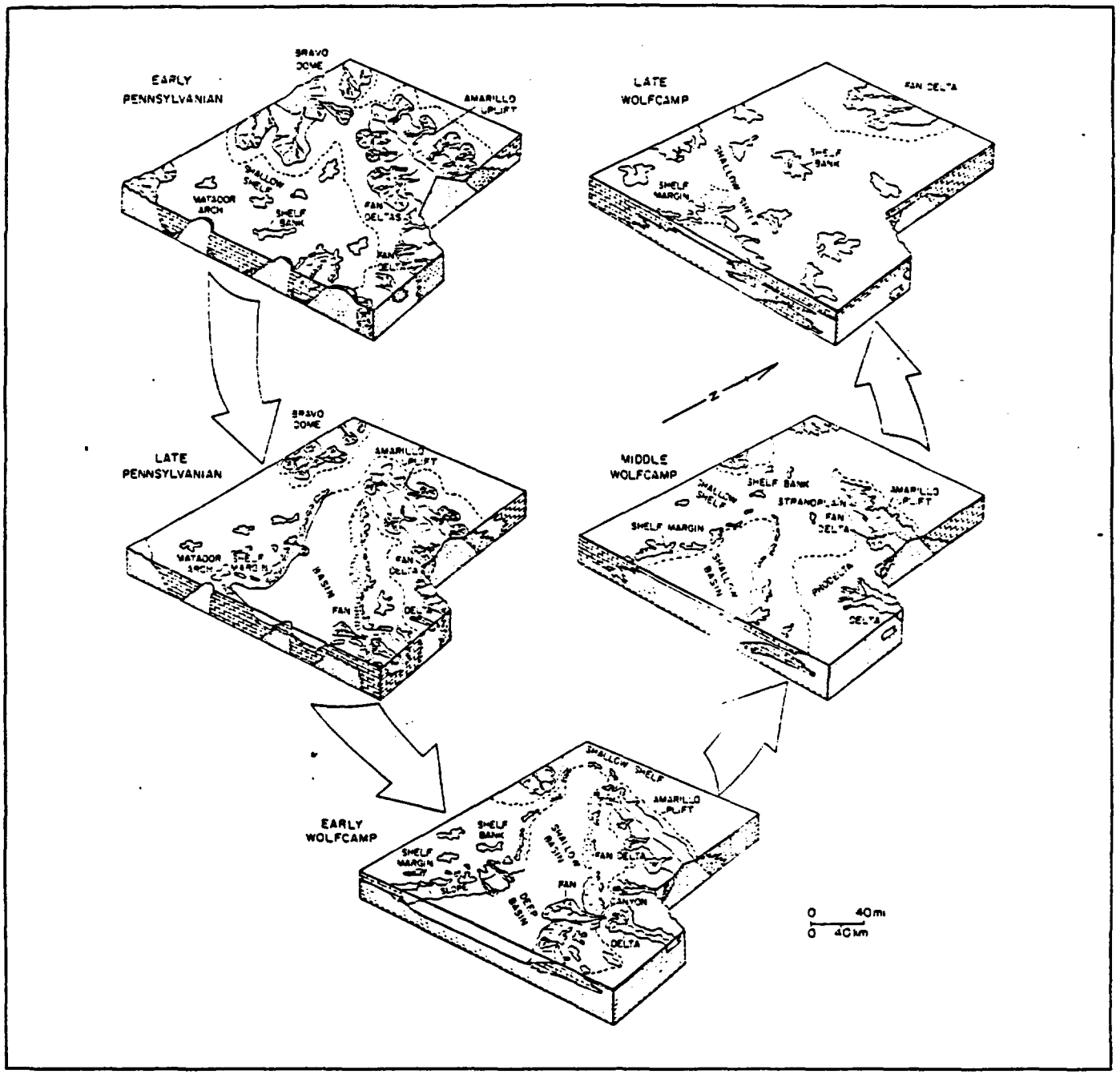


Figure 23. Block diagrams of paleogeographic evolution of Palo Duro Basin during Pennsylvanian and Wolfcampian time (from Handford and Dutton, 1980).

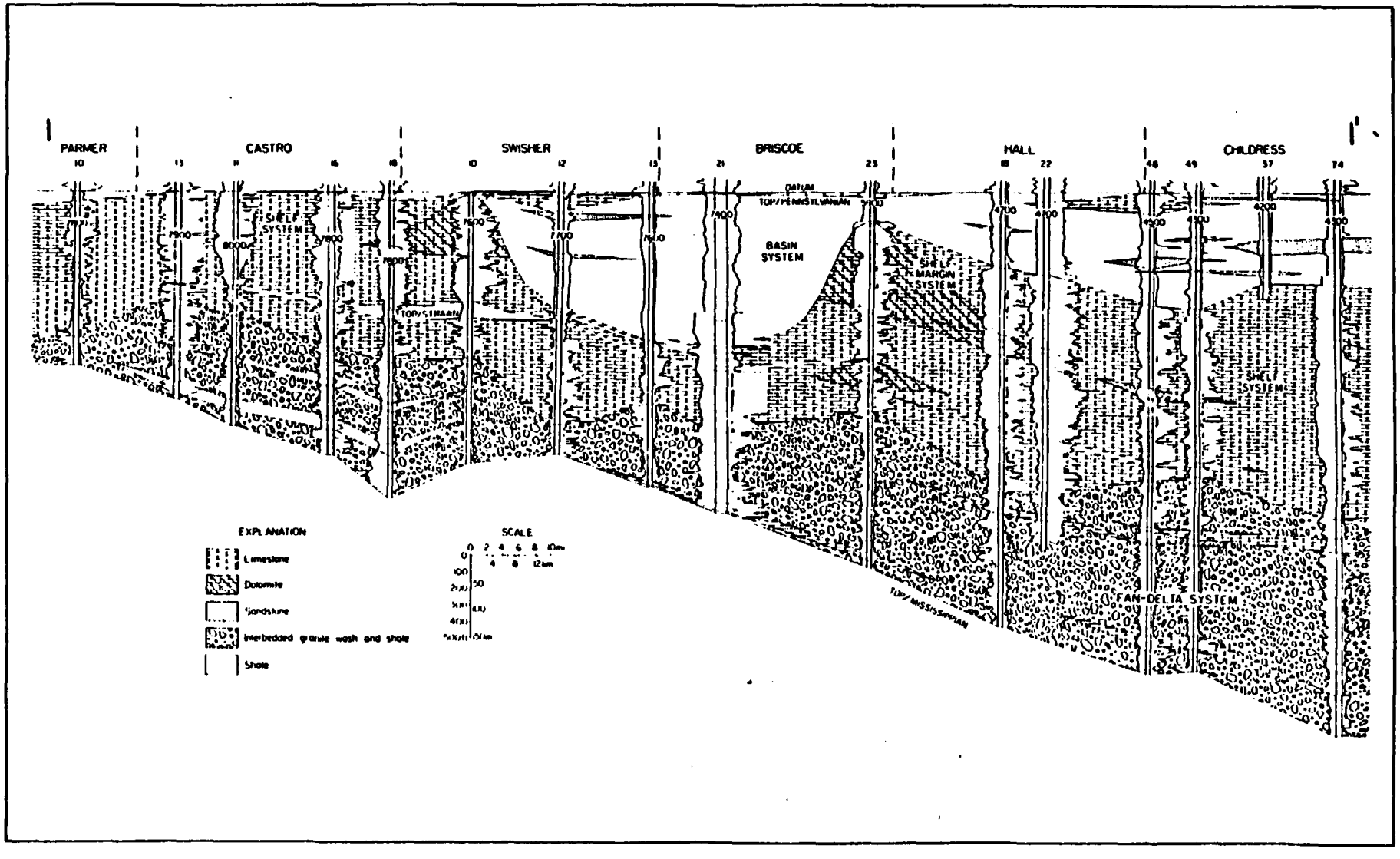


Figure 25. East-west cross section I-I' of Pennsylvanian strata, Parmer to Childress Counties (see fig. 3 for location).

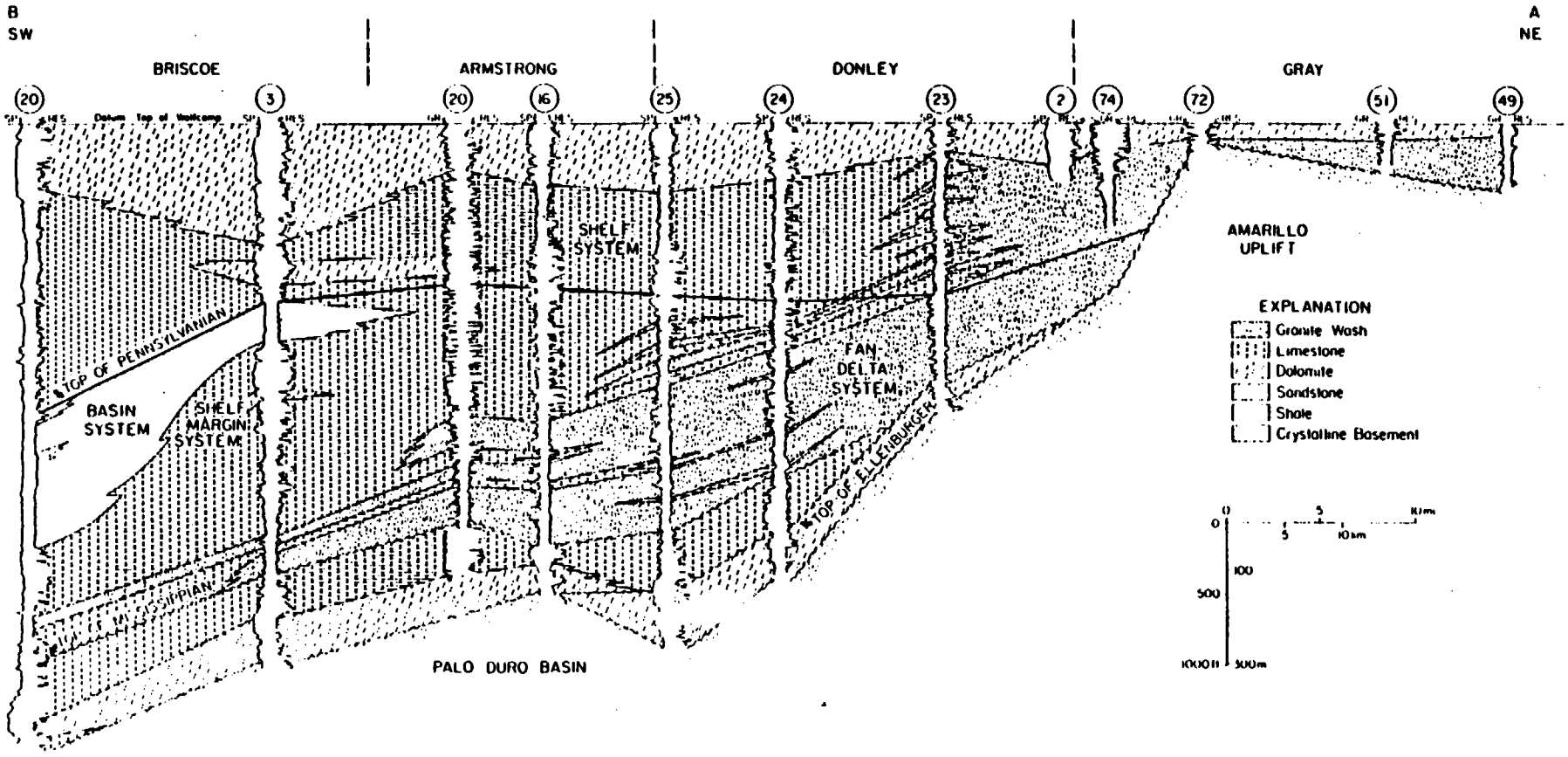


Figure 59. North-south regional cross section A-B from the central Palo Duro Basin to the Amarillo Uplift. Line of section shown in figure 57.

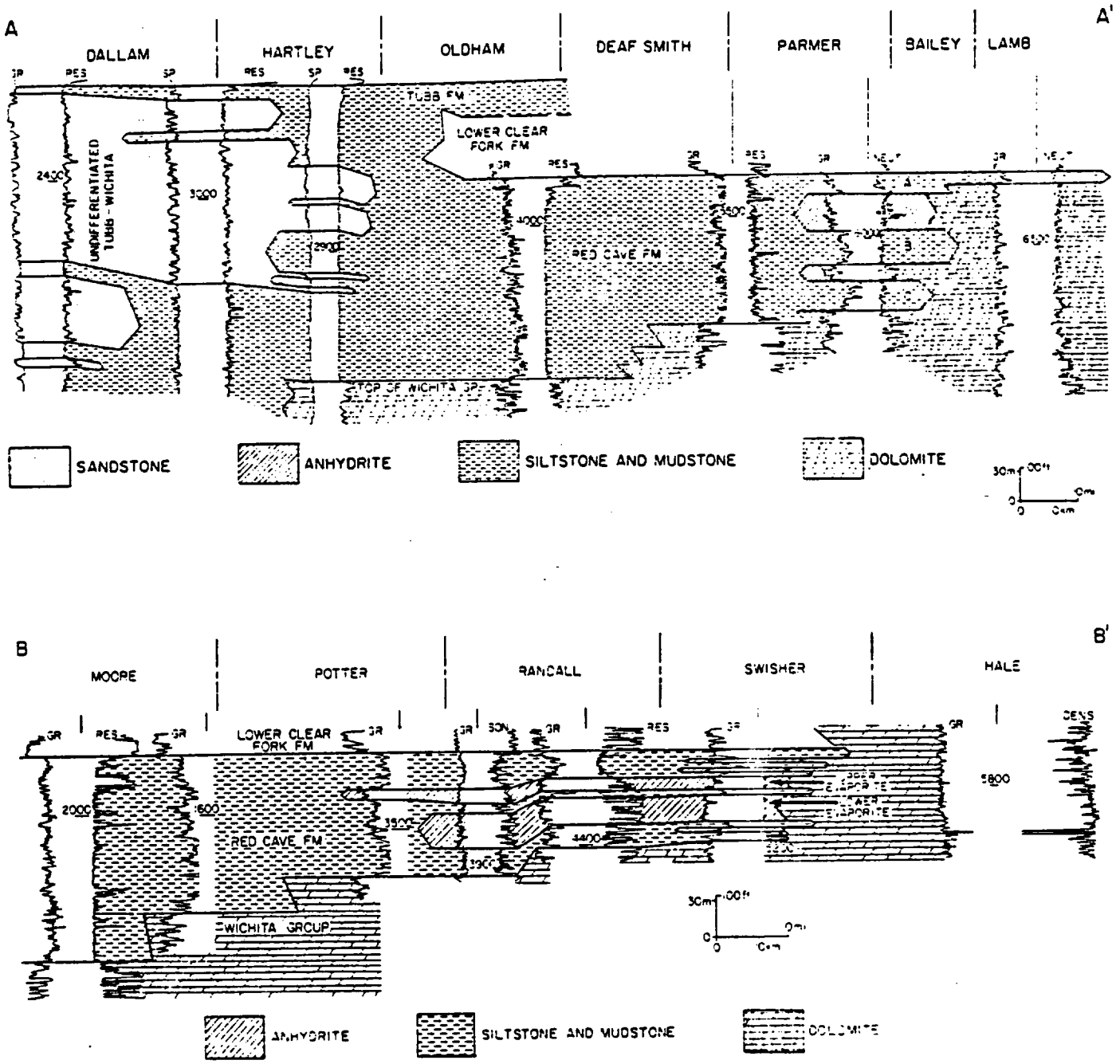


Figure 3. North-south cross sections A-A' and B-B' through the Red Cave Formation.

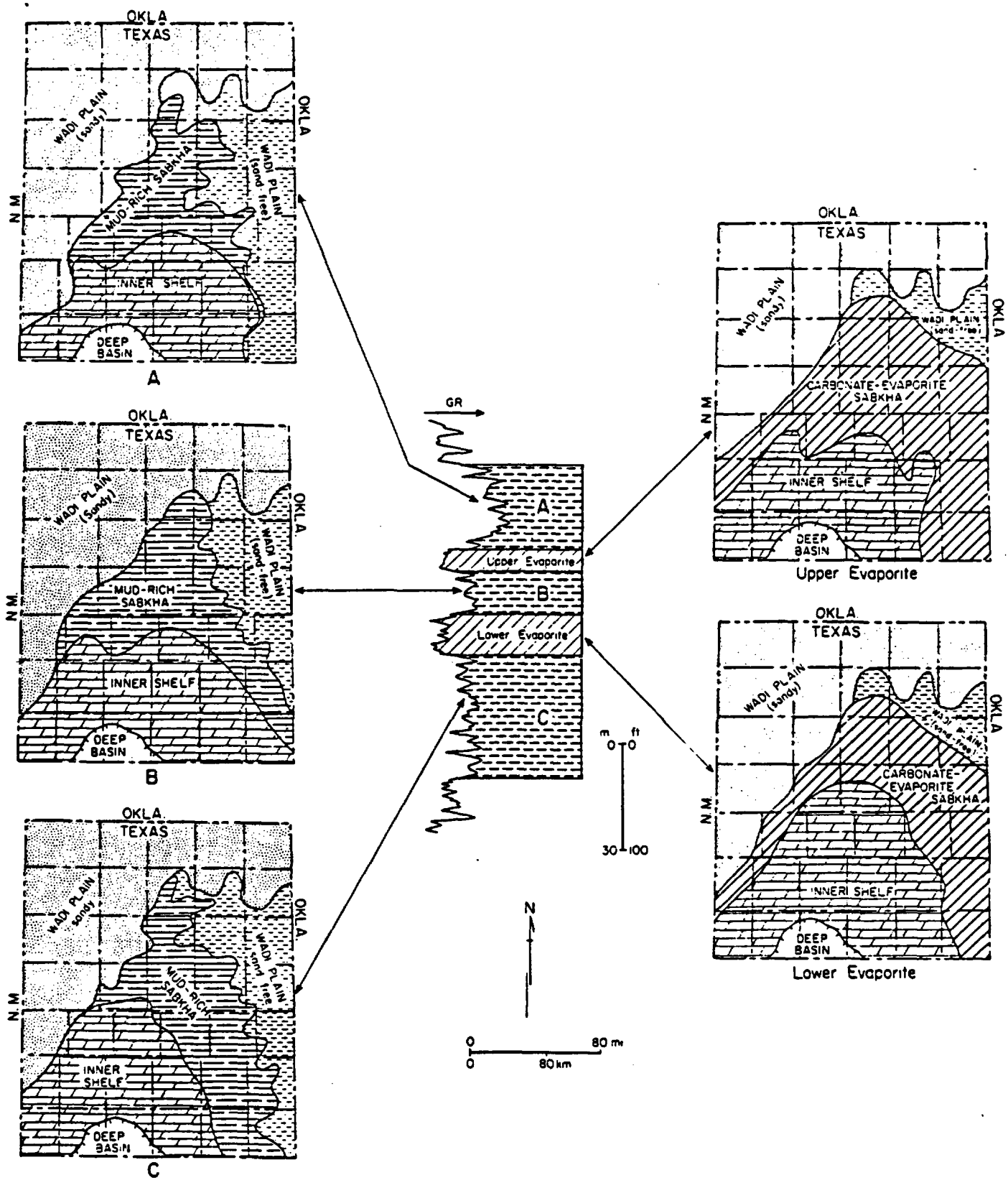


Figure 19. Paleogeography of the Red Cave Formation. Cyclic clastic and carbonate-evaporite facies reflect alternating styles of sabkha deposition that were brought on by the periodic availability and supply of clastics to sabkha environments.

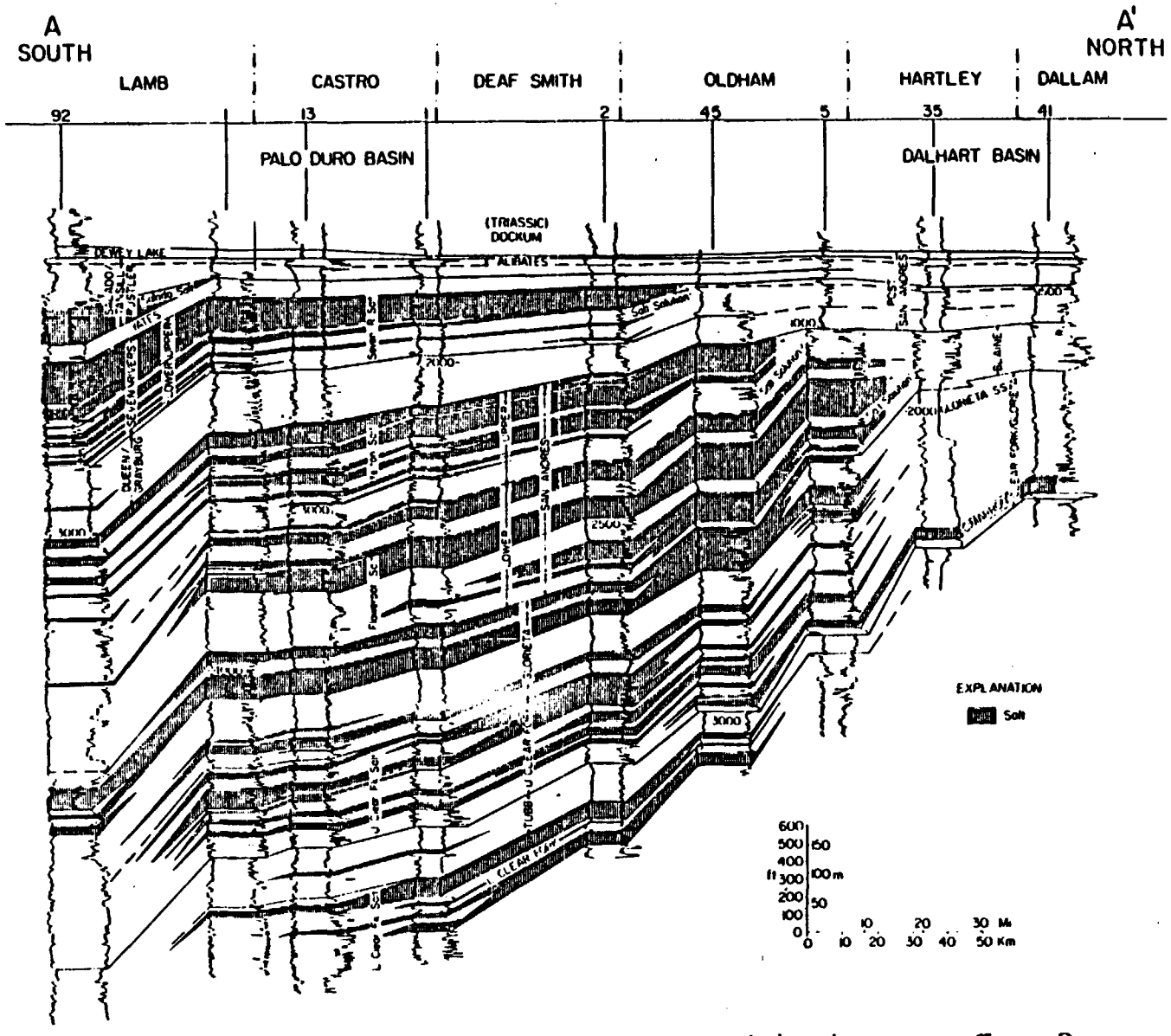


Figure 5. North-south cross section, Upper Permian salt-bearing strata, Texas Panhandle. Generalized salt units are correlated. Location of section in figure 4.

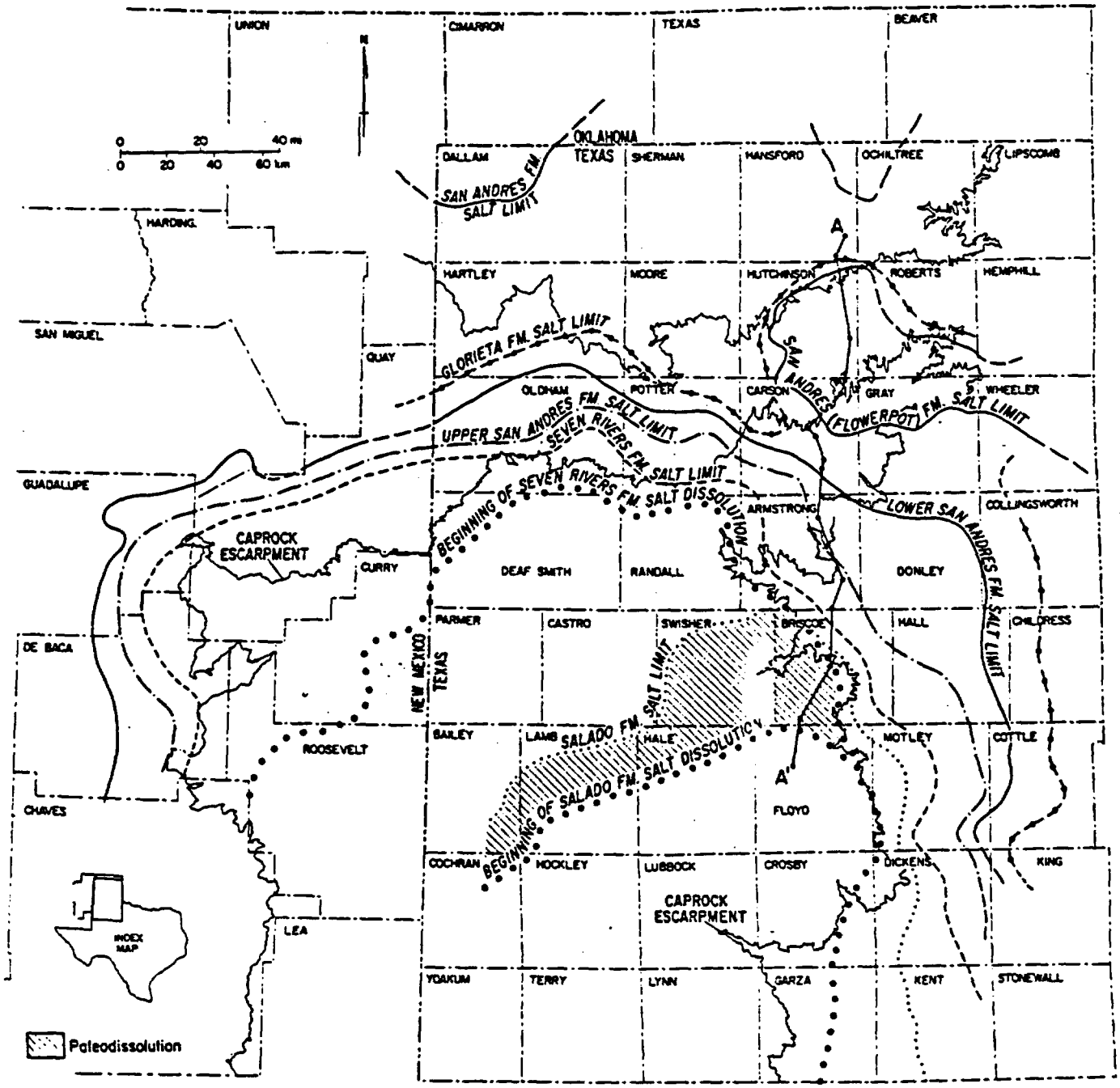


Figure 72. Salt dissolution zones, Texas Panhandle and eastern New Mexico. Except for the Seven Rivers and Salado Formations, where both the beginning of salt dissolution and the limit of salt are shown, the limit of salt for the younger formation marks the approximate beginning of salt dissolution for the next older formation (from Dutton and others, 1979).

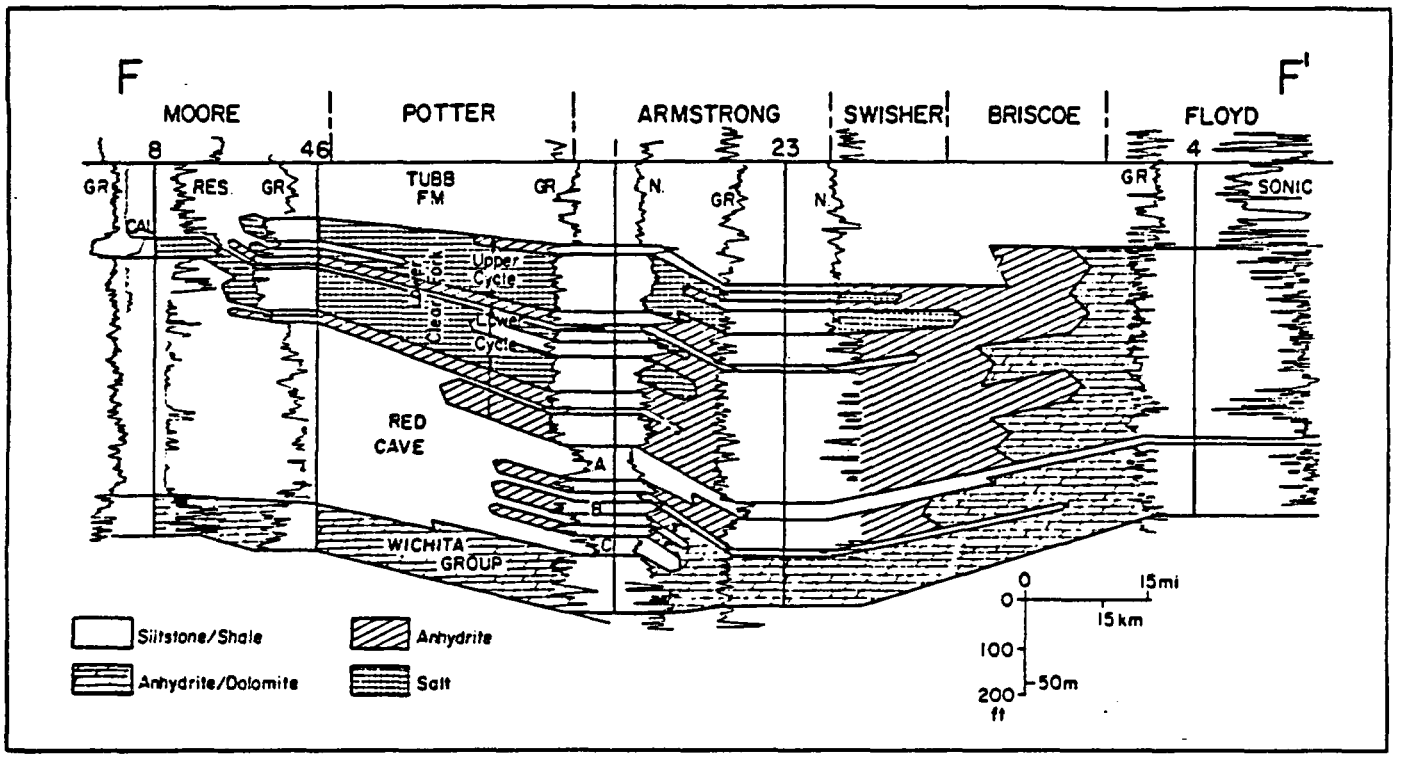


Figure 34. North-south cross section F-F' of lower Clear Fork Formation. See figure 3 for location (from Handford, 1981).

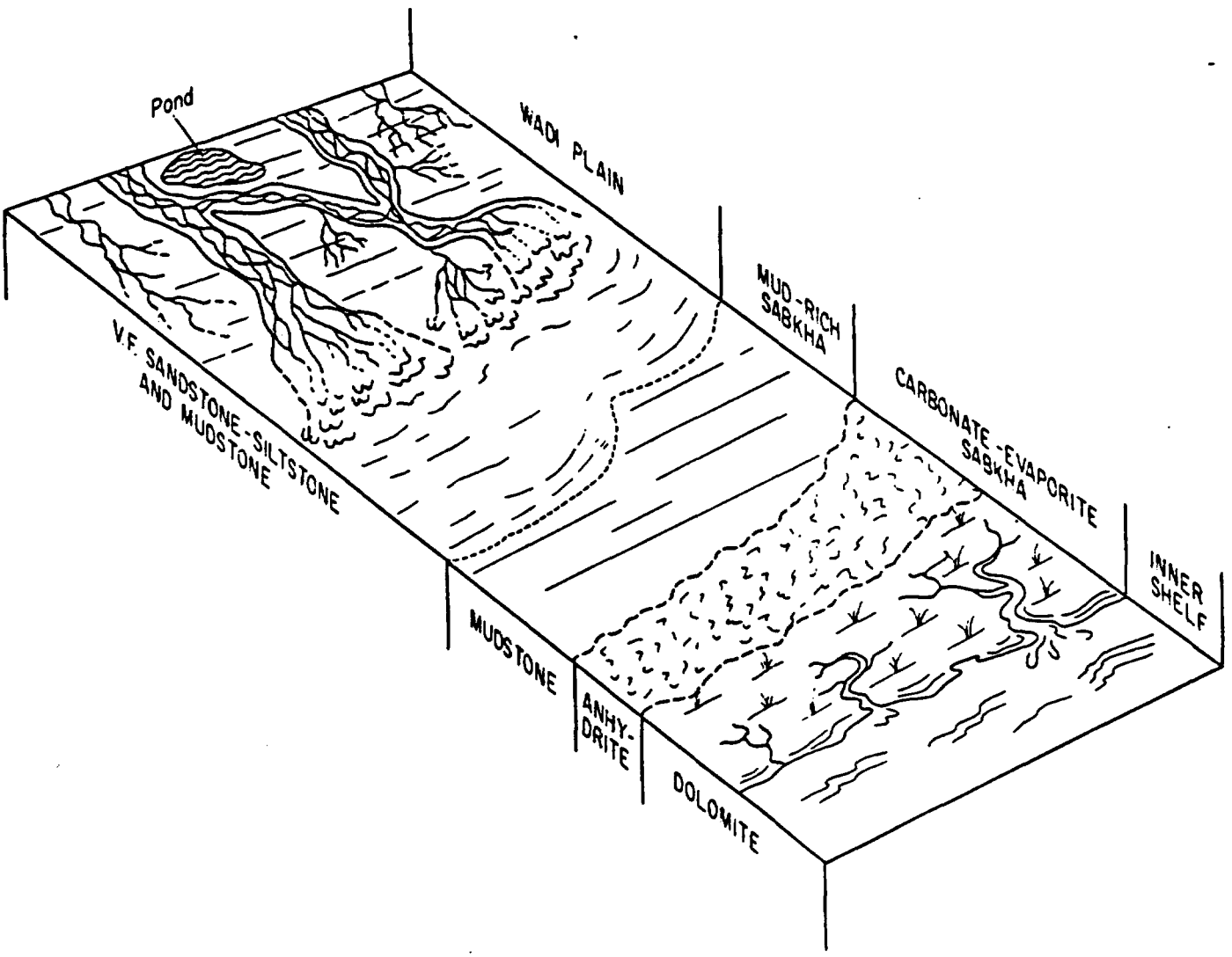


Figure 17. Composite depositional model for Red Cave carbonate, evaporite, and clastic facies.

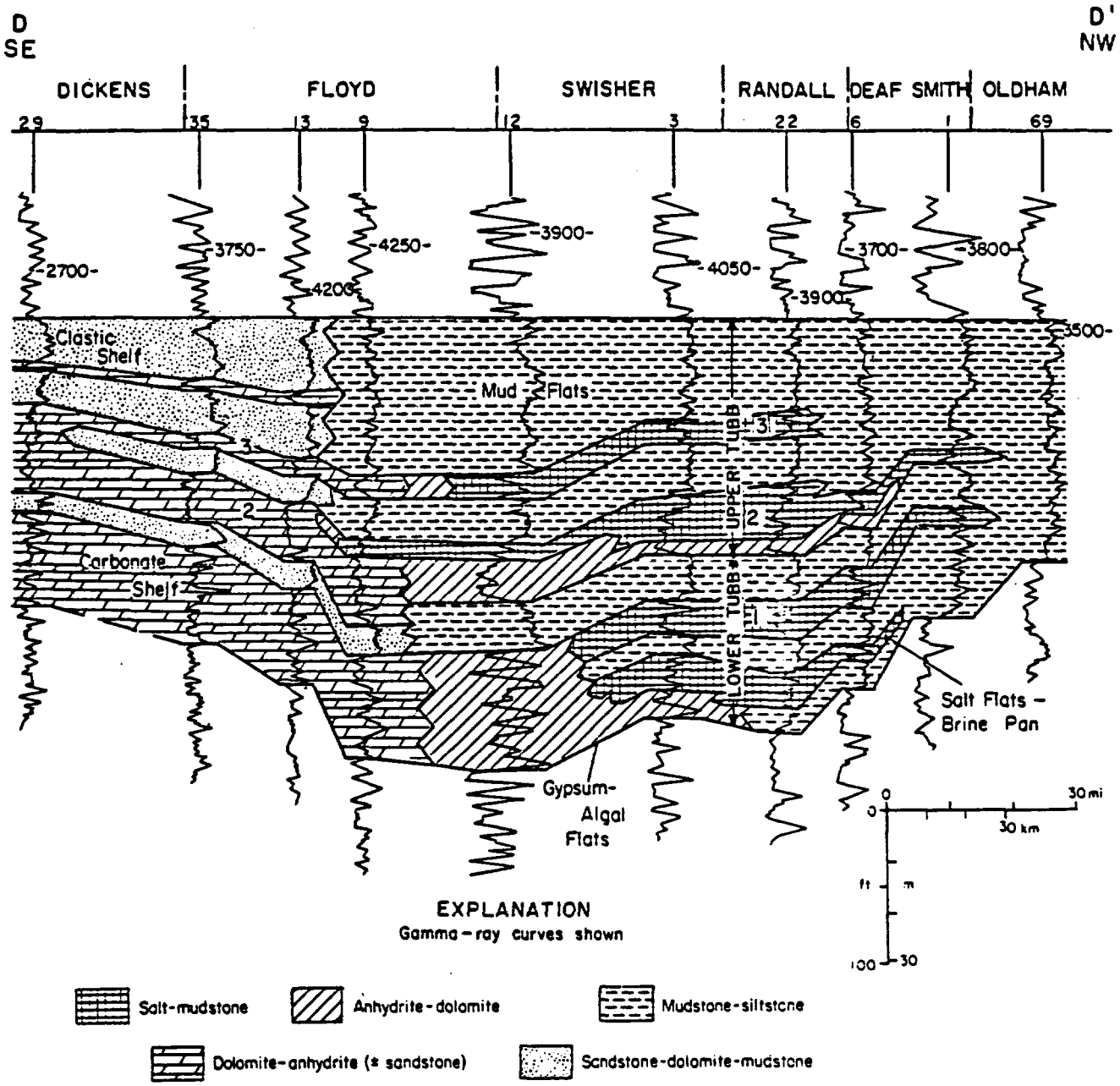


Figure 41. Northwest-southeast cross section, Tubb Formation, Palo Duro Basin. Line of cross section is indicated in figure 87. From Presley (1980b).

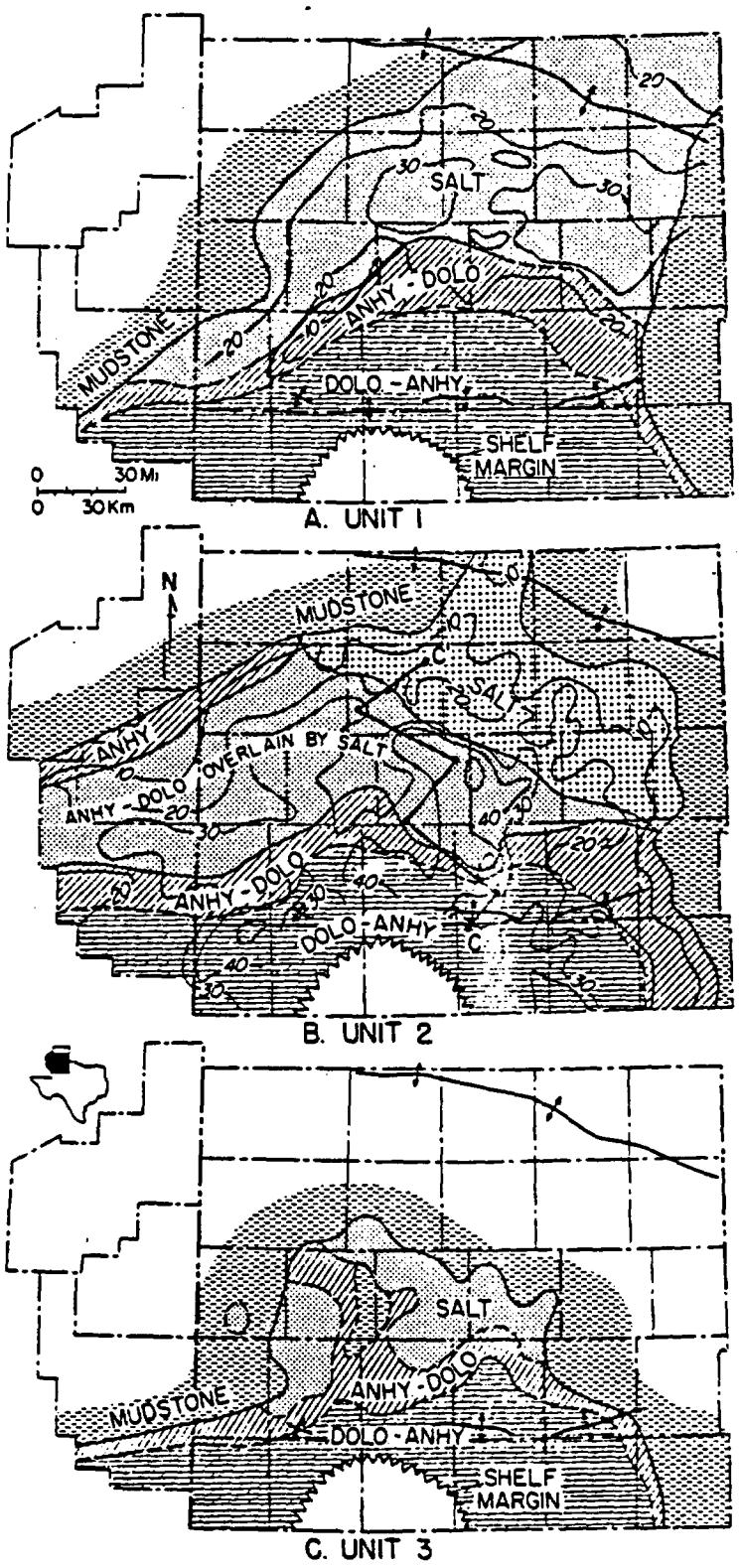


Figure 42. Facies maps of evaporite-carbonate units 1, 2, and 3 (oldest to youngest) of the Tubb Formation. Salt is dominant in updip regions to the north; carbonate is dominant to the south. These units show progressive southerly migration of evaporite-carbonate facies. From Presley (1980b).

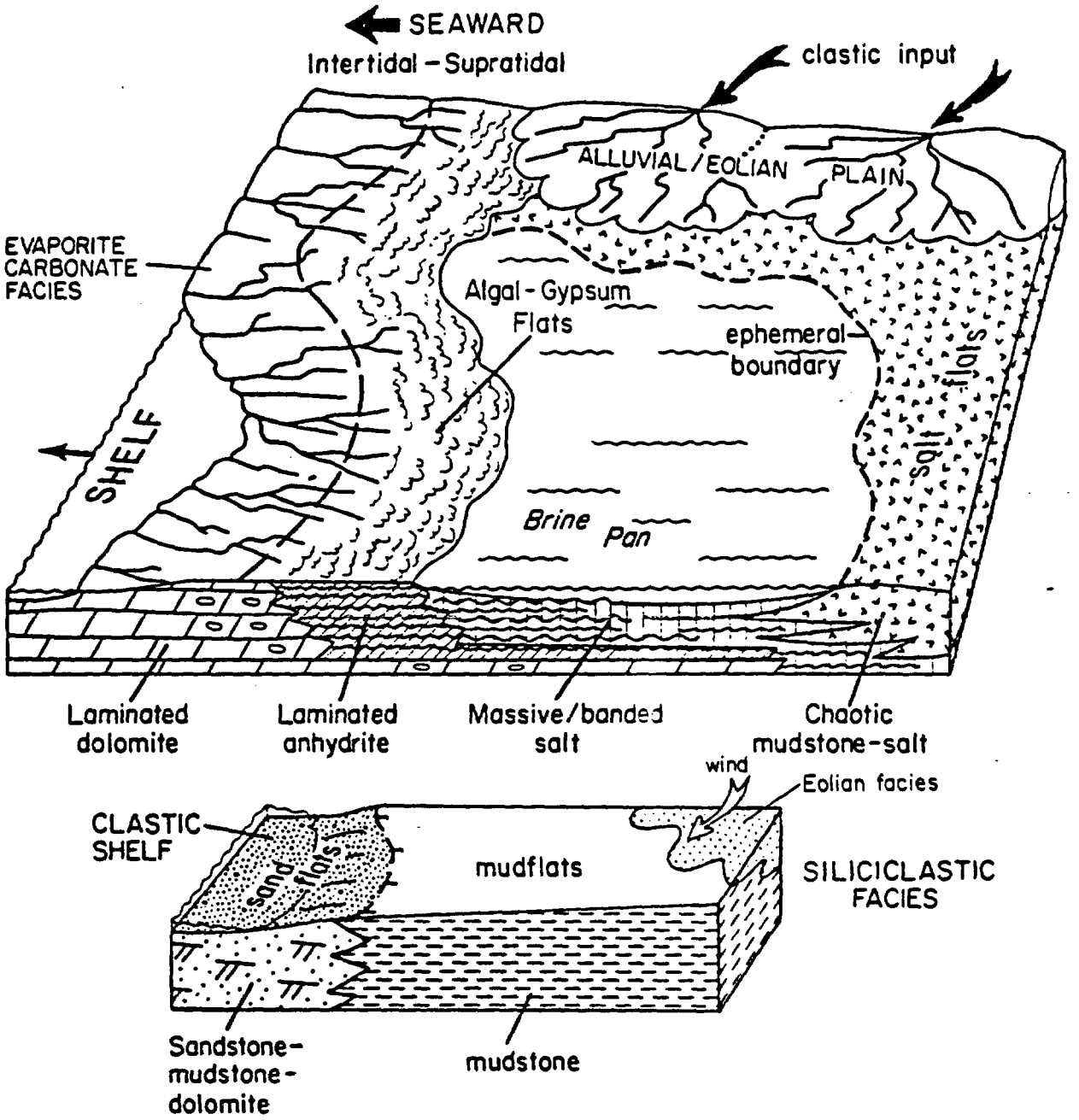


Figure 40. Facies and environments recorded in Tubb strata of the Palo Duro and Dalhart Basins. Evaporite-carbonate facies record a gradual basinward shift in environments. Siliciclastic (red-bed) facies dominate the Tubb sequence, and were deposited in tidal mud flats, which graded basinward into tidal sand flats. From Presley (1980b).

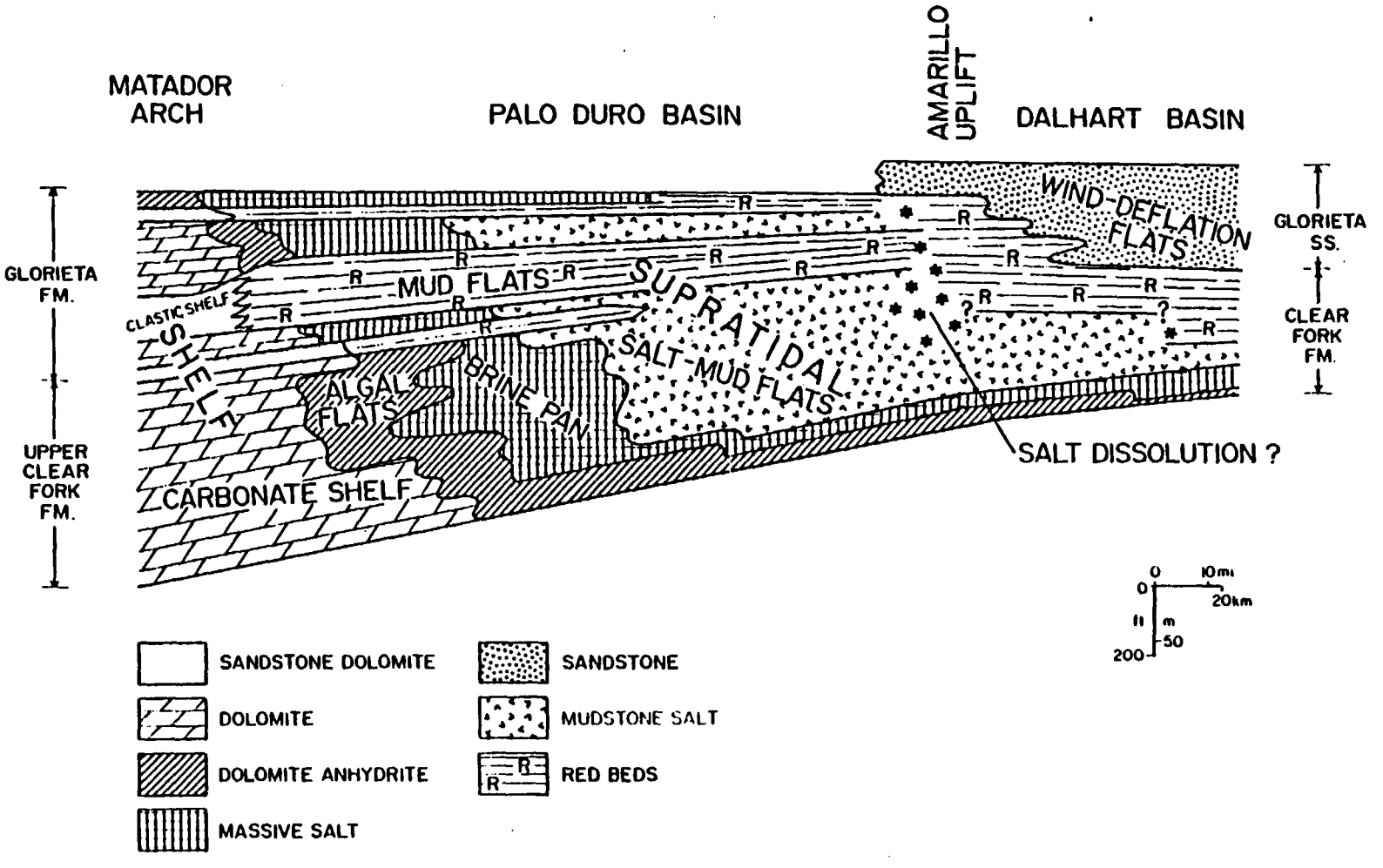


Figure 43. North-south facies cross section through Palo Duro and Dalhart Basins showing relation of environments for the upper Clear Fork and Glorieta Formations. From Presley (unpublished data).

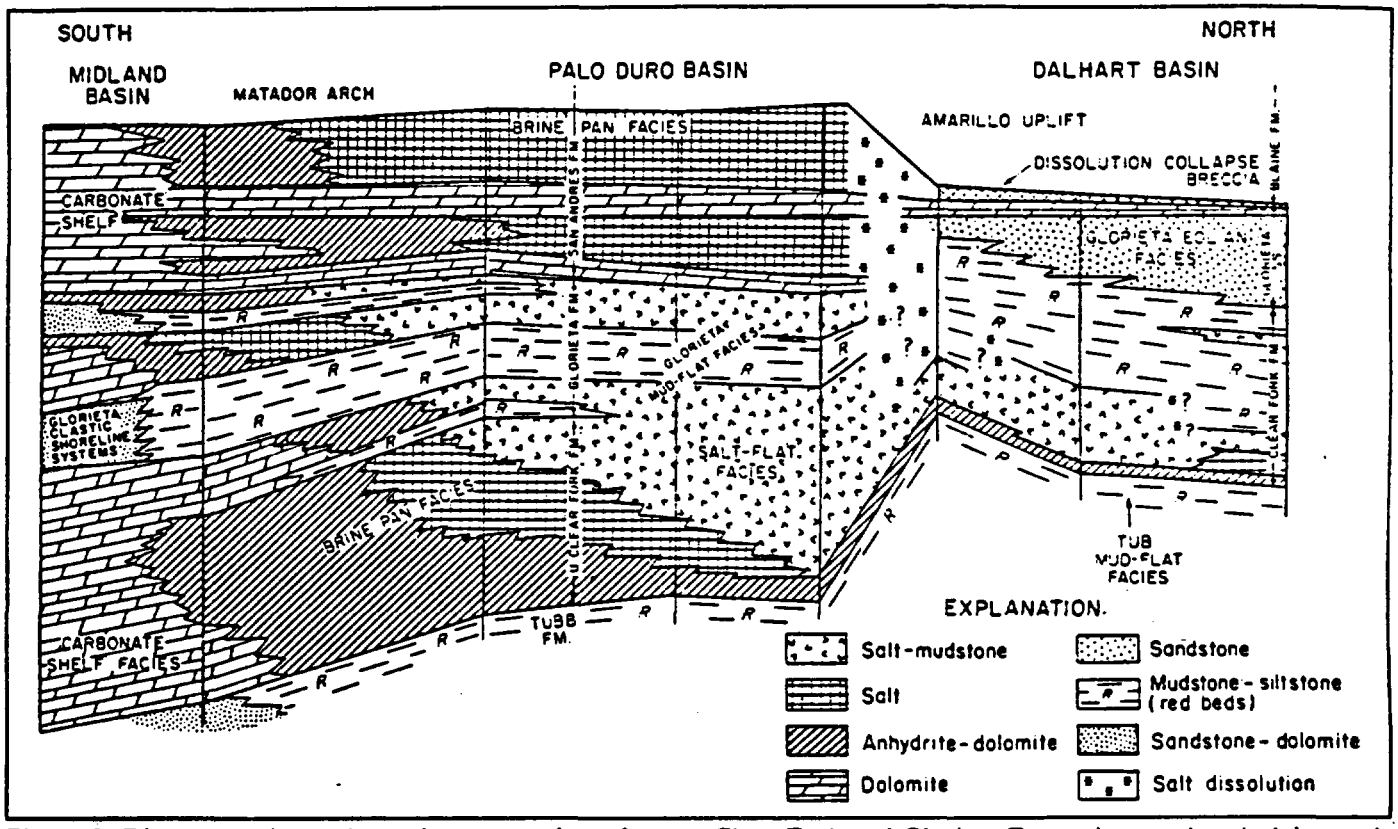


Figure 2. Diagrammatic north-south cross section of upper Clear Fork and Glorieta Formations and underlying and overlying units in Texas Panhandle. Generalized facies interpretations are shown. Location generally follows line of section A-A′ in figure 1.

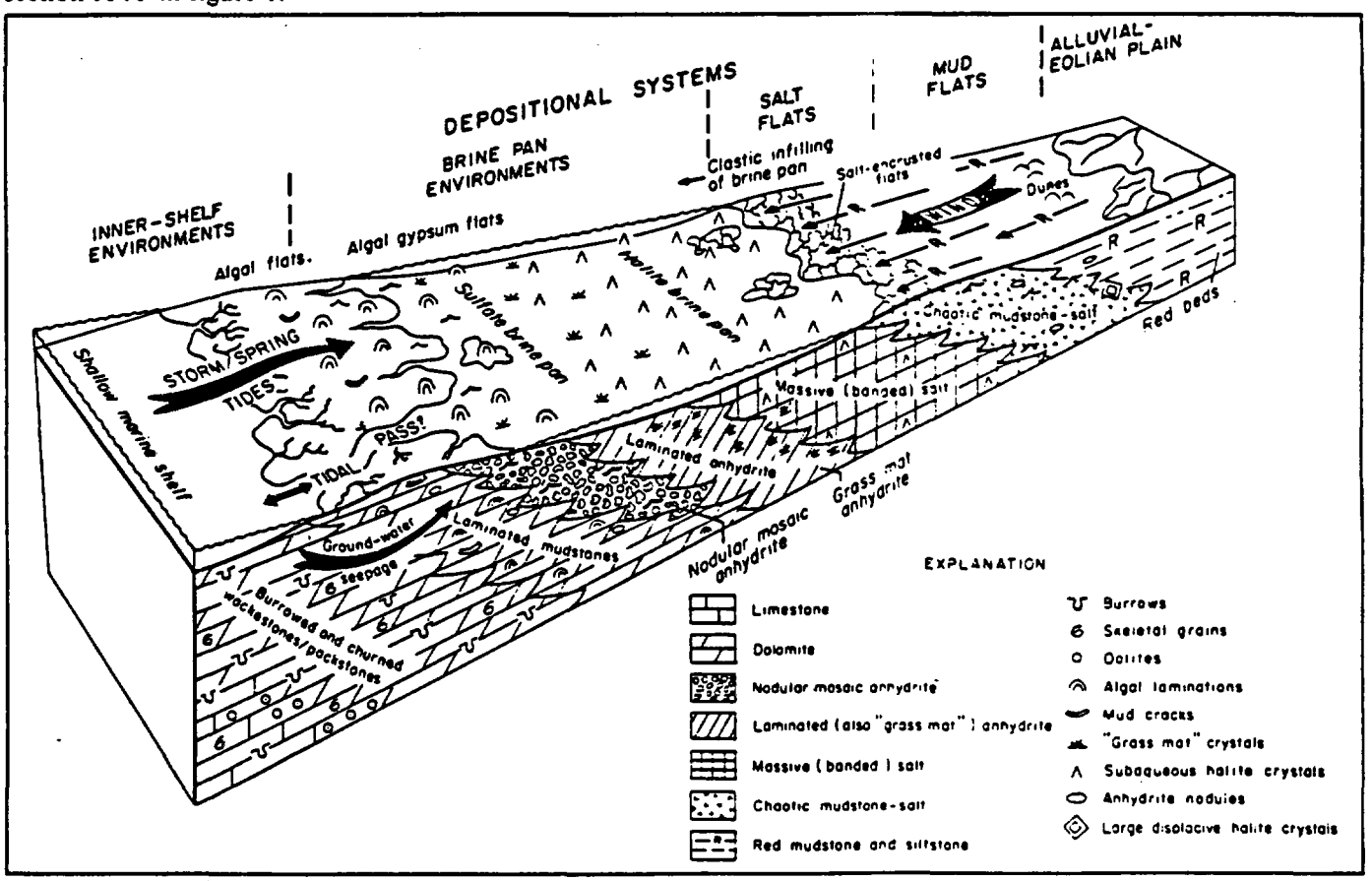


Figure 3. Evaporite and carbonate depositional facies and environments inferred for upper Clear Fork and Glorieta rocks.

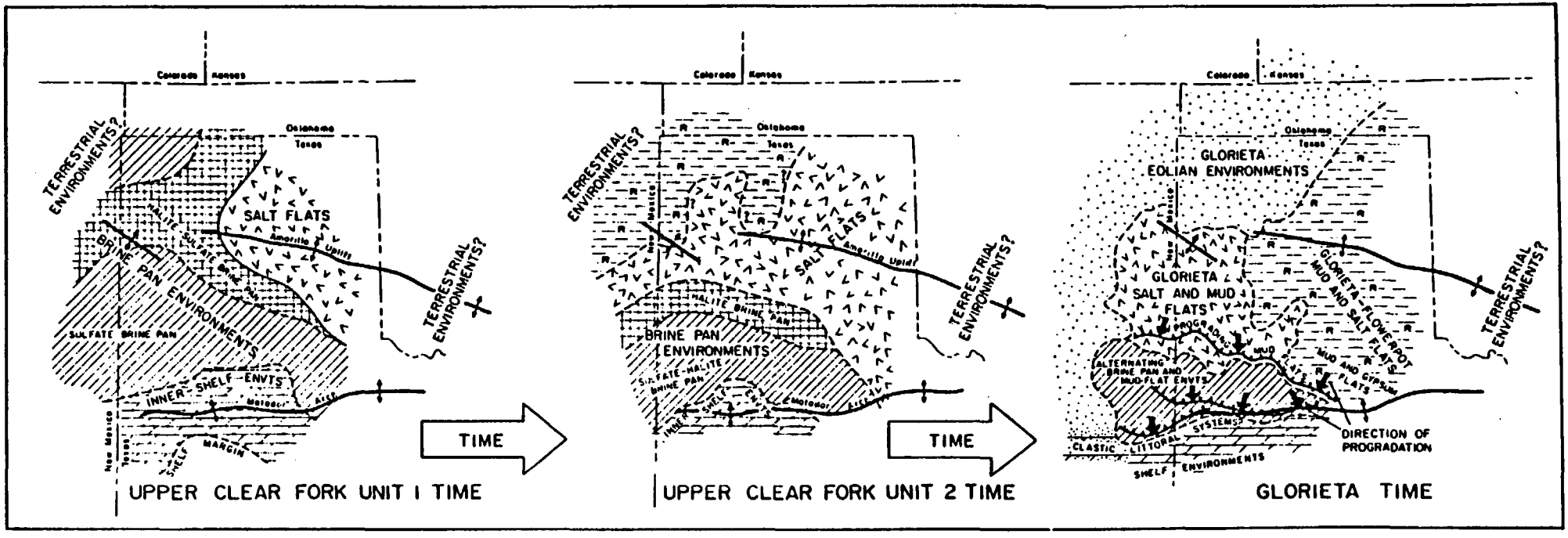


Figure 5. Paleogeography at the time of deposition of the upper Clear Fork and Glorieta Formations.

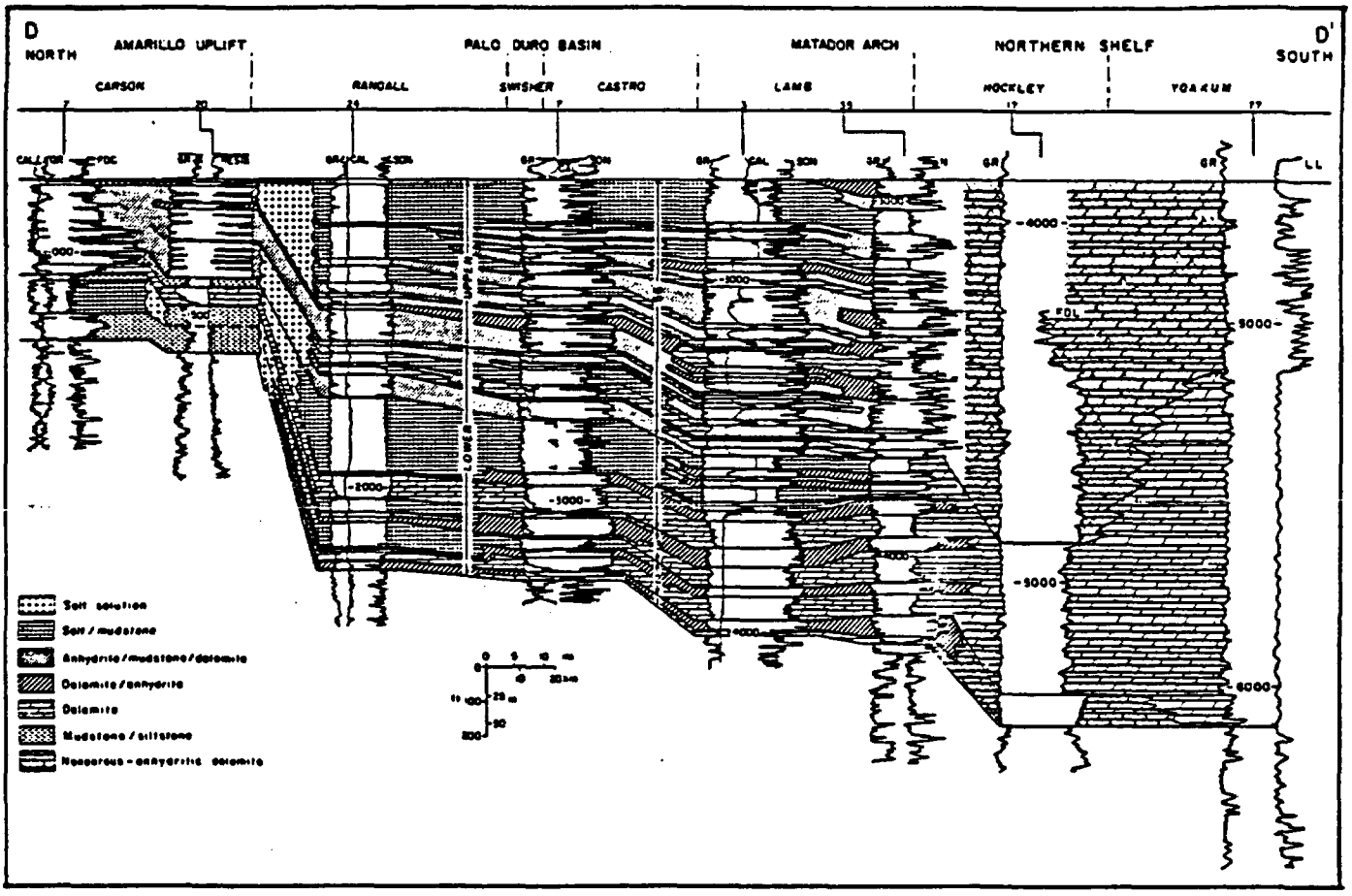
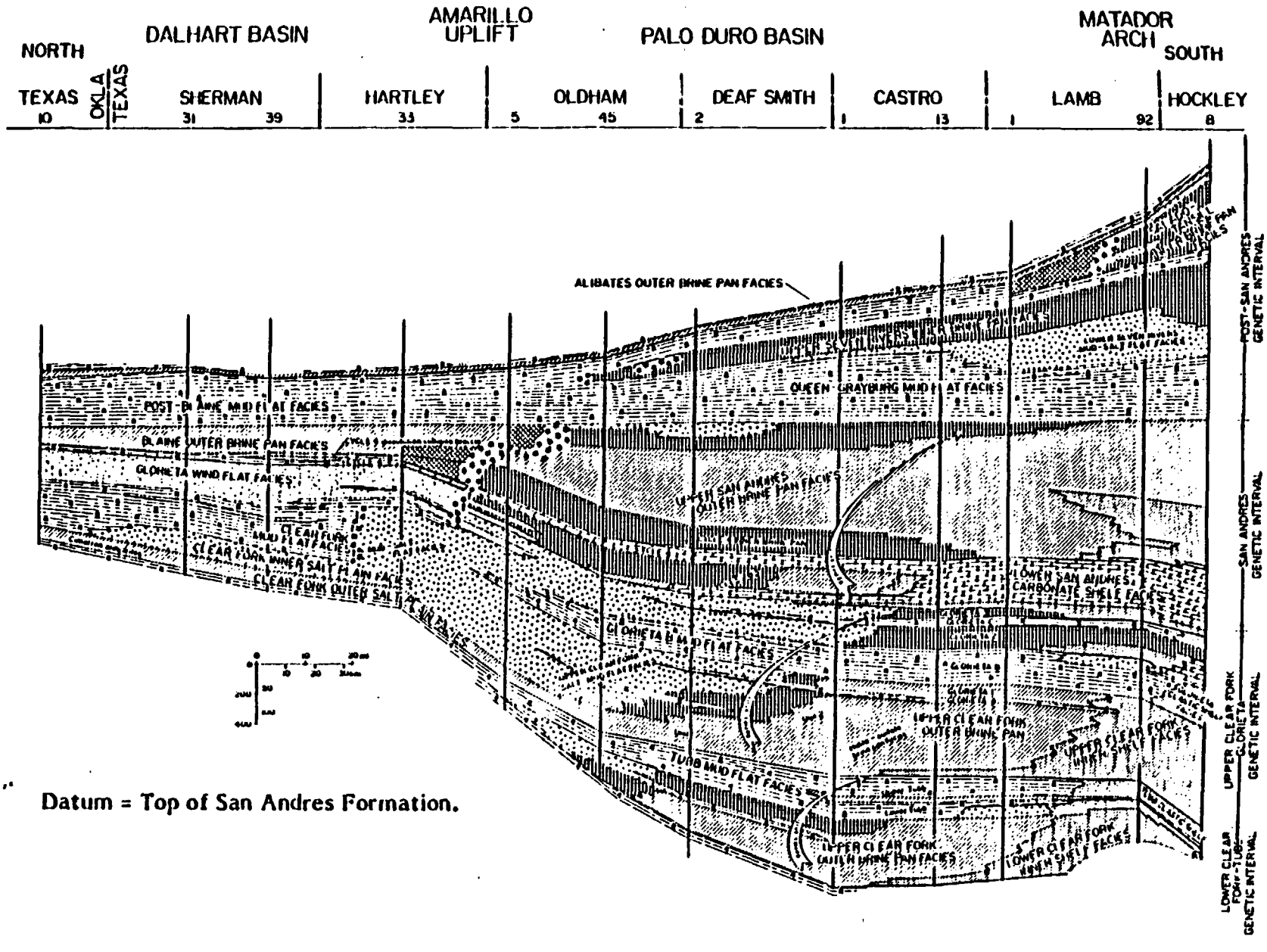


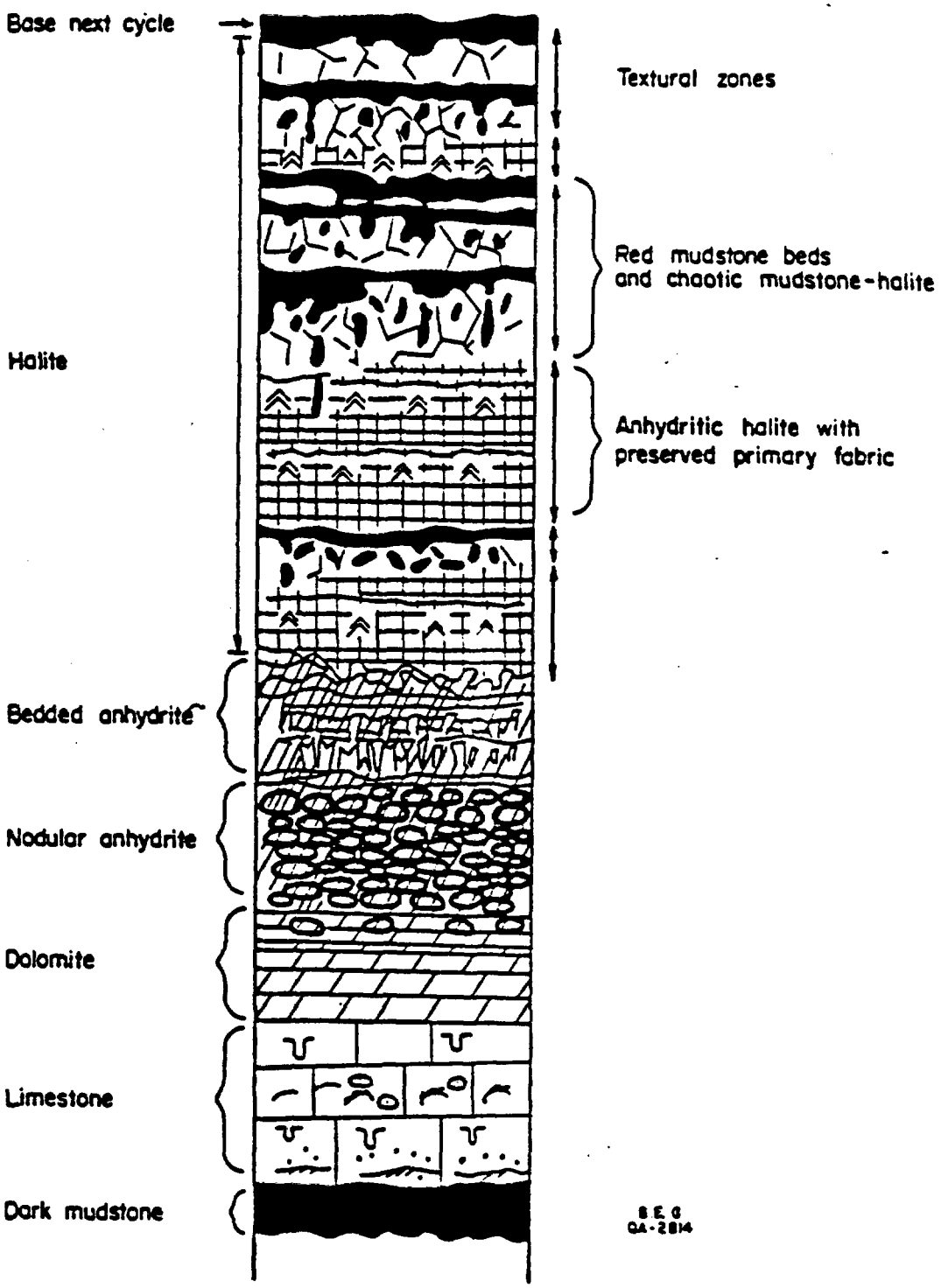
Figure 2. North-south cross section through the study area (after Presley, 1979, and P. Ramondetta, personal communication, 1981). Pinch-out of salt and anhydrite preclude detailed log correlation to the south. Datum: Top San Andres. See figure 1 for line of section.

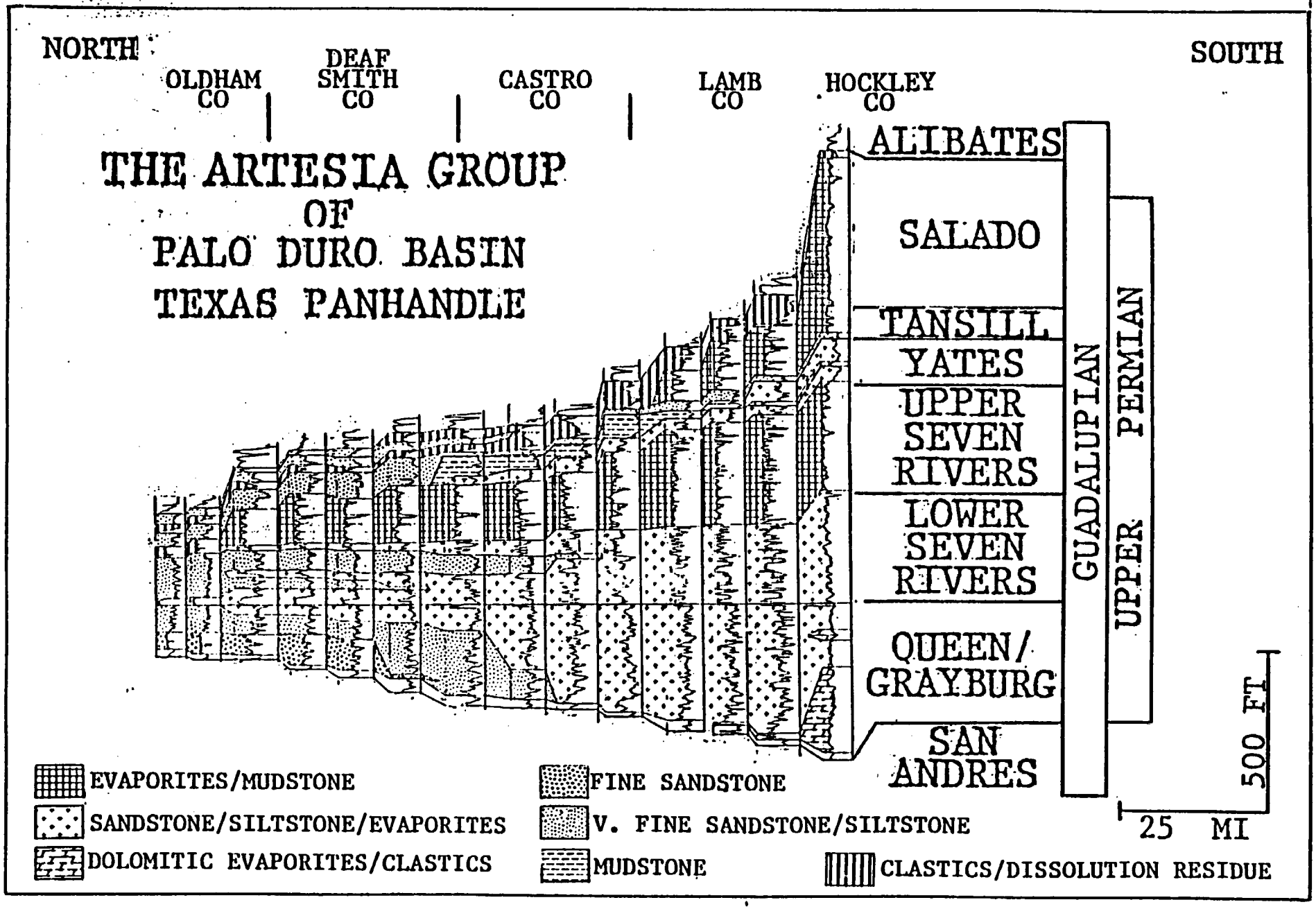
figure 2



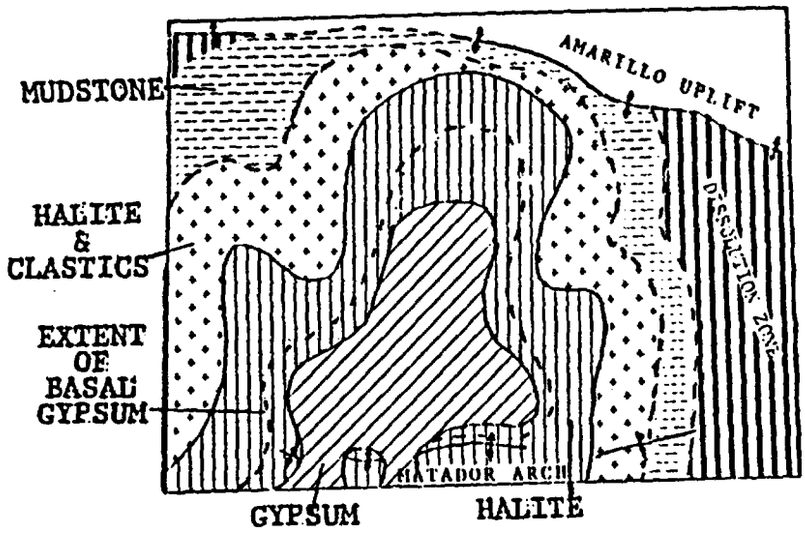
Datum = Top of San Andres Formation.

TYPICAL SAN ANDRES CYCLE

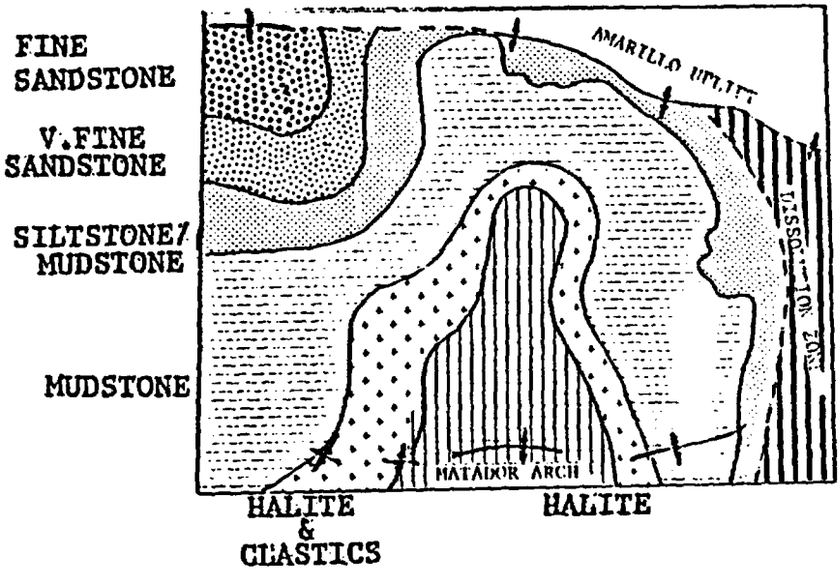



NORTH
SOUTH
OLDHAM CO
DEAF SMITH CO
CASTRO CO
LAMB CO
HOCKLEY CO
THE ARTESIA GROUP
OF
PALO DURO BASIN
TEXAS PANHANDLE
ALIBATES
SALADO
TANSILL
YATES
UPPER SEVEN RIVERS
LOWER SEVEN RIVERS
QUEEN/ GRAYBURG
SAN ANDRES
GUADALUPIAN
UPPER PERMIAN
500 FT
25 MI
EVAPORITES/MUDSTONE
SANDSTONE/SILTSTONE/EVAPORITES
DOLOMITIC EVAPORITES/CLASTICS
FINE SANDSTONE
V. FINE SANDSTONE/SILTSTONE
MUDSTONE
CLASTICS/DISSOLUTION RESIDUE

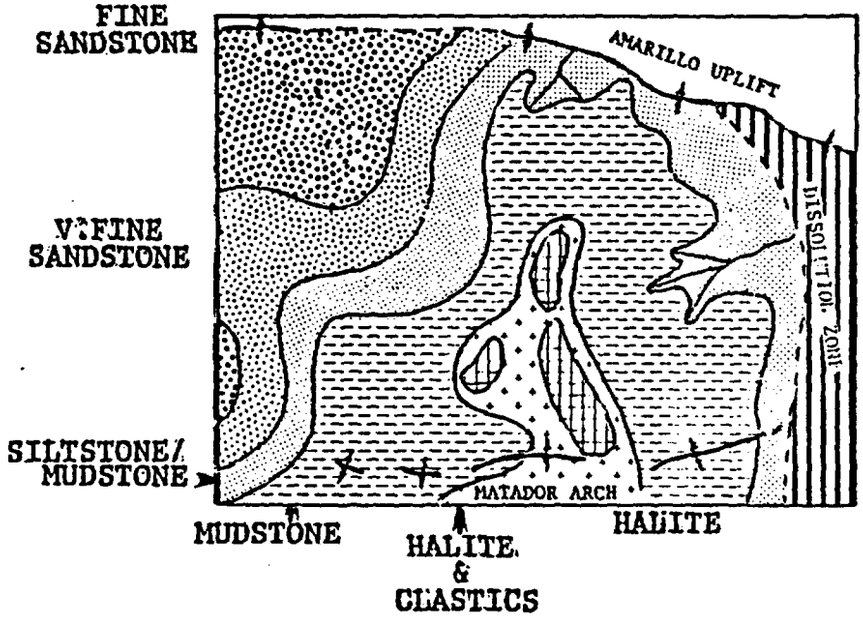
STAGE I



STAGE II



STAGE III



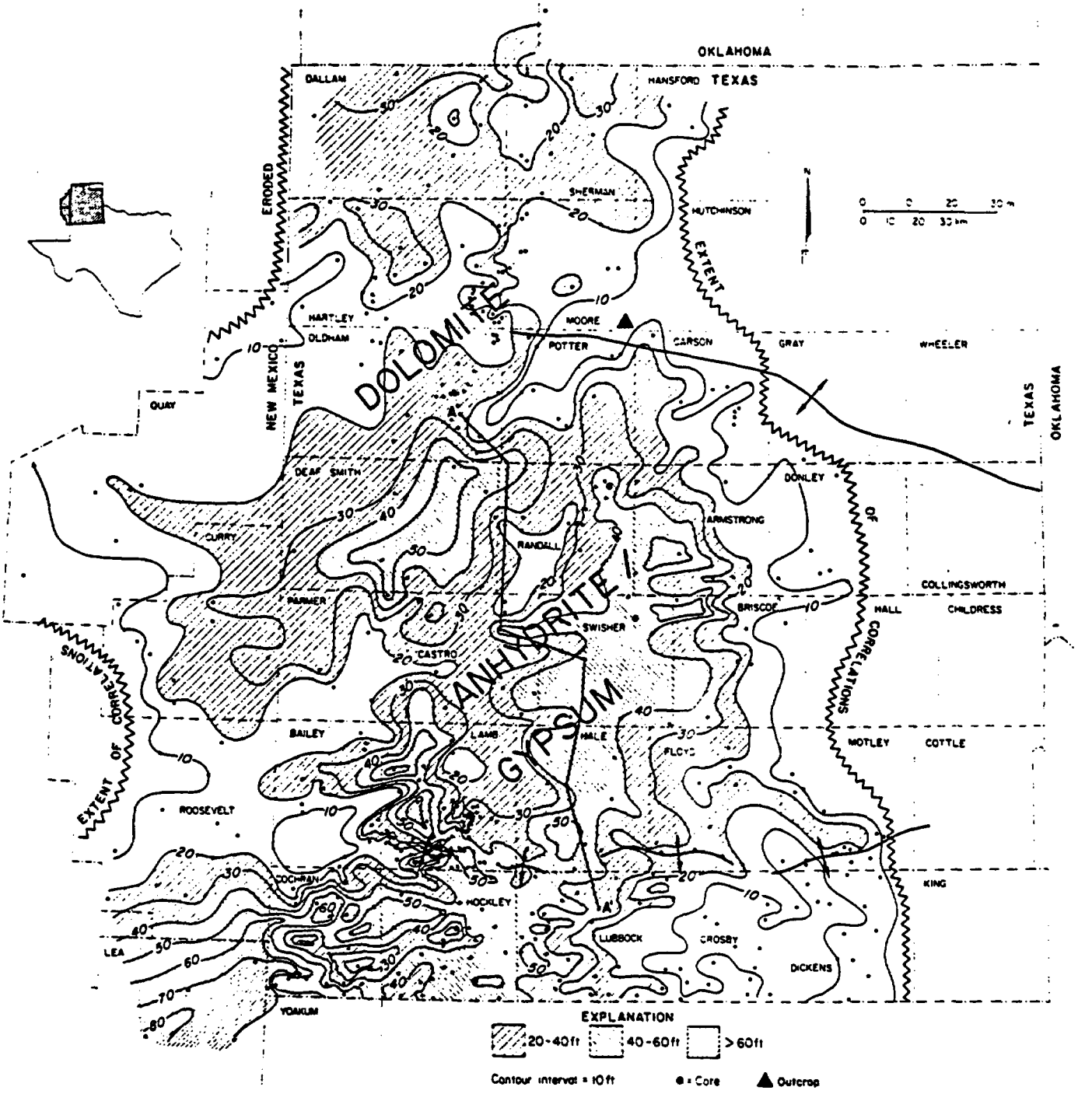


Figure 10. Isopach map, Alibates Formation. Serrate lines mark limit of correlation and erosional boundaries. Outcrop shown in Moore County. Maximum thickness in central and southern Palo Duro Basin.

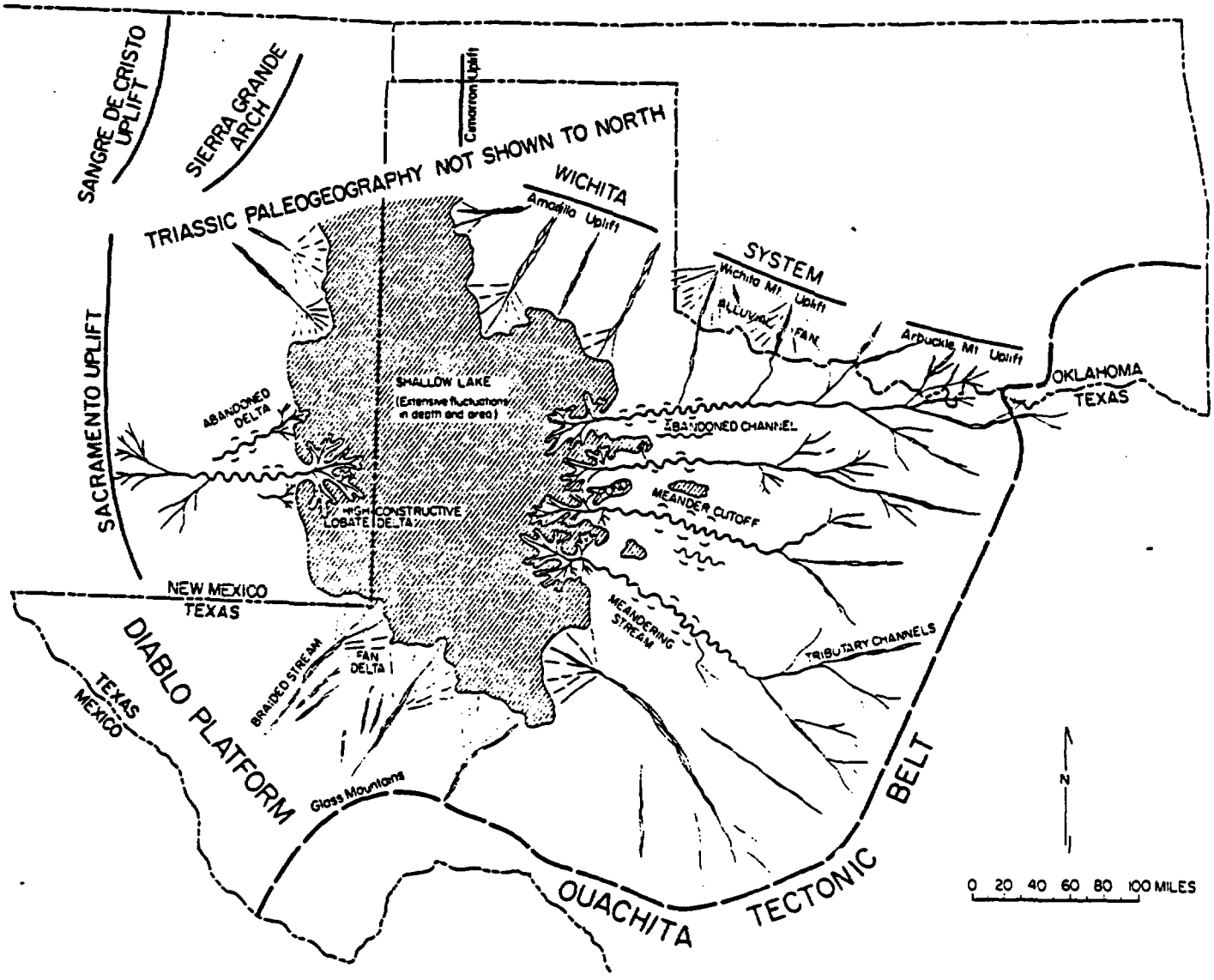
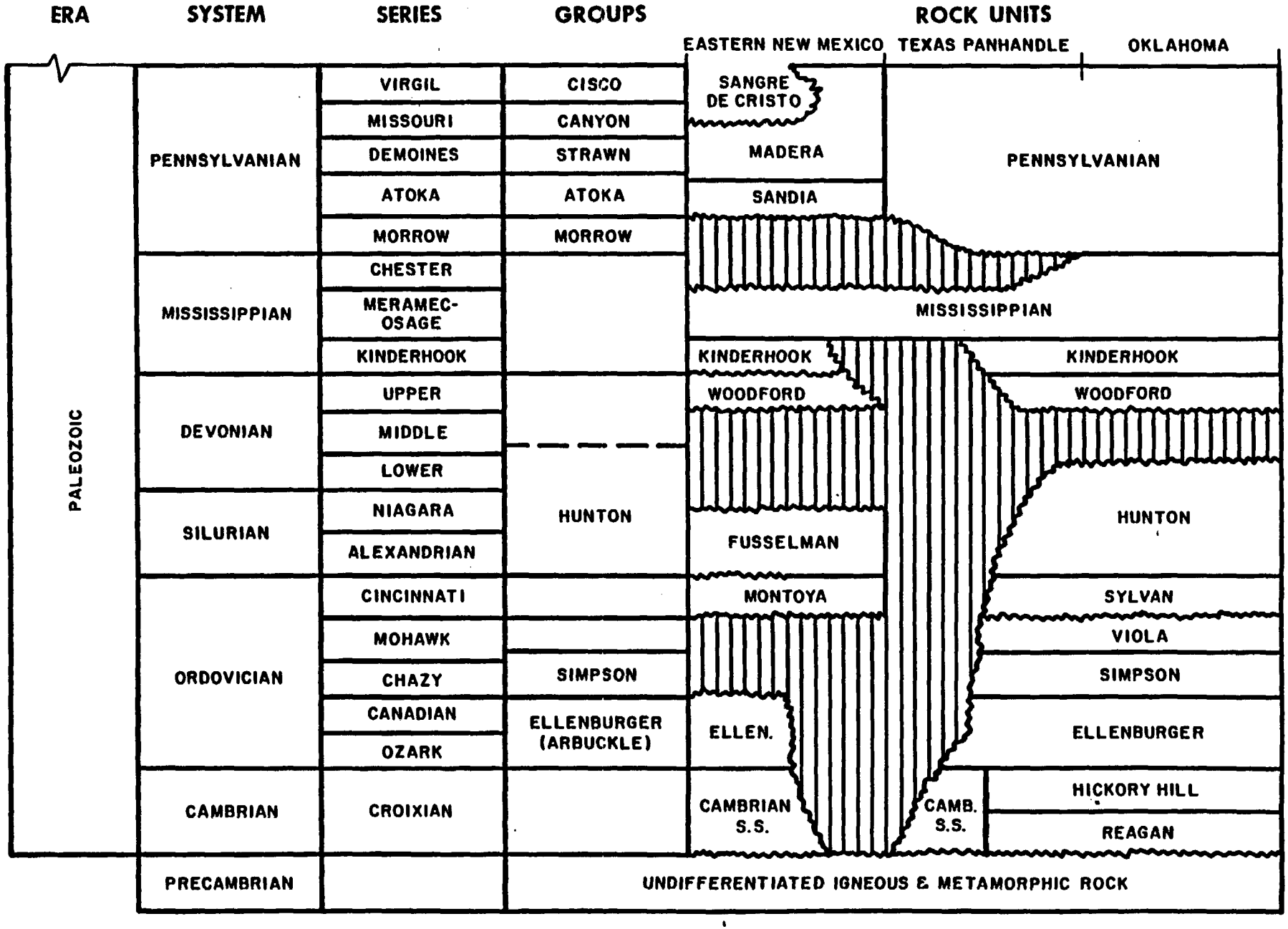


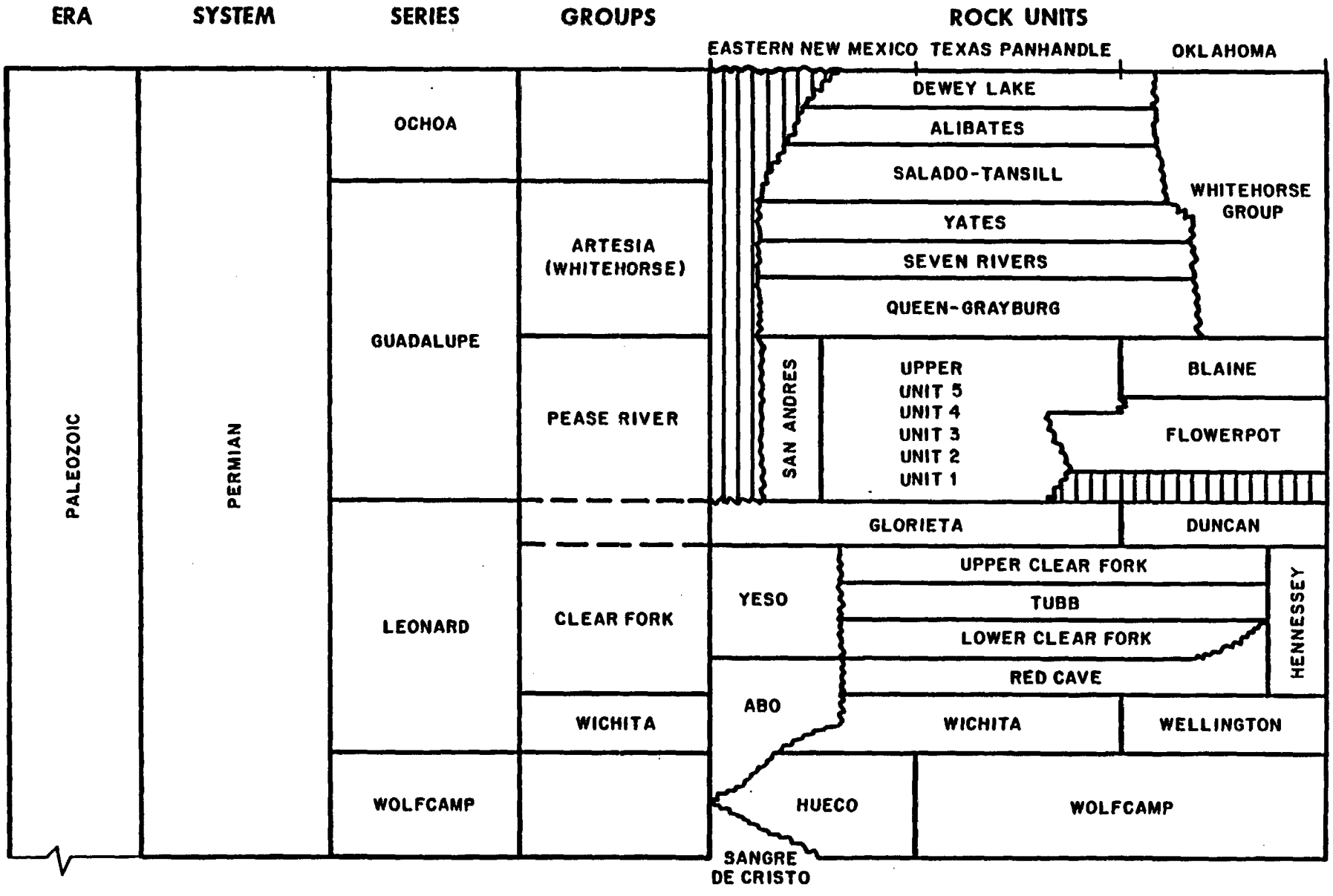
Figure 5. Inferred paleogeography during the initial stage of Dockum sedimentation in the area south of Amarillo Uplift - Bravo Dome. Depositional elements are braided streams, alluvial fans, fan deltas, meandering streams, distributary deltas, and shallow lakes.

STRATIGRAPHIC SECTION CONT.
PRECAMBRIAN TO PENNSYLVANIAN



85-44,008

STRATIGRAPHIC SECTION CONT.
PERMIAN SYSTEM



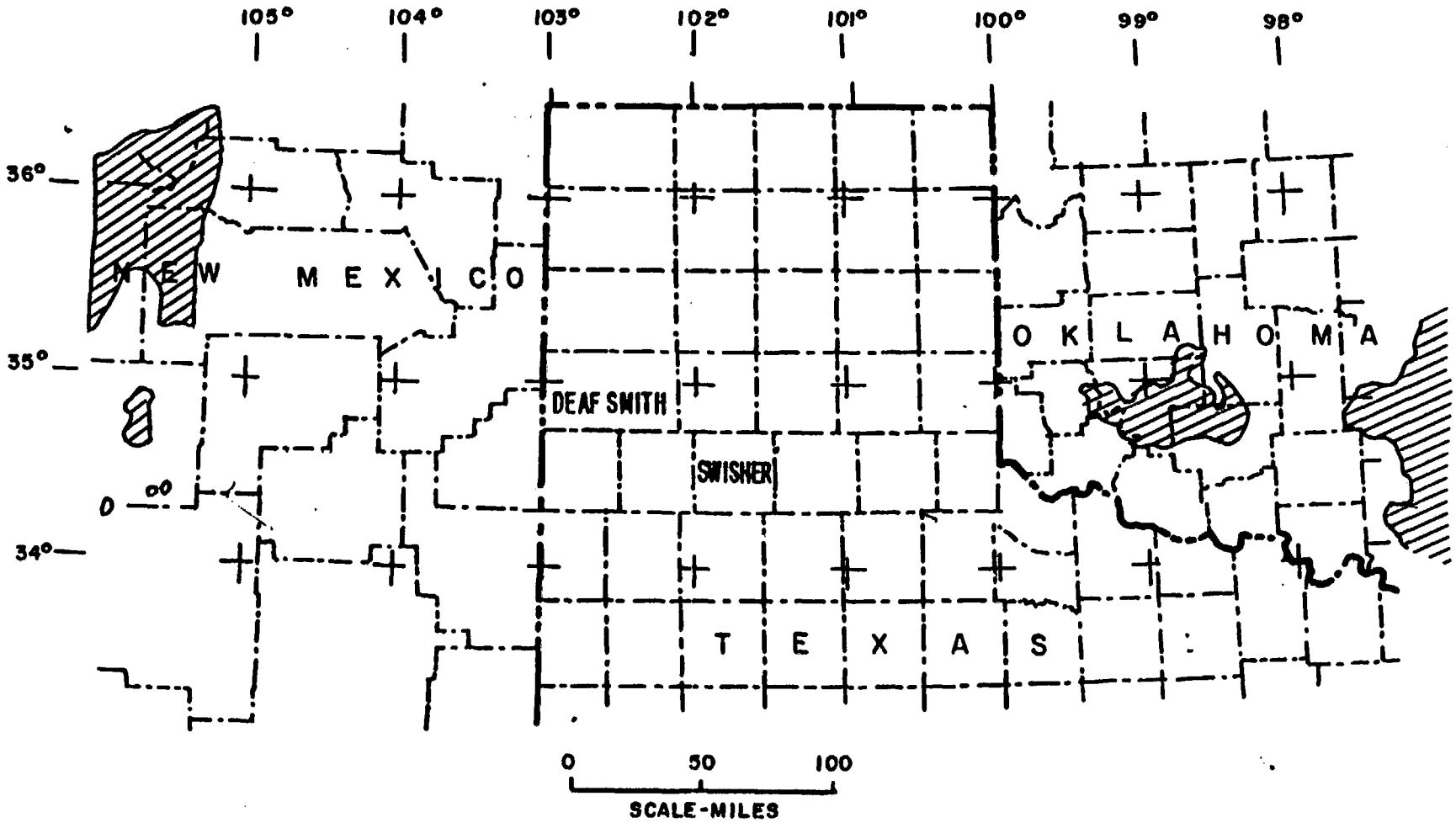
85-44,007

STRATIGRAPHIC SECTION
TRIASSIC TO RECENT

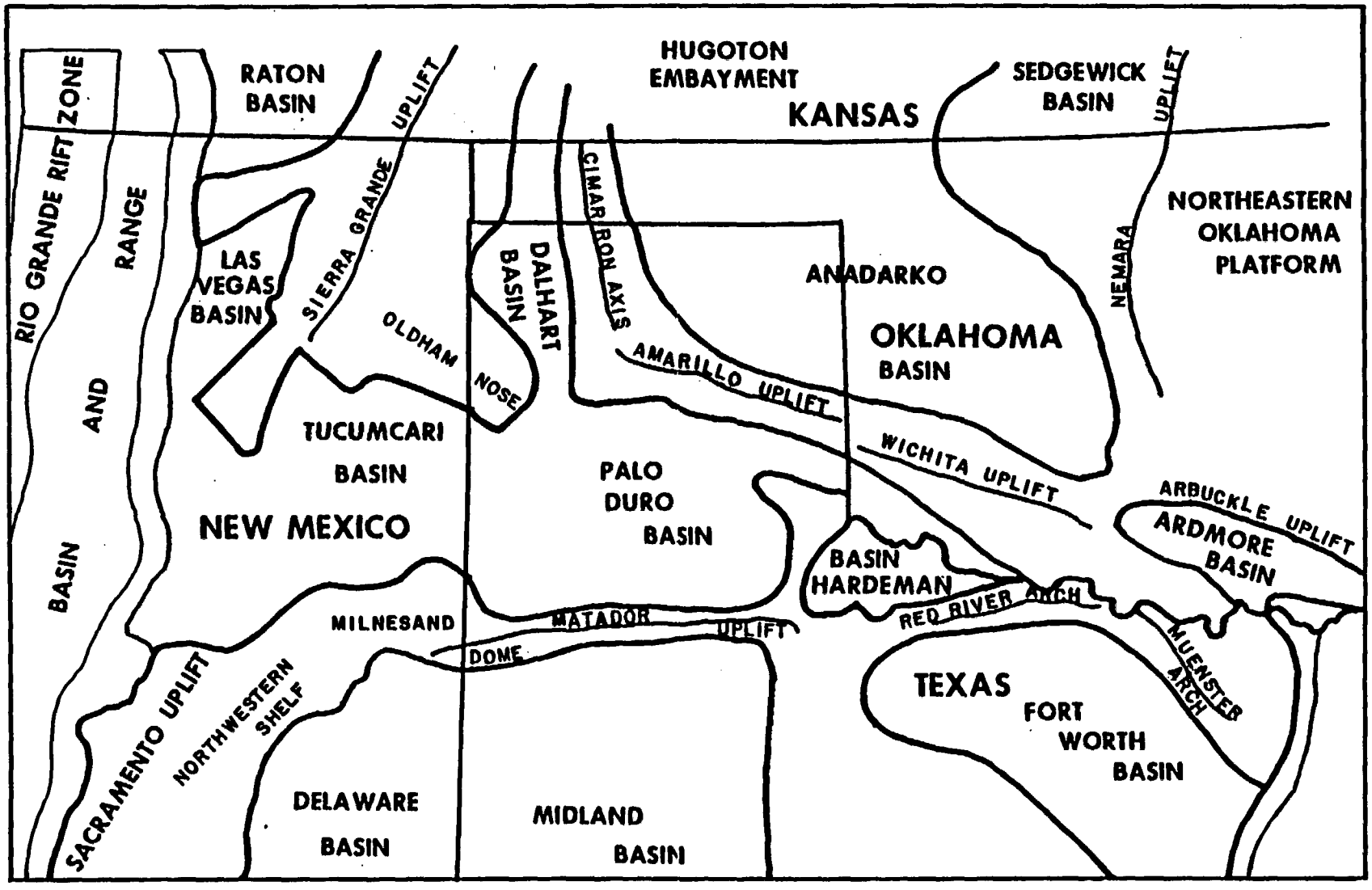
ERA	SYSTEM	SERIES	GROUPS	ROCK UNITS: EASTERN NEW MEXICO	ROCK UNITS: TEXAS PANHANDLE	ROCK UNITS: OKLAHOMA
CENOZOIC	QUATERNARY	RECENT		UNCONSOLIDATED SANDS & GRAVELS		
		PLEISTOCENE				
	TERTIARY	PLIOCENE-EOCENE		OGALLALA		
MESOZOIC	CRETACEOUS			NIOBRARA		
				CARLILE		
				GREENHORN		
				GRANEROS		
				DAKOTA		DAKOTA
			FREDRICKSBURG TRINITY	PURGATOIRE	FREDRICKSBURG TRINITY	
	JURASSIC			MORRISON		
				BELL RANCH-WANAKAH		
				TODILTO		
				EXETER (ENTRADA)		
	TRIASSIC		DOCKUM	CHINLE	DOCKUM	
				SANTA ROSA		

85-44,006

LOCATION OF PRECAMBRIAN-PENNSYLVANIAN OUTCROPS



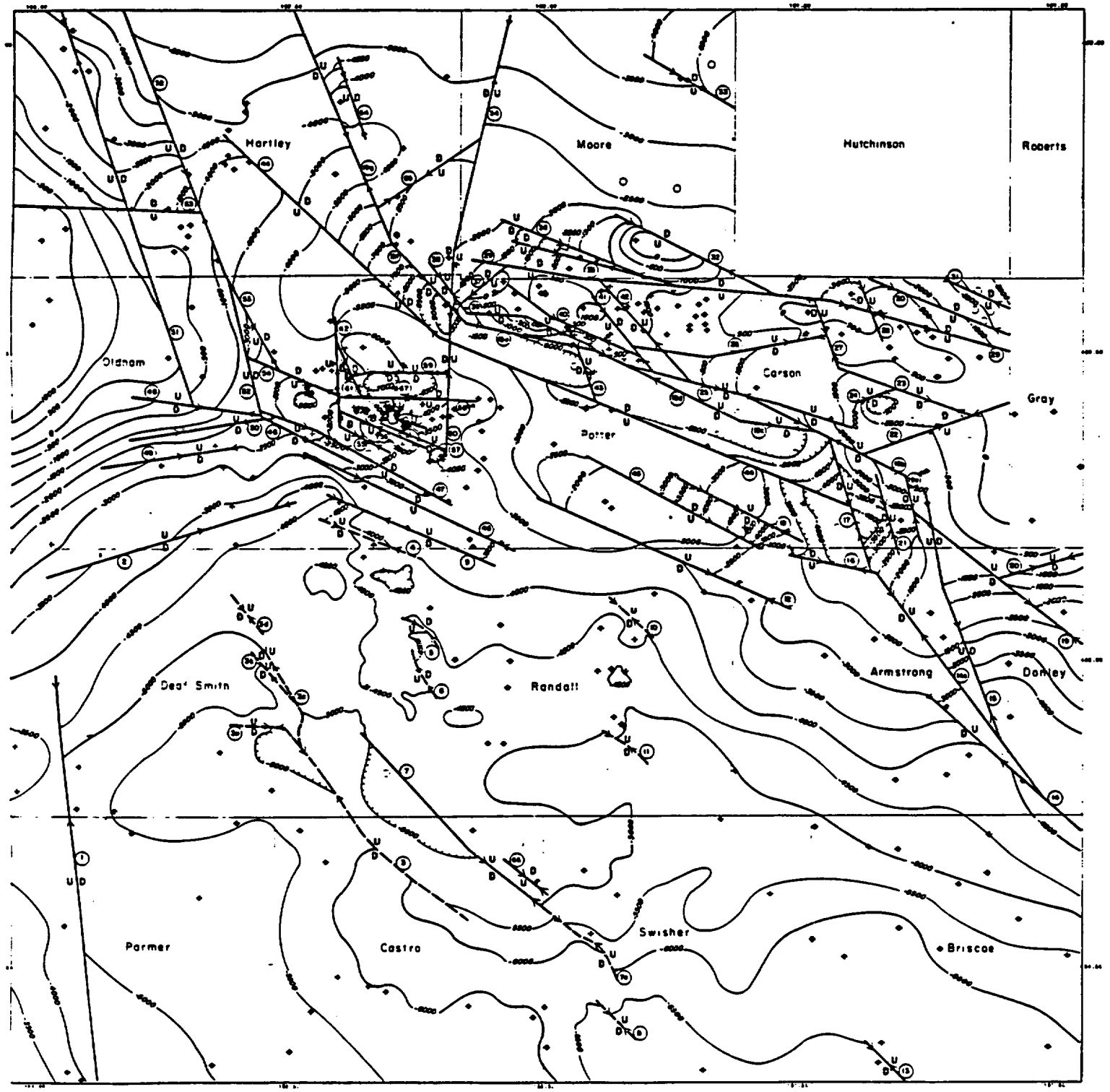
REGIONAL TECTONIC FEATURES



0 25 50
SCALE-MILES

0 50 100
SCALE-KILOMETERS

35-44,009



Explanation:

Datum is Mean Sea Level

Numbers Identifying Faults Refer to Tables 1 and 2.

Fault Interpreted From Geophysical Well Log Data (U-Upthrown, D-Downthrown). Arrows Indicate Areas of Maximum Observed Displacement.

Fault Interpreted by Long, 1983 (U-Upthrown, D-Downthrown). Arrows Indicate Areas of Maximum Observed Displacement.

Structure Contour-Interval 500 Feet.

Well Control.

C Well Not Penetrating Precambrian, But Used to Confine Maximum Elevation.

Fault Identification Number

0 5 10 15 20
Scale - Miles

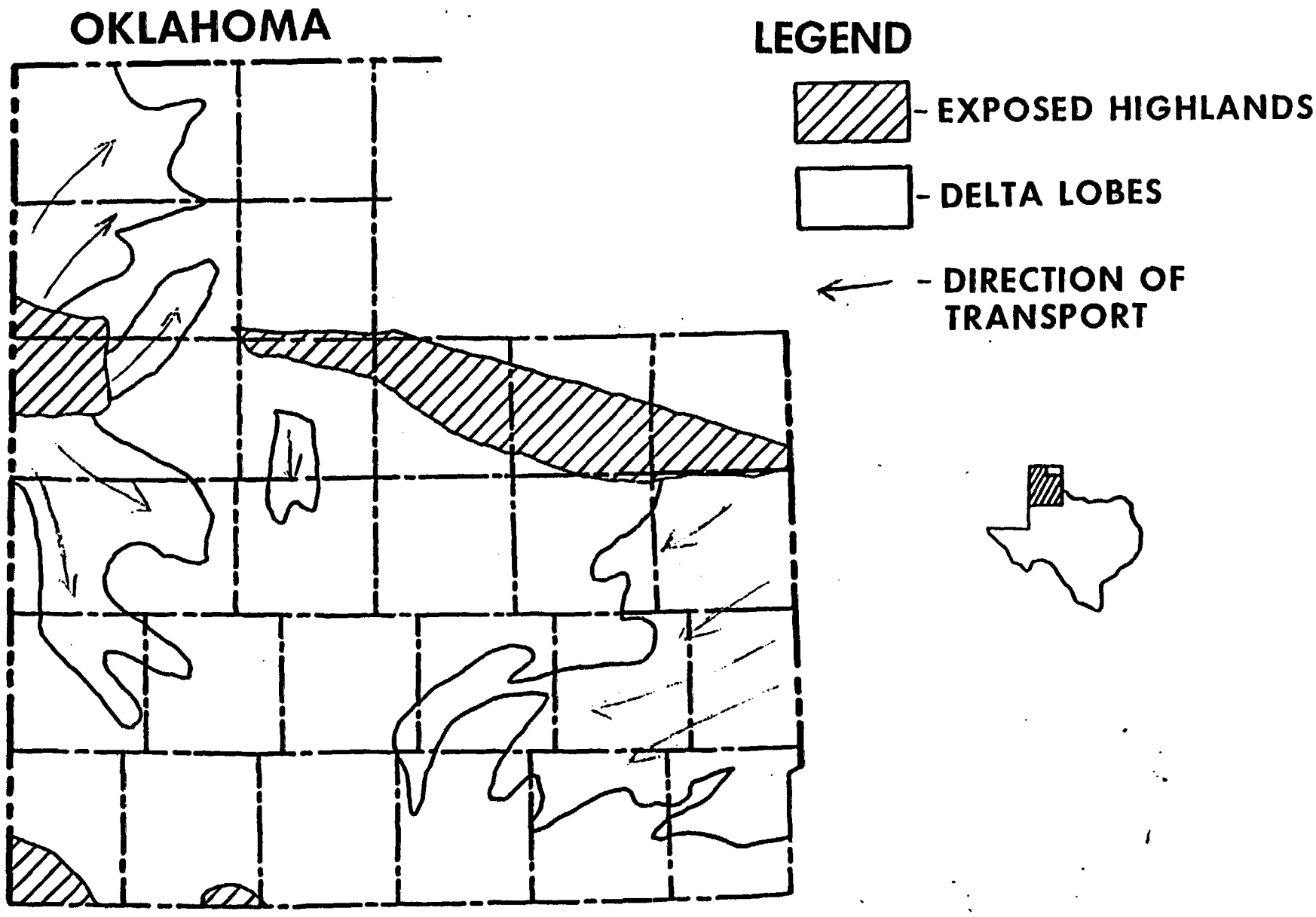
0 5 10 15 20
Scale - Kilometers

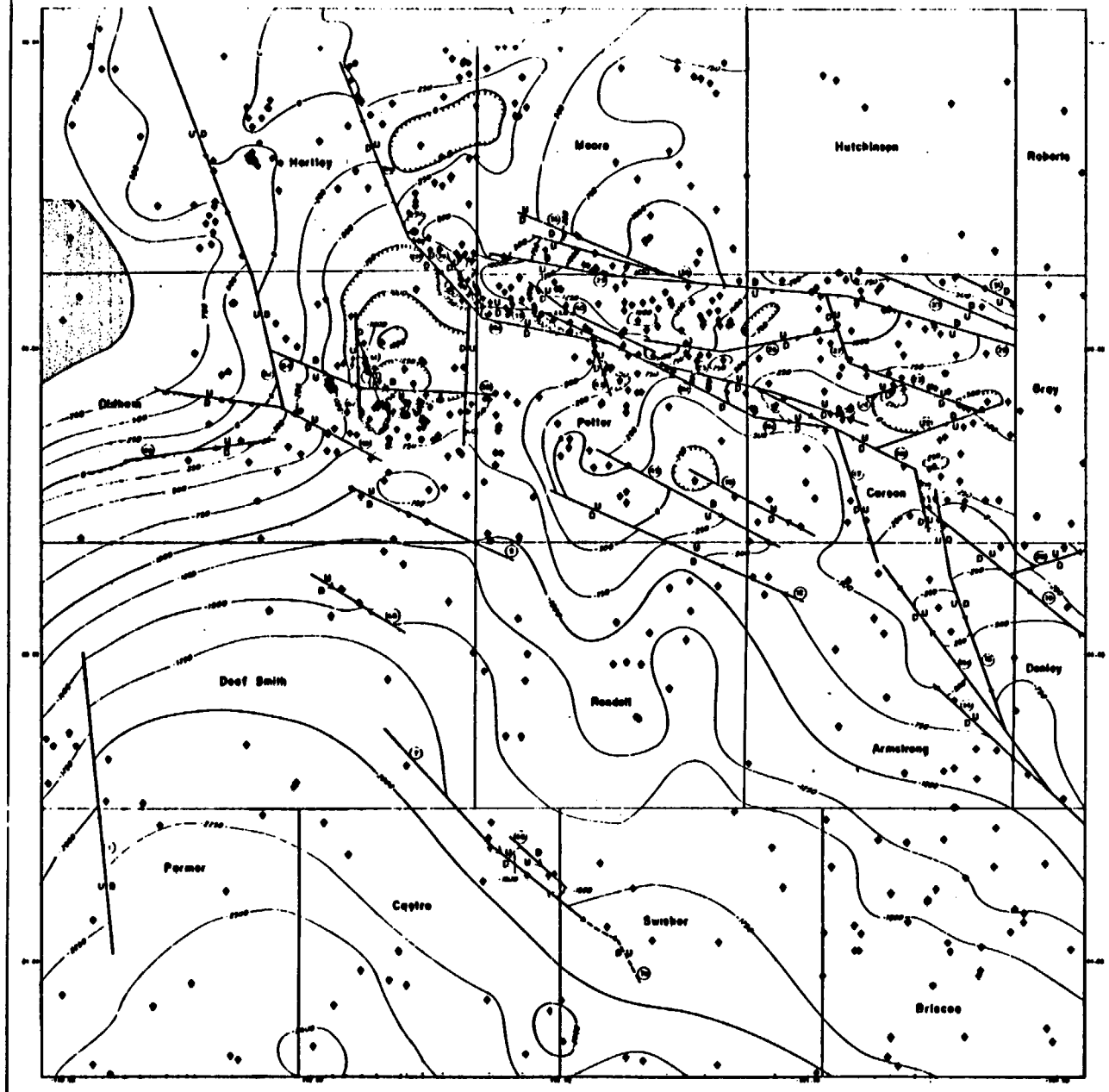
Sources: SWEC Sketch 12687-S4-F-1; Seismic Data From Long 1983

Elevation of Precambrian

Figure 4

PENNSYLVANIAN DELTAS





LEGEND

FAULT INTERPRETED FROM GEOPHYSICAL WELL LOG DATA (U-UPTHROWN, D-DOWNTHROWN) ARROWS INDICATE AREAS OF MAXIMUM OBSERVED DISPLACEMENT

FAULT INTERPRETED BY LONG, 1983 (U-UPTHROWN, D-DOWNTHROWN) ARROWS INDICATE AREAS OF MAXIMUM OBSERVED DISPLACEMENT

STRUCTURE CONTOUR-INTERVAL 200 FEET

WELL CONTROL

FAULT IDENTIFICATION NUMBER

PRECAMBRIAN SUBCROP

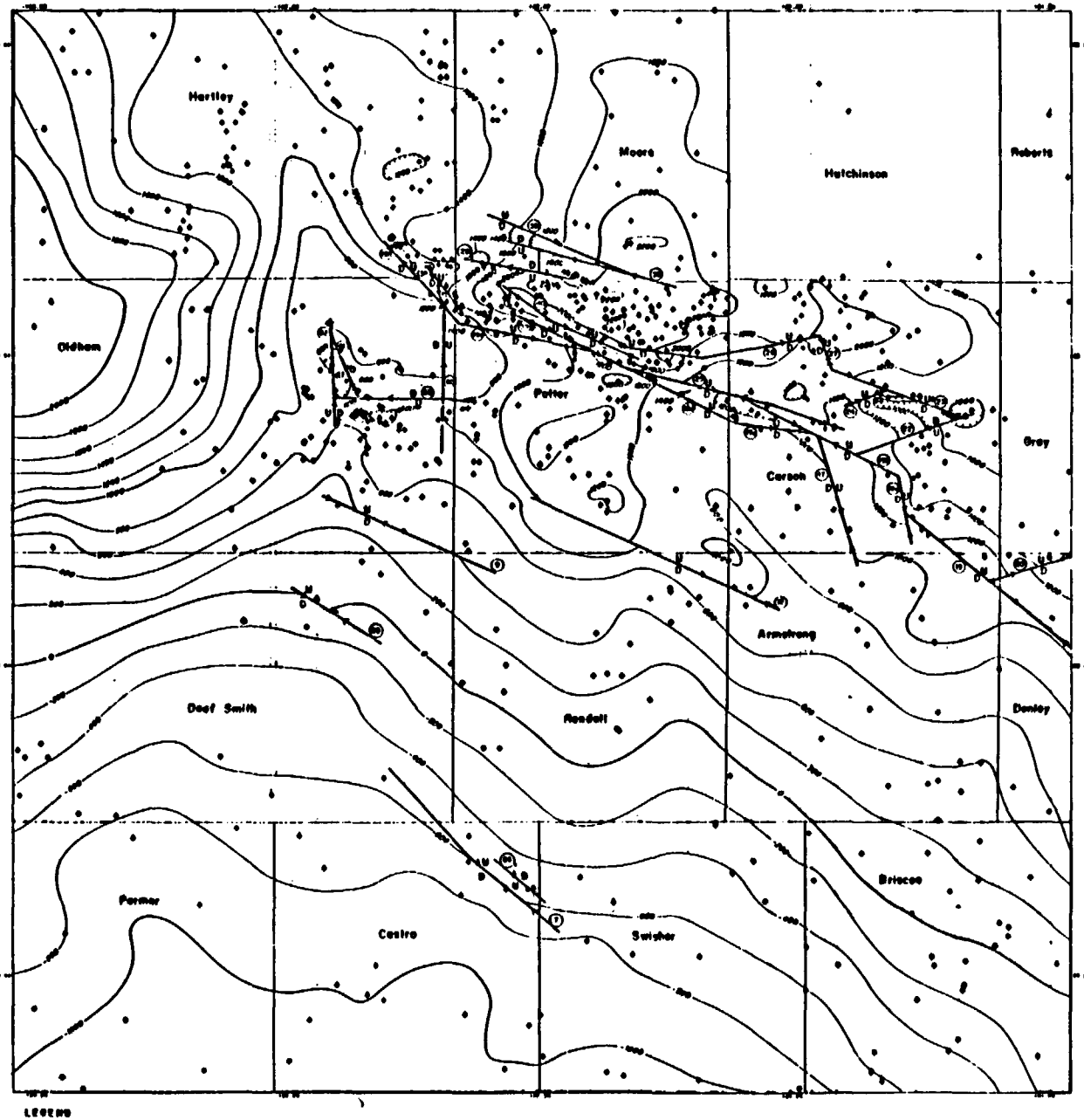
NOTES
1 DATUM IS MEAN SEA LEVEL
2 NUMBERS IDENTIFYING FAULTS REFER TO TABLES 1 & 2

0 5 10 15 20
SCALE - MILES

0 5 10 15 20
SCALE - KILOMETERS

Elevations of the Top of the Wolfcamp Series

Figure 6



LEGEND

FAULT INTERPRETED FROM GEOPHYSICAL WELL LOG DATA (U-UPTHROWN, D-DOWNTHROWN) ARROWS INDICATE AREAS WITH MAXIMUM OBSERVED DISPLACEMENT

STRUCTURE CONTOUR - INTERVAL 200 FEET

WELL CONTROL

FAULT IDENTIFICATION NUMBER

NOTES

1 DATUM IS MEAN SEA LEVEL

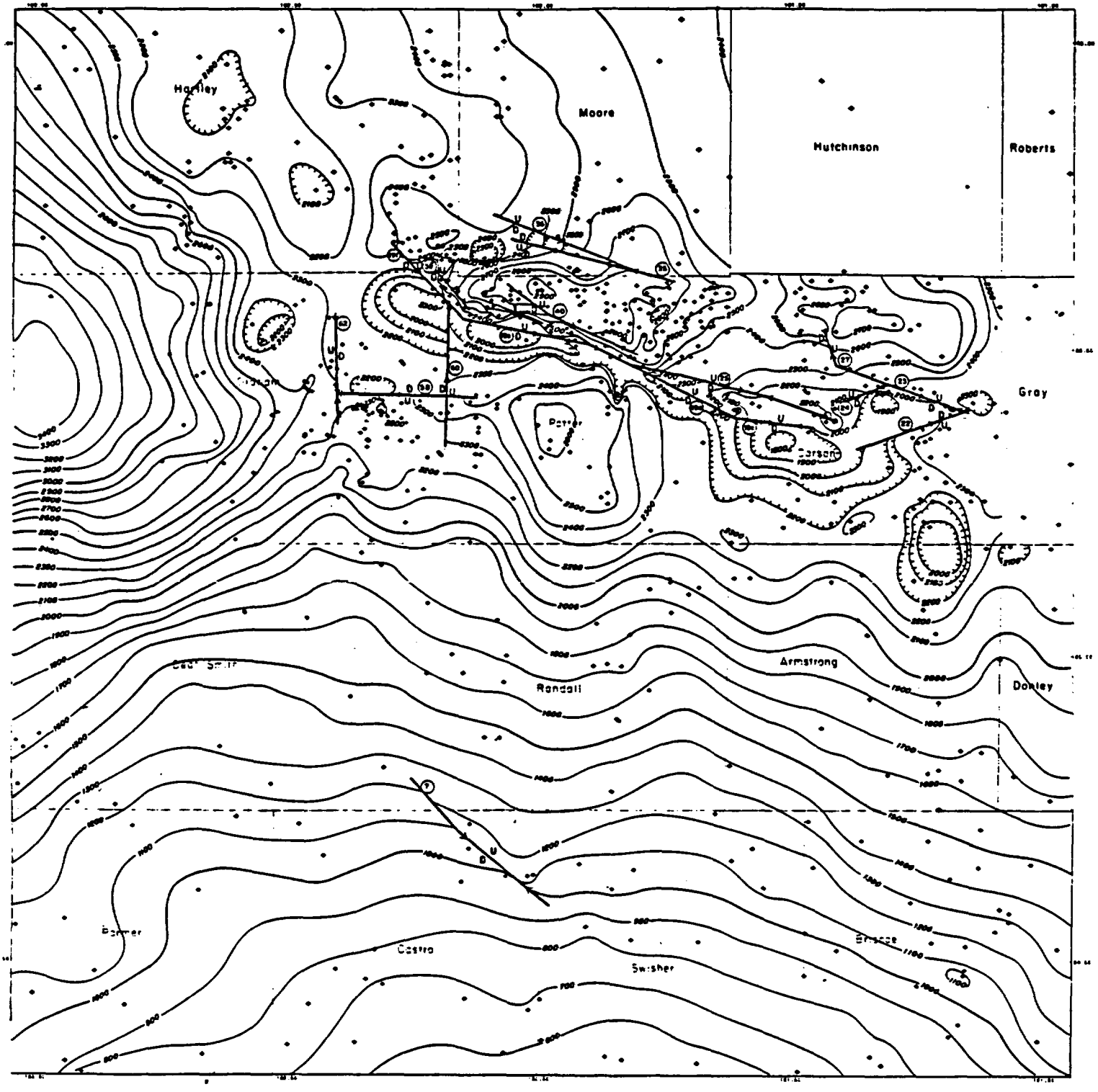
2 NUMBERS REFERRING FAULTS REFER TO TABLES 1&2

0 5 10 15 20

SCALE - MILES

Elevation of the Top of the Tubb Formation

Figure 7



Explanation:

Datum is Mean Sea Level

Numbers Identifying Faults Refer to Tables 1 and 2.

Fault Interpreted From Geophysical Well Log Data (U-Upthrown, D-Downthrown). Arrows Indicate Areas of Maximum Observed Displacement.

—1000— Structure Contour-Interval 100 Feet.

Well Control.

(23) Fault Identification Number

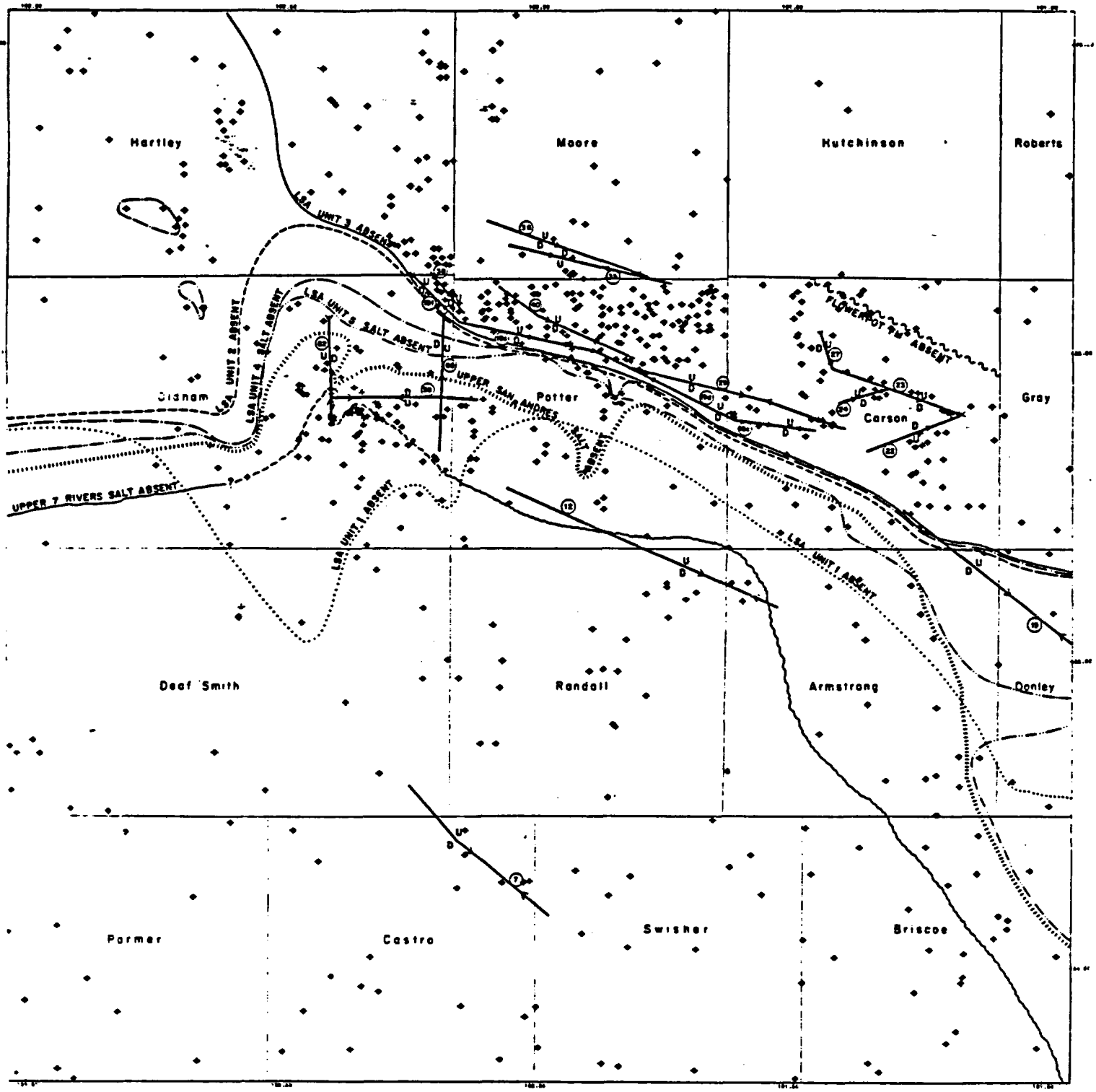
0 5 10 15 20
Scale - Miles

0 5 10 15 20
Scale - Kilometers

Source: BWEC Section 13897-84-R-1

Elevation of the Top of the Lower San Andres Formation

Figure 9



Explanation:

Numbers Identifying Faults Refer to Tables 1 and 2.

Fault Interpreted From Geophysical Well Log Data (U-Upthrown, D-Downthrown). Arrows Indicate Areas With Maximum Observed Displacement.

Well Control.

Fault Identification Number

0 5 10 15 20
Scale - Miles

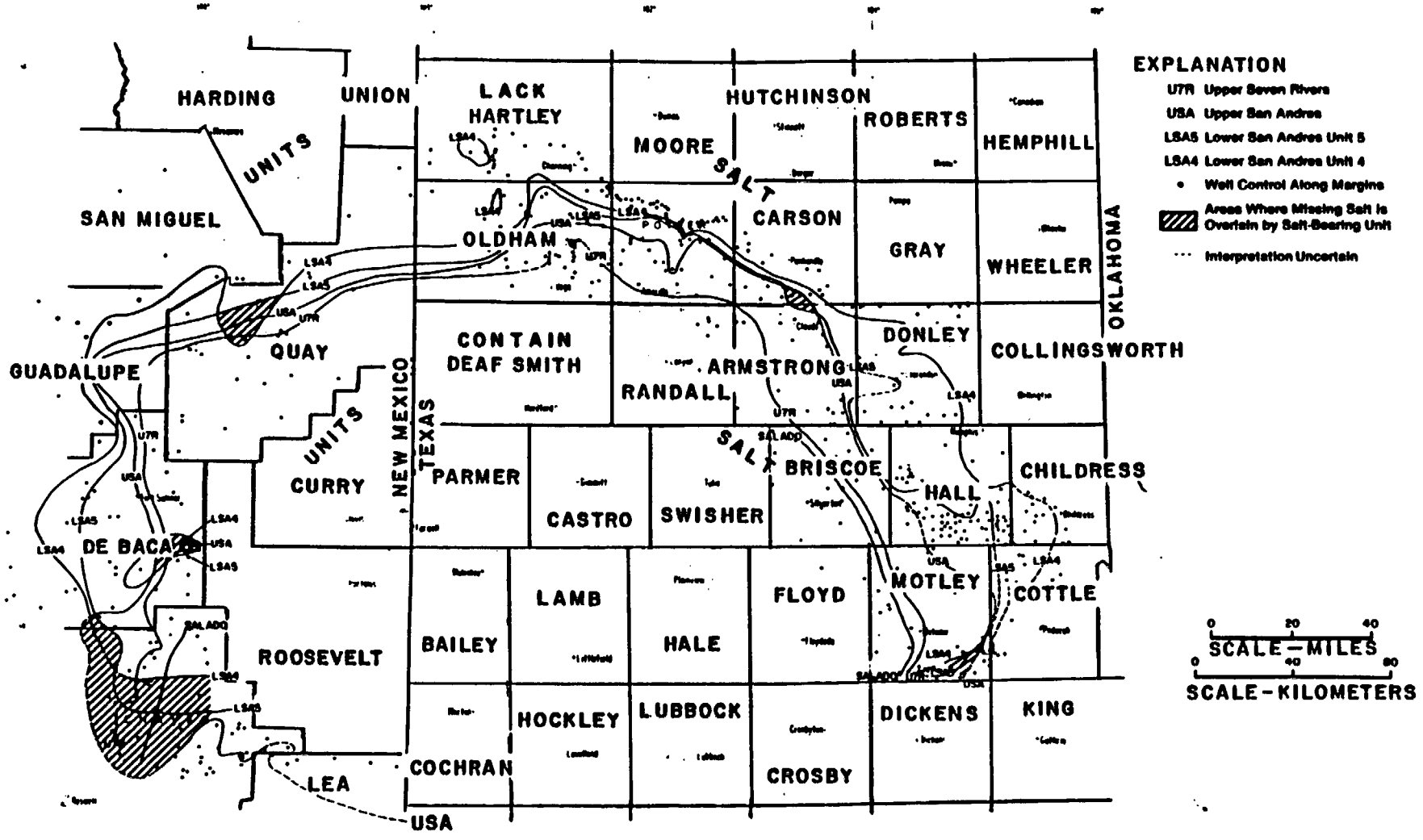
0 5 10 15 20
Scale - Kilometers

Sources: SWEC Sketch 13887-S4-H-1; Salt Information From Bovd and Murphy, 19[illegible]

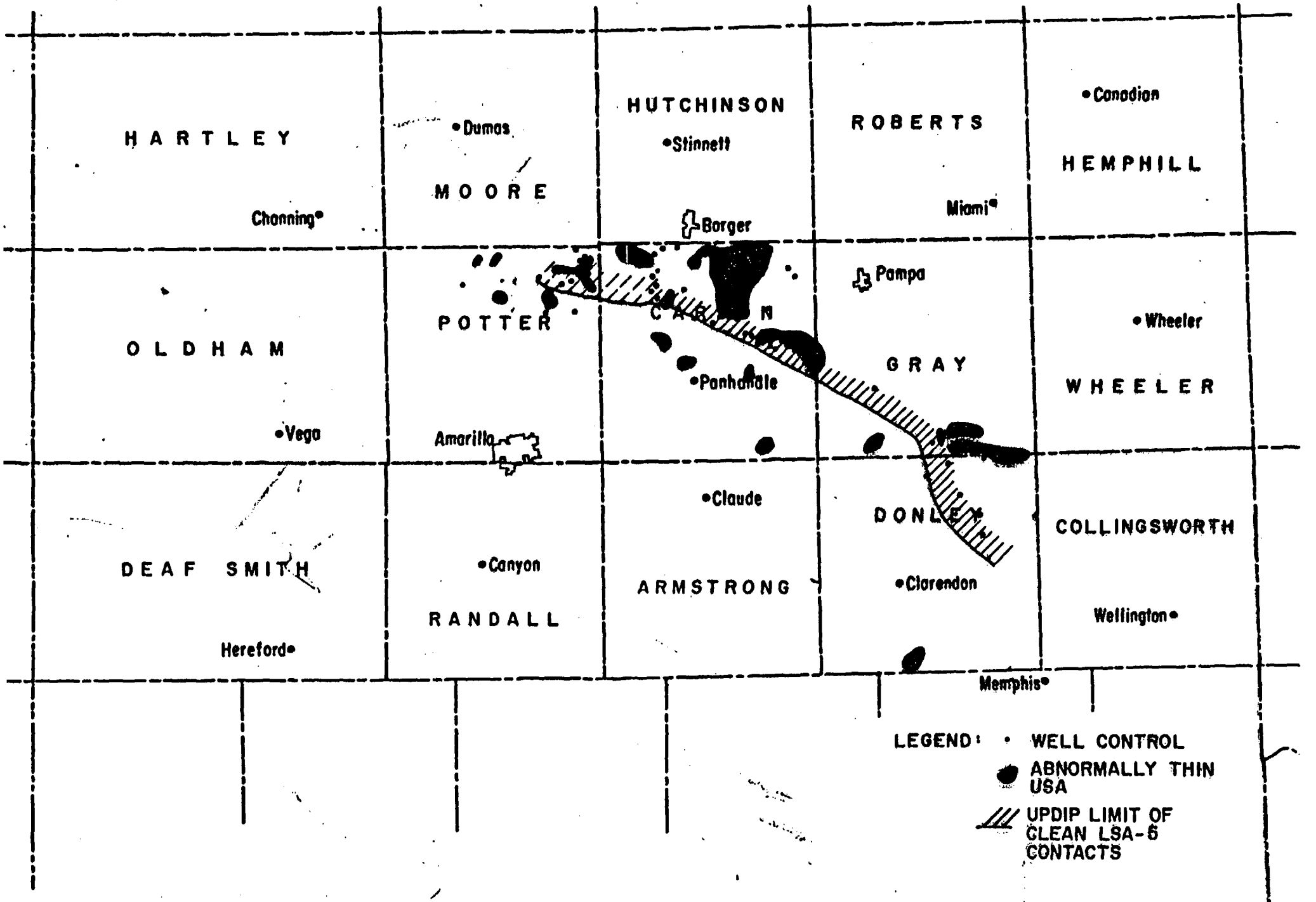
Areal Extent of Selected Upper Permian Units

Figure 12

SALT MARGINS



85-44,146

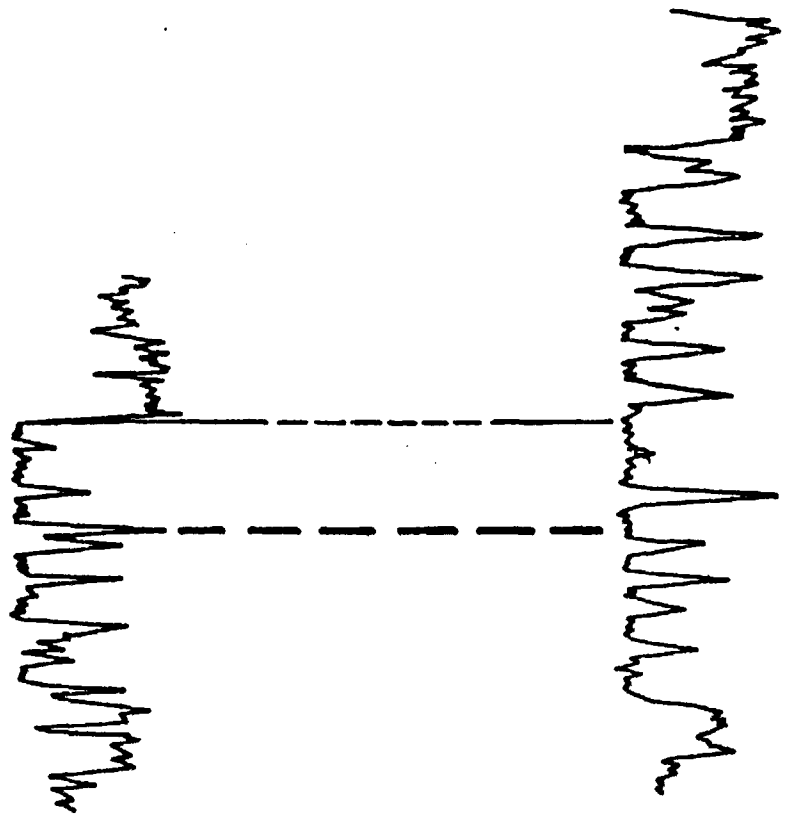

HARTLEY
Channing
MOORE
Dumas
HUTCHINSON
Stinnett
Borger
ROBERTS
Miami
Canadian
HEMPHILL
OLDHAM
Vega
POTTER
Amarillo
CARSON
Panhandle
Pampa
GRAY
Wheeler
WHEELER
DEAF SMITH
Hereford
RANDALL
Canyon
ARMSTRONG
Claude
DONLEY
Clarendon
Memphis
COLLINGSWORTH
Wellington
LEGEND: • WELL CONTROL
ABNORMALLY THIN USA
UPDIP LIMIT OF CLEAN LSA-5 CONTACTS

1-30, 594

SHORT VS. AVERAGE
USA NON SALT SECTION

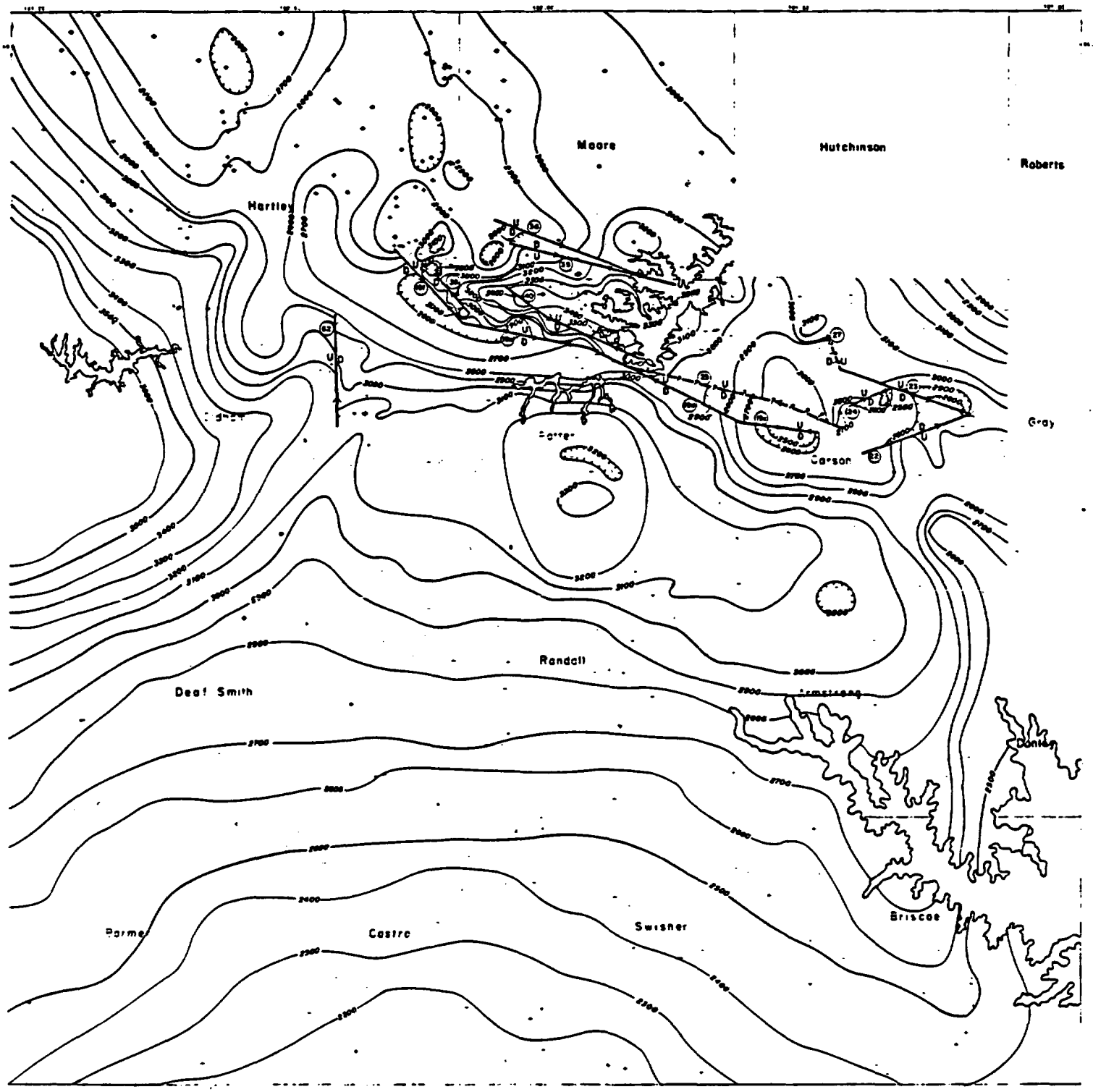
CITIES SERVICE
ROYER # 1

TEXAS GULF
BOBBITT # 1



BOTH WELLS IN CARSON CO.

3-30.595



Explanation:

Datum is Mean Sea Level

Numbers Identifying Faults Refer to Tables 1 and 2.

Fault Interpreted From Geophysical Well Log Data (U-Upthrown, D-Downthrown). Arrows Indicate Areas With Maximum Observed Displacement.

Fault, Vertical Extent is Uncertain.

3000 Structure Contour-Interval 100 Feet.

Well Control.

Fault Identification Number

Alibates Missing Due to Erosion.

0 5 10 15 20
Scale - Miles

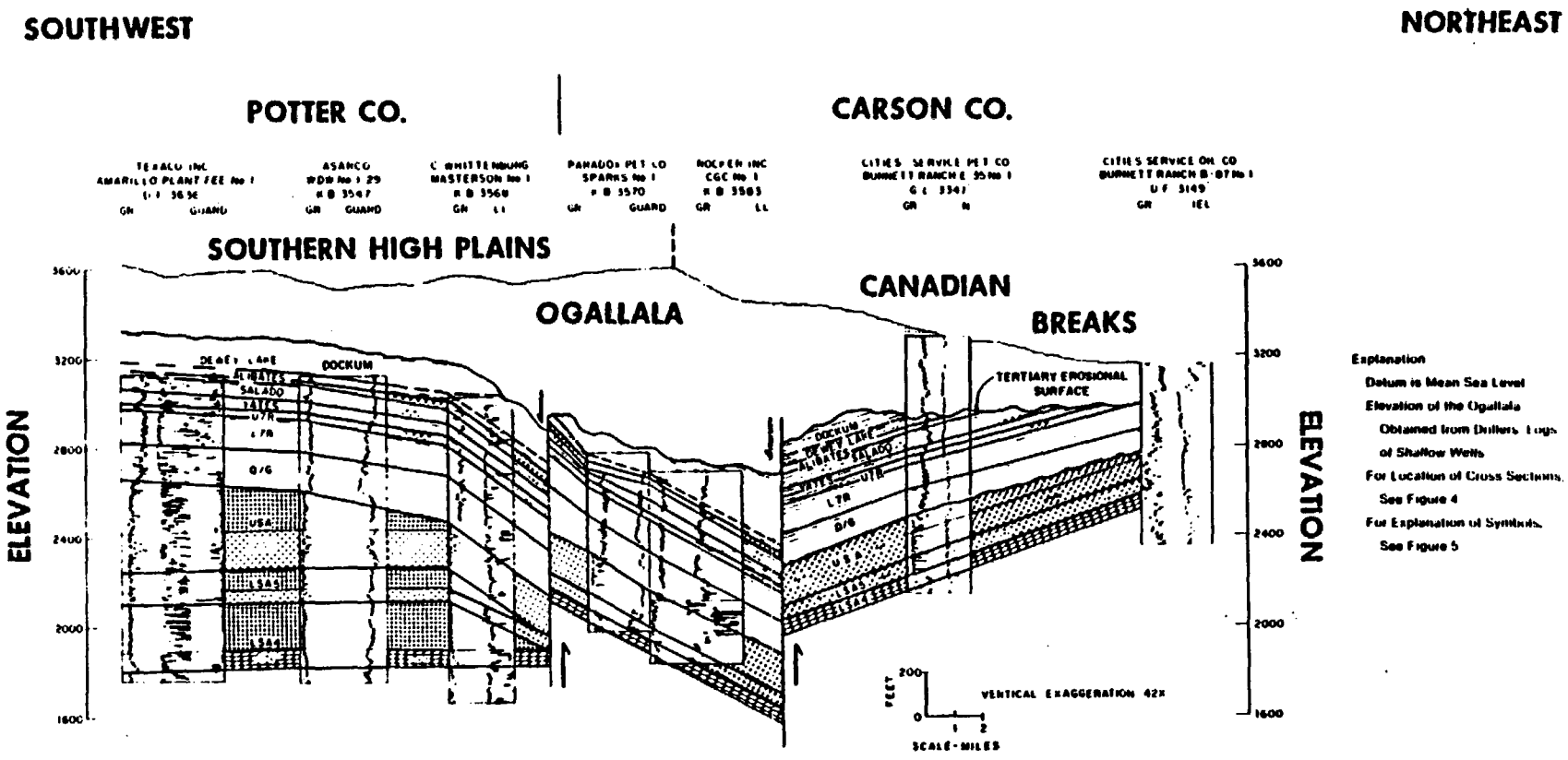
0 5 10 15 20
Scale - Kilometers

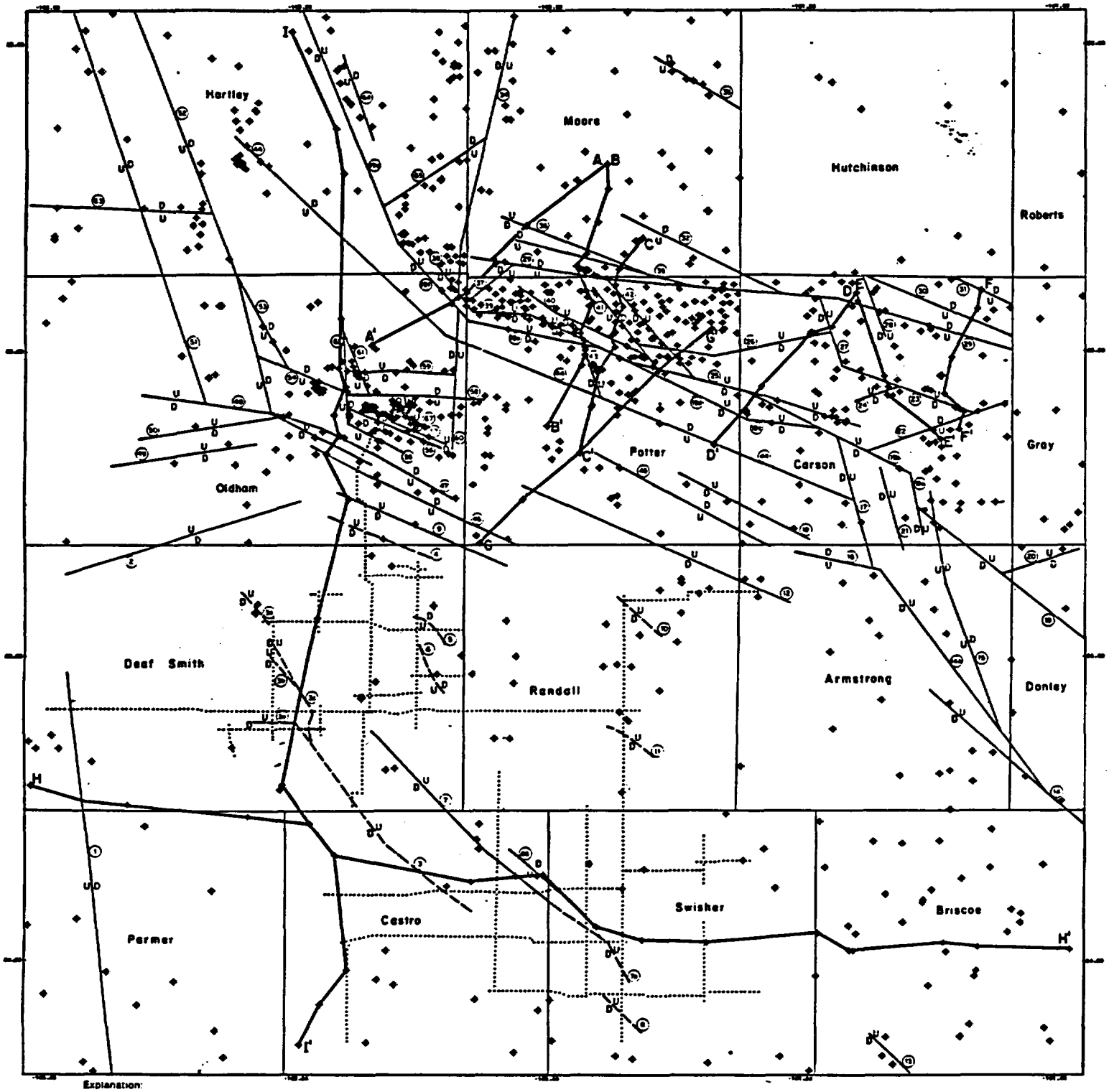
Sources: SWEC Sheron 13897-54-L-1; Outcrops From Barnes, 1967, 1968.

Elevation of the Top of the Alibates Formation

Figure 10

CROSS SECTION H





Explanation:

Numbers identifying Faults Refer to Tables 1 and 2

H——H' Cross Section Line

Seismic Line

Well Control

Fault Interpreted from Geophysical Well Log Data (U-Upthrown, D-Downthrown)

Fault Interpreted by Long, 1983 (U-Upthrown, D-Downthrown)

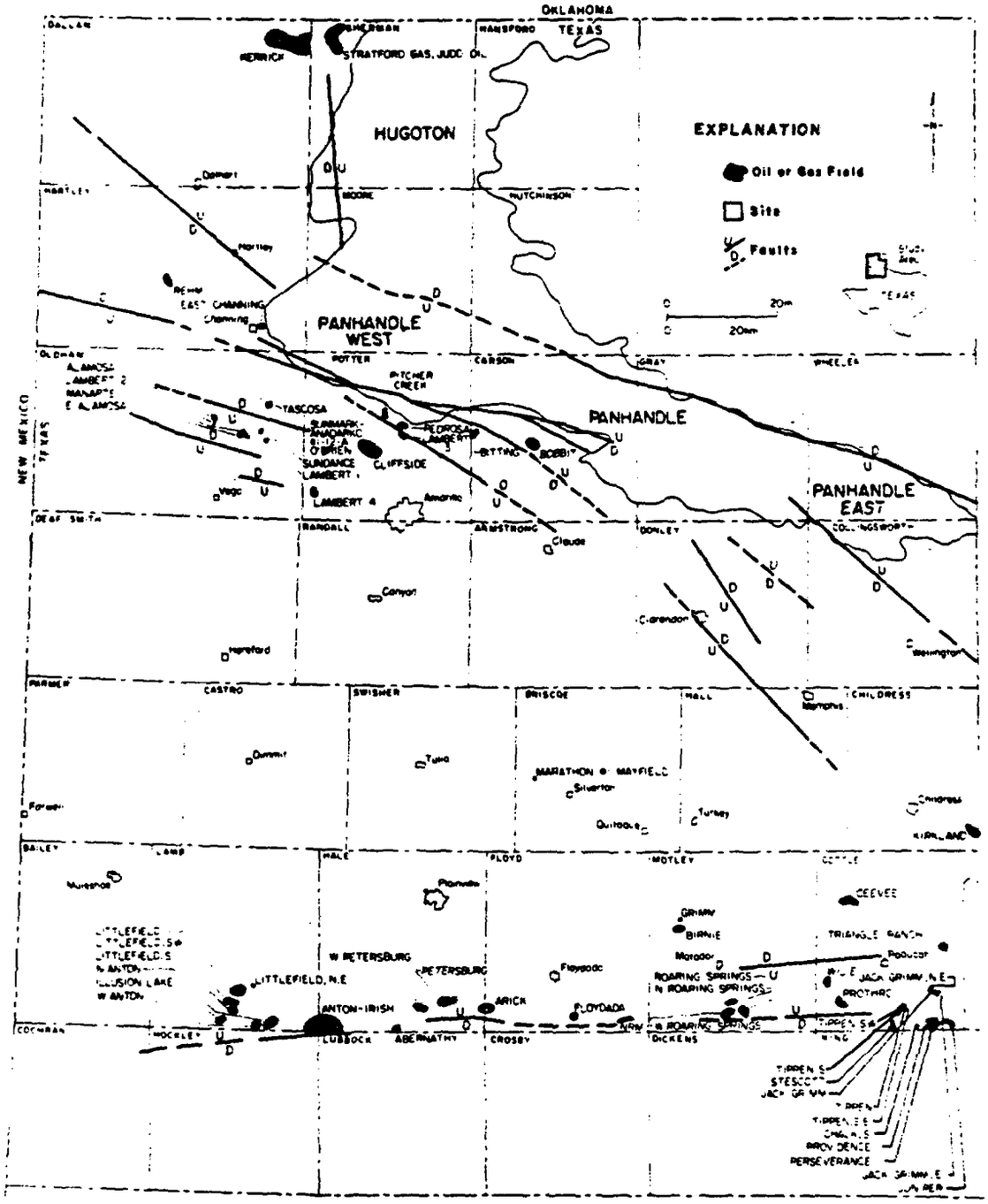
Fault Identification Number

0 5 10 15 20
Scale-Miles

0 5 10 15 20
Scale-Kilometers

Index Map of Study Area

Figure 3

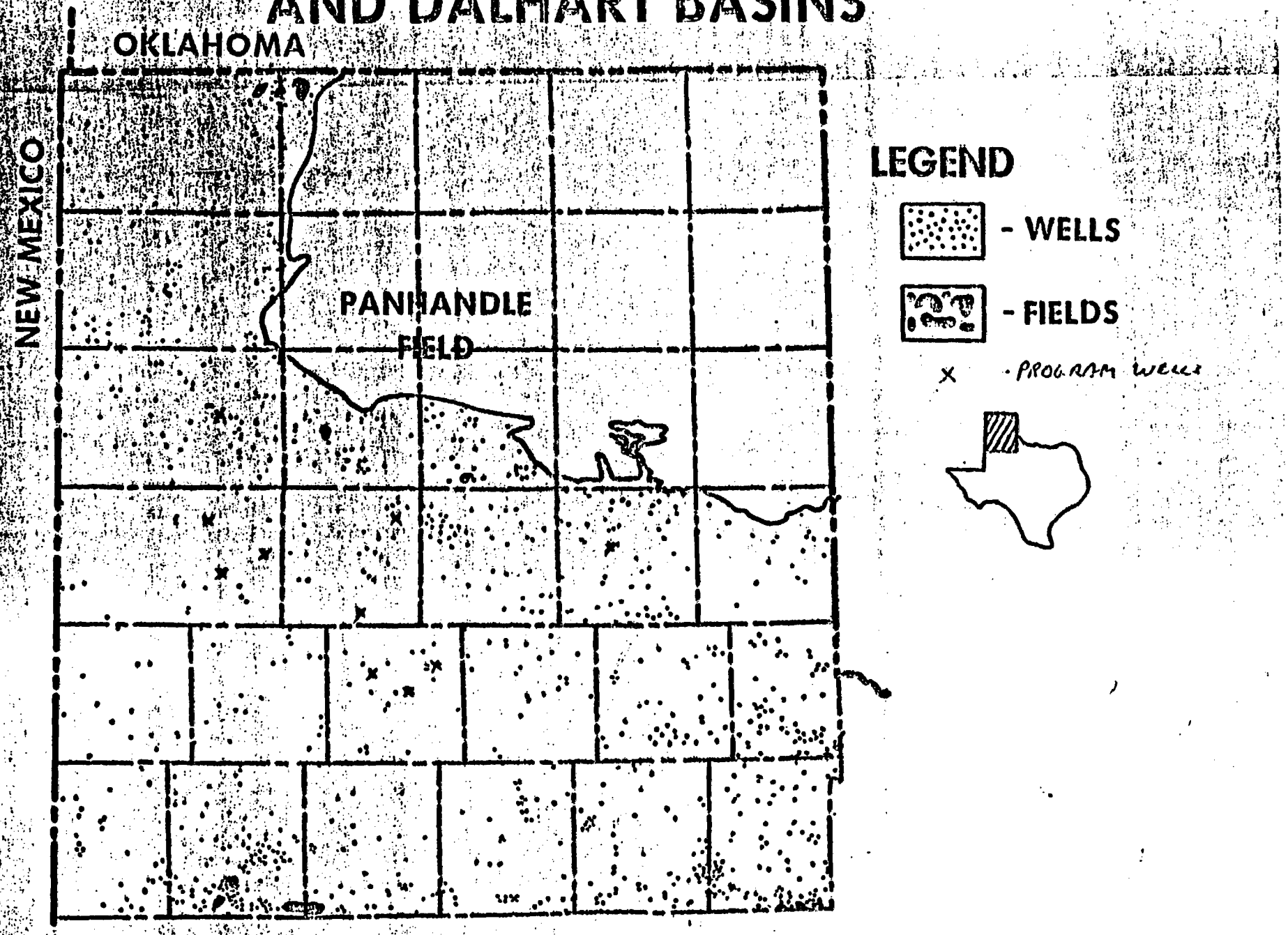


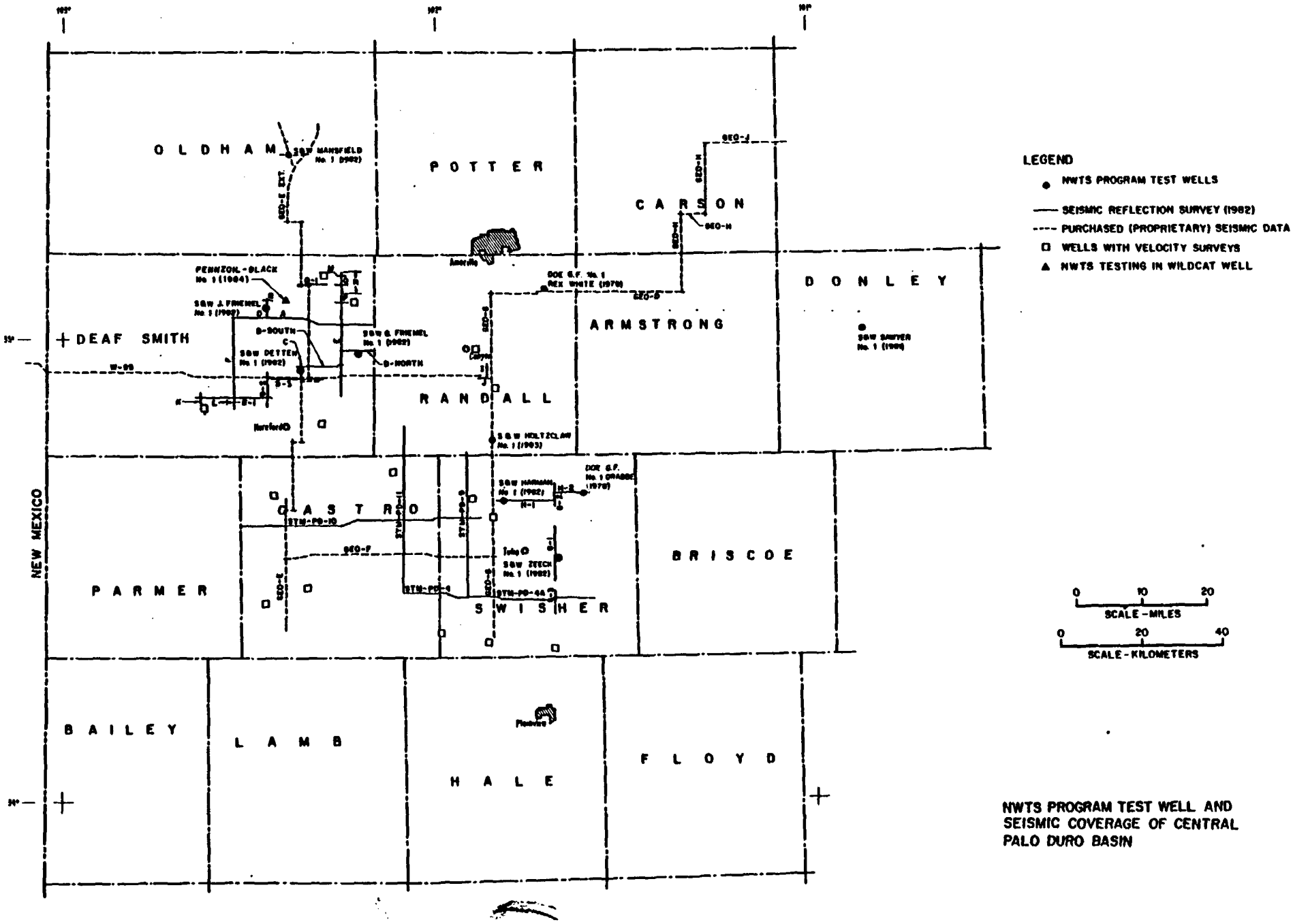
Location of Oil and Gas Fields in the Palo Duro Basin and Surrounding Areas.

Source: Dutton, Goldstein and Ruppel, 1982

Figure 3-3

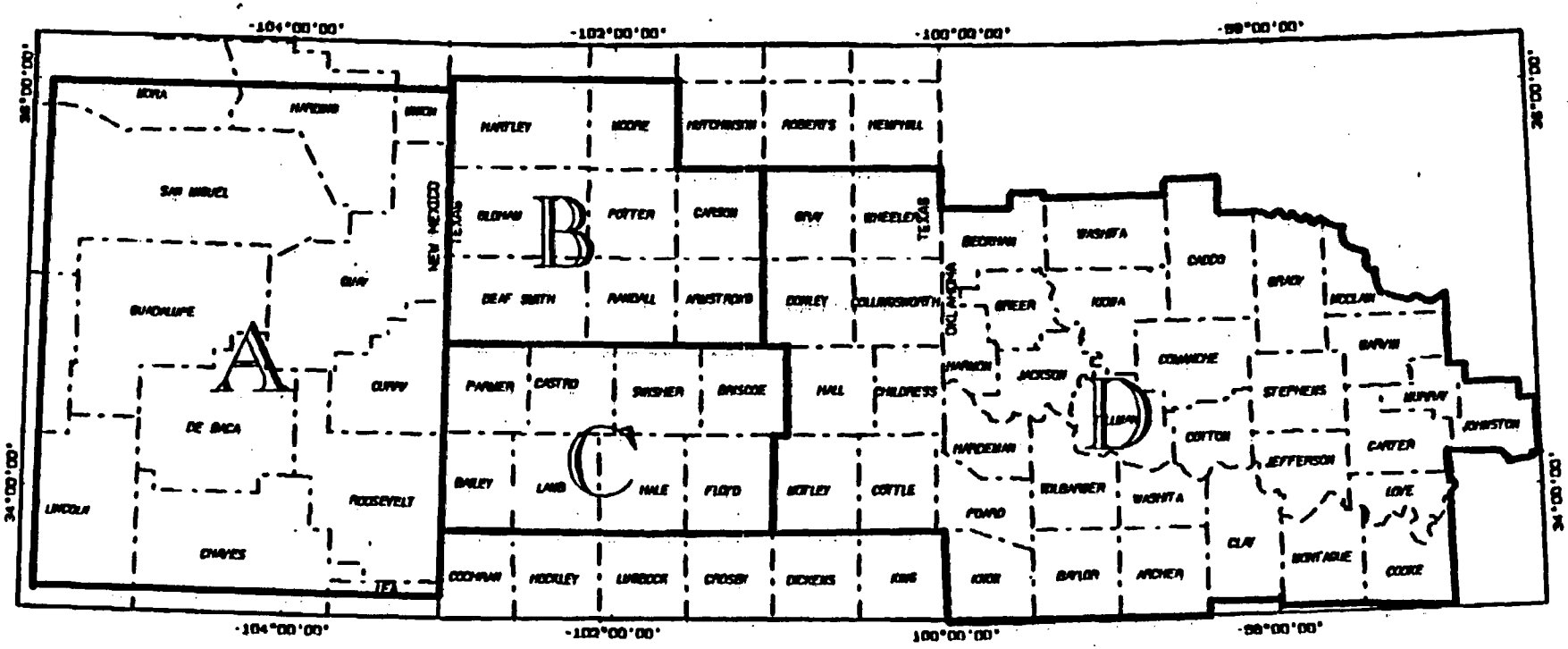
WELLS IN THE PALO DURO AND DALHART BASINS





NWTS PROGRAM TEST WELL AND SEISMIC COVERAGE OF CENTRAL PALO DURO BASIN

HYDROGEOLOGIC STUDY AREAS



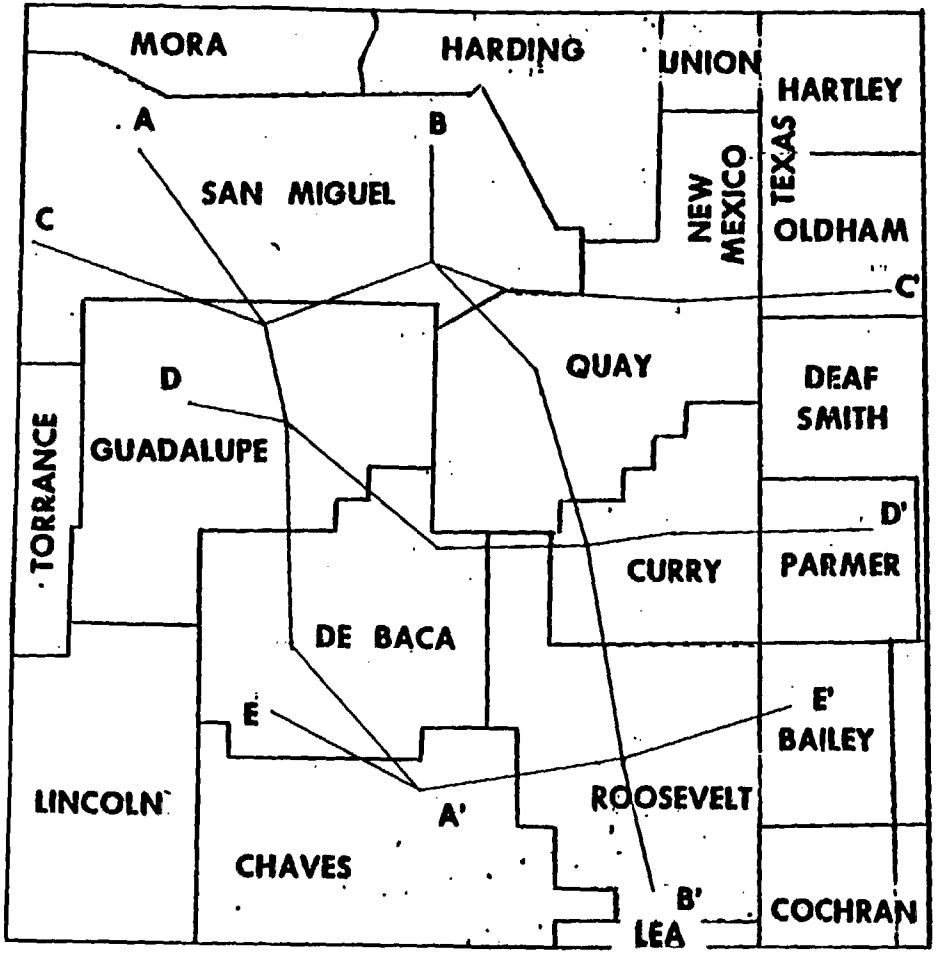
A Eastern New Mexico (Task .31)

B Deaf Smith (Task .32)

C Swisher (Task .33)

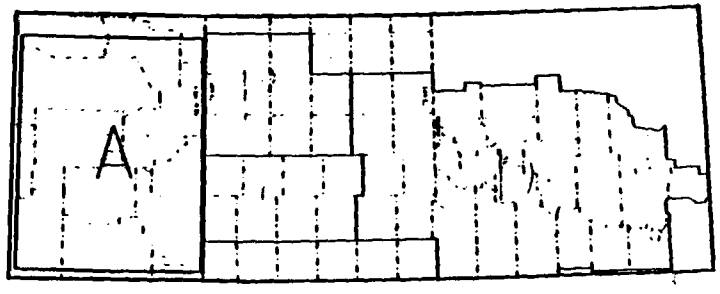
D Eastern Panhandle and Oklahoma (Task .34)

LOCATION OF STUDY AREA AND LINES OF CROSS SECTION



Legend:

- o Well Control
- — Cross Section Line



Hydrogeologic Study Areas

A Eastern New Mexico

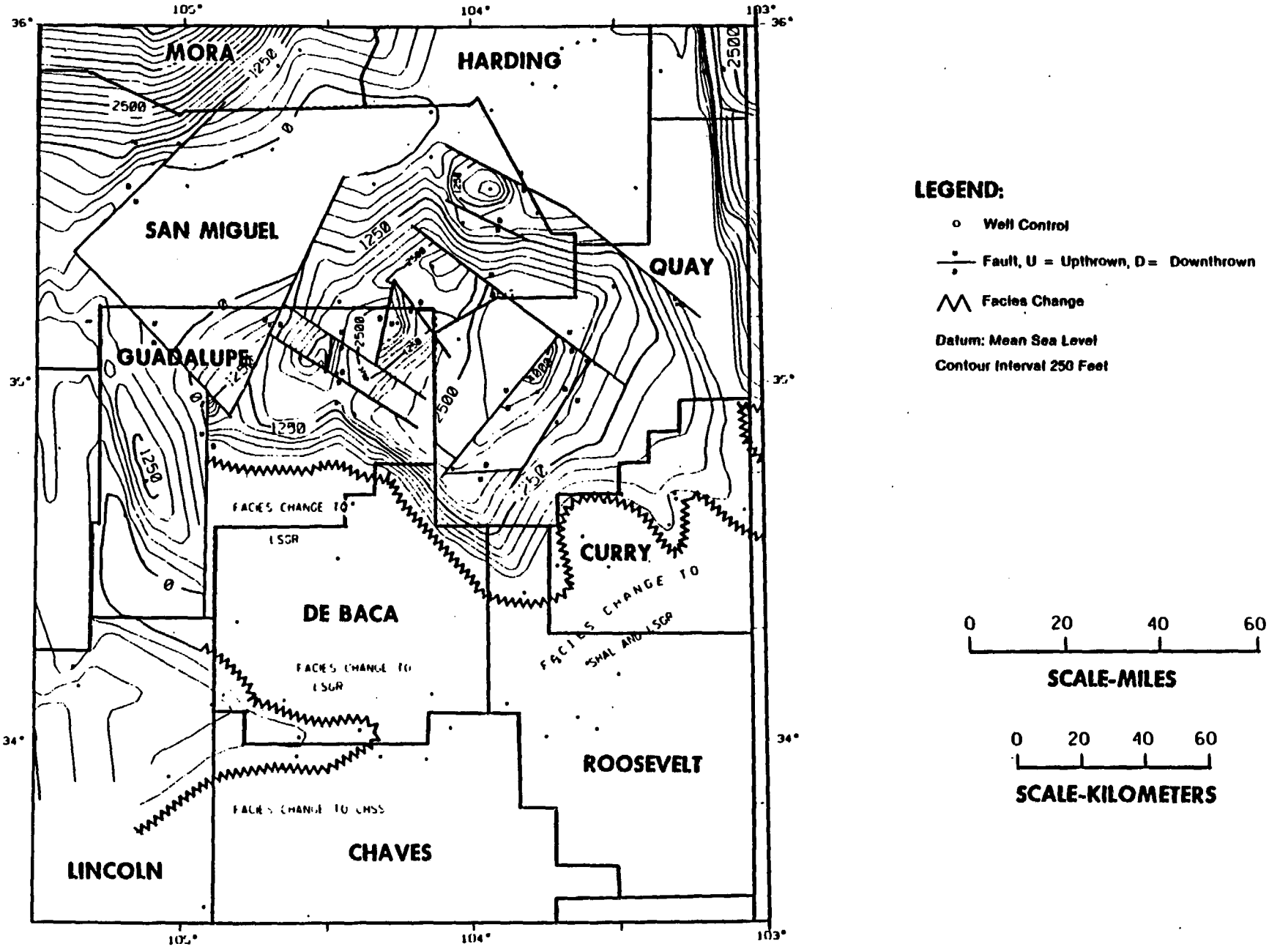
B Deaf Smith

C Swisher

D Eastern Panhandle and Oklahoma

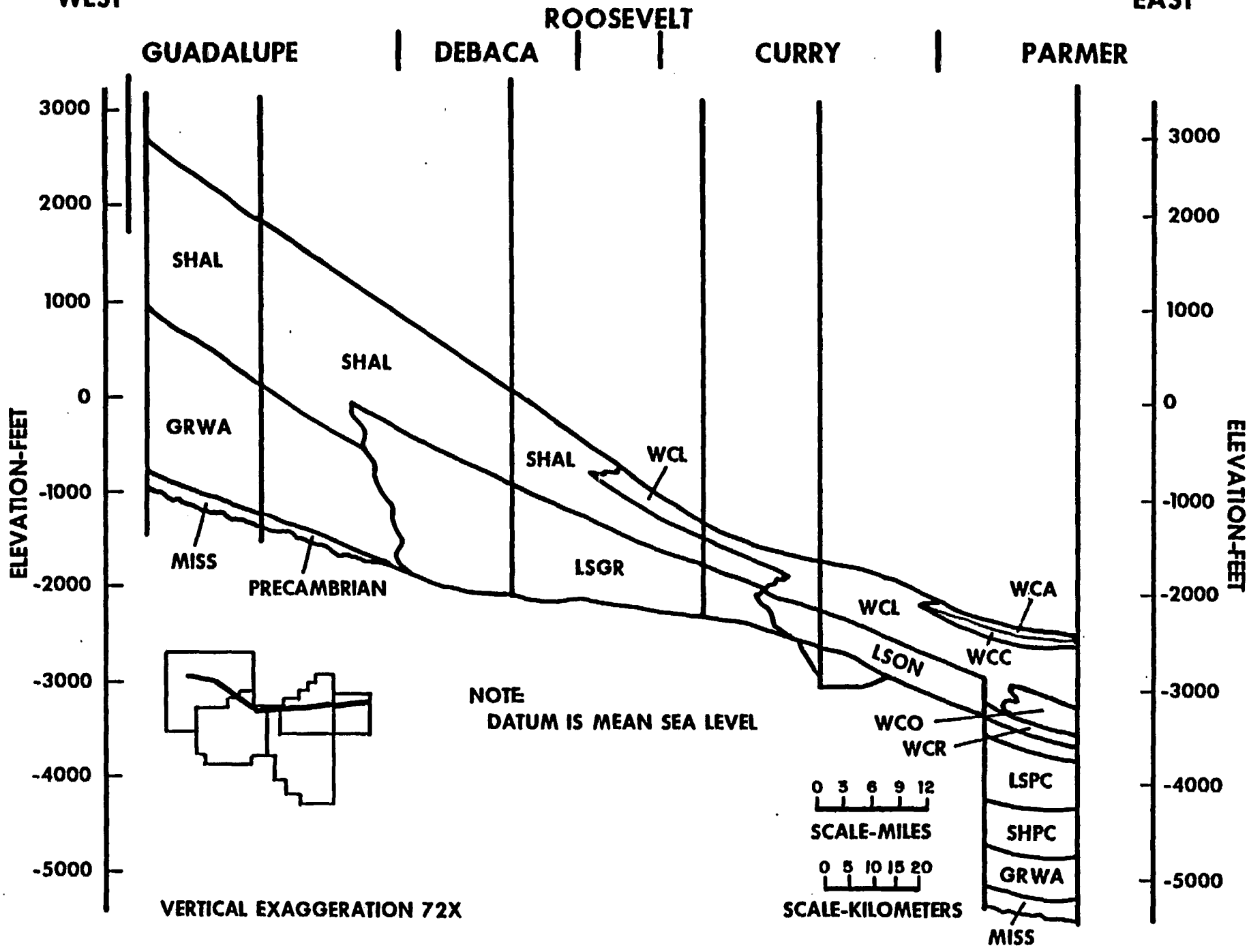
85-44,037

THICKNESS OF GRWA HYDROGEOLOGIC UNIT



85-44,167

CROSS SECTION D-D'



85-44,010

DISSOLUTION CONSIDERATIONS

Process: Shallow ground water dissolving salt

Types: "Peripheral" and "Interior" ?

Controls: Hydraluic gradient, evaporite geology, overlying geology

Extent: Geographic and stratigraphic

Rates: Rates of dissolution for different types

Timing: Ongoing or relict process

Implications to nuclear repository

TYPES OF DATA

Geologic data: Stratigraphic, structural, geomorphic

Hydrologic-hydrochemical data: dissolution wells saline springs

Core data: DOE stratigraphic and hydro wells

HYDROLOGIC-HYDROCHEMICAL DATA

Well locations

Mansfield and Sawyer well results ("peripheral")

1. Hydrologic Testing
2. Chemical composition
3. Stable isotope composition
4. C^{14} Concentrations

Harmon and Detten wells ("interior")

1. Hydrologic testing
2. Chemical composition
3. Stable isotope composition

CORE DESCRIPTION

Well locations for core in dissolution zone

Diagnostic features of dissolution

Geographic distribution of dissolution features

BEG PUBLICATIONS

REQUESTS FOR REVIEW PENDING

West Texas Waste Isolation Project
Contract No. DE-AC97-83WM46651

1.	Draft: Bureau RI	"Hydrogeology and Hydrochemical Facies of the San Andres Formation in Eastern New Mexico, West-Central Texas, and the Texas Panhandle," by Dutton and Orr. Review requested 2/6/85.
2.	Draft: Bureau RI	"Numerical Modeling of Regional Ground-Water Flow in the Deep-Brine Aquifers of the Palo Duro Basin, Texas Panhandle," by Wirojanagud, Kreitler, and Smith. Review requested 4/18/85.
3.	Final: Contract Report	"The Internal Structure of Model and Natural Salt Domes - Experimental Modeling of Salt Diapirs: Final Report," by Jackson and Talbot. Review requested 4/29/85.
4.	Article: AAPG Bulletin	"Wolfcampian Series Porosity Distribution: Implications for Deep-Basin Ground-Water Flow in the Palo Duro Basin, Texas Panhandle," by Conti, Senger, Wirojanagud, and Herron. Review requested 5/17/85.
5.	Draft: Bureau RI	"Cyclicity in the Middle Permian San Andres Formation, Palo Duro Basin, Texas Panhandle," by Fracasso and Hovorka. Review requested 6/20/85.
6.	Draft: Bureau GC	"Fracture Analyses of the Palo Duro Basin Area, Texas Panhandle and Eastern New Mexico," by Collins and Luneau. Review requested 7/29/85.

BEG PUBLICATIONS

APPROVAL PENDING

1.	Draft: Contract Report Bureau GC	"Geology and Geohydrology of the Palo Duro Basin, Texas Panhandle: A Report on the Progress of Nuclear Waste Isolation Feasibility Studies (1983)," by Gustavson and others. Review requested 10/2/84. Comments received 7/1/85. Extension to 8/15/85 requested.
2.	Article: Groundwater	"Geochemistry of Salt Water in the Rolling Plains, North-Central Texas," by Richter and Kreitler,

		Review requested 10/10/84. Comments received 5/13/85 Responses submitted 6/13/85. Revised article submitted 7/3/85.
3.	Article: Geology	"Geochemical and Textural Evidence of Primary and Altered Bedded Salt, Permian Lower San Andres Formation, Palo Duro Basin, Texas," by Fisher and Hovorka. Review requested 10/19/84. Comments received 5/13/85. Response period extended to 9/1/85.
4.	Draft: Bureau RI	"Late Cenozoic Geomorphic Evolution of the Texas Panhandle and Northeast New Mexico - Case Studies of Structural Controls of Regional Drainage Development," by Gustavson and Finley. Review requested 12/21/84. Comments received 7/1/85. Extension to 8/15/85 requested.
5.	Article: GSA Bulletin	"Structural Control of the Development of the Canadian River Valley, Texas Panhandle: An Example of Regional Salt Dissolution and Subsidence," by Gustavson. Review requested 3/7/85. Comments received 7/5/85. Extension to 8/31/85 requested.
6.	Draft: Bureau RI	"The Pre-Pennsylvanian of the Palo Duro Basin, Texas Panhandle: Stratigraphy and Petroleum Potential," by Ruppel. Review requested 3/11/85. Comments received 7/15/85. Responses submitted 7/24/85.
7.	Draft: Bureau RI	"Stratigraphy of Bedded Halite in the Permian San Andres Formation, Units 4 and 5, Palo Duro Basin, Texas," by Hovorka, Luneau and Thomas. Review requested 4/3/85. Comments received 7/3/85. Responses submitted 7/25/85.
8.	Article: South Texas Geological Society	"Reinterpretation of the Internal Structure of Palangana Salt Dome, South Texas," by Jackson and Talbot. Review requested 4/23/85. Comments received 7/22/85.

Enclosure

STATUS OF REVIEWS

(List from June, 1985 Progress Report)

West Texas Waste Isolation Project
Contract No. DE-AC97-83WM46651

1. Draft: Contract Report Bureau GC	"Geology and Geohydrology of the Palo Duro Basin, Texas Panhandle: A Report on the Progress of Nuclear Waste Isolation Feasibility Studies (1983)," by Gustavson and others. Review requested 10/02/84. Consolidated review comments sent to TBEG for resolution 06/25/85. Response requested by 08/01/85.
2. Draft: Bureau RI	"Late Cenozoic Geomorphic Evolution of the Texas Panhandle and Northeast New Mexico - Case Studies of Structural Controls of Regional Drainage Development," by Gustavson and Finley. Review requested 12/21/84. Review comments sent to TBEG for resolution 06/26/85. Response requested by 07/31/85.
3. Draft: Bureau RI	"Hydrogeology and Hydrochemical Facies of the San Andres Formation in Eastern New Mexico, West-Central Texas, and the Texas Panhandle," by Dutton and Orr. Review requested 02/06/85. Report is in review cycle at SRPO.
4. Article: GSA Bulletin	"Structural Control of the Development of the Canadian River Valley, Texas Panhandle: An Example of Regional Salt Dissolution and Subsidence," by Gustavson. Review requested 03/07/85. Review comments sent to TBEG for resolution 07/01/85. Response requested by 08/08/85.
5. Draft: Bureau RI	"The Pre-Pennsylvanian of the Palo Duro Basin, Texas Panhandle: Stratigraphy and Petroleum Potential," by Ruppel. Review requested 03/11/85. Review comments sent to TBEG for resolution 07/08/85. Response requested by 08/12/85.
6. Draft: Bureau RI	"Stratigraphy of Bedded Halite in the Permian San Andres Formation, Units 4 and 5, Palo Duro Basin, Texas," by Hovorka, Luneau and Thomas. Review requested 04/03/85. Review comments sent to TBEG for resolution 07/03/85. Response requested by 08/05/85.

7. Draft: Bureau RI	"Numerical Modeling of Regional Ground-Water Flow in the Deep-Brine Aquifers of the Palo Duro Basin, Texas Panhandle," by Wirojanagud, Kreitler, and Smith. Review requested 04/18/85. Report is in review cycle at SRPO.
8. Article: South Texas Geological Society Bulletin	"Reinterpretation of the Internal Structure of Palangana Salt Dome, South Texas," by Jackson and Talbot. Review requested 04/23/85. Report was sent to CER on 05/30/85. Review has been received by SRPO; transmittal to TBEG is in preparation.
9. Final: Contract Report	"The Internal Structure of Model and Natural Salt Domes - Experimental Modeling of Salt Diapirs: Final Report," by Jackson and Talbot. Review requested 04/29/85. Report was sent to ETC via ONWI on 05/16/85. Review due date has been extended to 07/17/85.
10. Article: AAPG Bulletin	"Wolfcampian Series Porosity Distribution: Implicatons for Deep-Basin Ground-Water Flow in the Palo Duro Basin, Texas Panhandle," by Conti, Senger, Wirojanagud, and Herron. Review requested 05/17/95. Report is in internal review, SRPO.
11. Draft: Bureau RI	"Cyclicity in the Middle Permian San Andres Formation, Palo Duro Basin, Texas Panhandle," by Fracasso and Hovorka. Review requested 06/20/85. Report was sent to SWEC via ONWI on 07/05/85. Review is due to SRPO by 08/09/85.

7956B

COPIED FOR QA FILES

BEG PUBLICATIONS

APPROVAL PENDING

West Texas Waste Isolation Project
Contract No. DE-AC97-83WM46651

1.	Article: Groundwater	"Geochemistry of Salt Water in the Rolling Plains, North-Central Texas," by Richter and Kreitler, Review requested 10/10/84. Comments received 05/13/85. Responses submitted 06/13/85.
2.	Article: Geology	"Geochemical and Textural Evidence of Primary and Altered Bedded Salt, Permian Lower San Andres Formation, Palo Duro Basin, Texas," by Fisher and Hovorka. Review requested 10/19/84. Comments received 05/13/85. Comment response requested by 06/15/85.
3.	Article: Geological Society	"External Shapes and Dynamics of Salt Structures," by Jackson and Talbot. Review requested 11/29/84. Comments received May 24, 1985. Response period extended to 07/31/85.

7956B

COPIED FOR QA FILES

June 1985

PUBLICATIONS ASSOCIATED WITH RESEARCH IN THE PALO DURO AND DALHART BASINS

I. Bureau Publications

1979

Dutton, S. P., Finley, R. J., Galloway, W. E., Gustavson, T. C., Handford, C. R., and Presley, M. W., 1979, Geology and geohydrology of the Palo Duro Basin, Texas Panhandle: a report on the progress of nuclear waste isolation feasibility studies (1978): The University of Texas at Austin, Bureau of Economic Geology Geological Circular 79-1, 99 p.

McGowen, J. H., Granata, G. E., and Seni, S. J., 1979, Depositional framework of the Lower Dockum Group (Triassic), Texas Panhandle: The University of Texas at Austin, Bureau of Economic Geology Report of Investigations No. 97, 60 p.

1980

Dutton, S. P., 1980, Depositional systems and hydrocarbon resource potential of the Pennsylvanian System, Palo Duro and Dalhart Basins, Texas Panhandle: The University of Texas at Austin, Bureau of Economic Geology Geological Circular 80-8, 49 p.

Dutton, S. P., 1980, Petroleum source rock potential and thermal maturity, Palo Duro Basin, Texas: The University of Texas at Austin, Bureau of Economic Geology Geological Circular 80-10, 48 p.

Finley, R. J., and Gustavson, T. C., 1980, Climatic controls on erosion in the Rolling Plains and along the Caprock Escarpment of the Texas Panhandle: The University of Texas at Austin, Bureau of Economic Geology Geological Circular 80-11, 50 p.

Gustavson, T. C., Finley, R. J., and McGillis, K. A., 1980, Regional dissolution of Permian salt in the Anadarko, Dalhart, and Palo Duro Basins of the Texas Panhandle: The University of Texas at Austin, Bureau of Economic Geology Report of Investigations No. 106, 40 p.

Gustavson, T. C., Presley, M. W., Handford, C. R., Finley, R. J., Dutton, S. P., Baumgardner, R. W., Jr., McGillis, K. A., and Simpkins, W. W., 1980, Geology and geohydrology of the Palo Duro Basin, Texas Panhandle: a report on the progress of nuclear waste isolation feasibility studies (1979): The University of Texas at Austin, Bureau of Economic Geology Geological Circular 80-7, 99 p.

Handford, C. R., and Fredericks, P. E., 1980, Facies patterns and depositional history of a Permian sabkha complex: Red Cave Formation, Texas Panhandle: The University of Texas at Austin, Bureau of Economic Geology Geological Circular 80-9, 38 p.

Handford, C. R., and Fredericks, P. E., 1980, Lower Permian facies of the Palo Duro Basin, Texas: depositional systems, shelf-margin evolution, paleogeography, and petroleum potential: The University of Texas at Austin, Bureau of Economic Geology Report of Investigations No. 102, 31 p.

Seni, S. J., 1980, Sand-body geometry and depositional systems, Ogallala Formation, Texas: The University of Texas at Austin, Bureau of Economic Geology Report of Investigations No. 105, 36 p.

1981

Finley, R. J., and Gustavson, T. C., 1981, Lineament analysis of the Texas Panhandle using Landsat imagery: The University of Texas at Austin, Bureau of Economic Geology Geological Circular 81-5, 37 p.

Gustavson, T. C., Bassett, R. L., Finley, R. J., Goldstein, A. G., Handford, C. R., McGowen, J. H., Presley, M. W., Baumgardner, R. W., Jr., Bentley, M. E., Dutton, S. P., Griffin, J. A., Hoadley, A. D., Howard, R. C., McGookey, D. A., McGillis, K. A., Palmer, D. P., Ramondetta, P. J., Roedder, E., Simpkins, W. W., and Wiggins, W. D., 1981, Geology and geohydrology of the Palo Duro Basin, Texas Panhandle: a report on the progress of nuclear waste isolation feasibility studies (1980): The University of Texas at Austin, Bureau of Economic Geology Geological Circular 81-3, 173 p.

Handford, C. R., Dutton, S. P., and Fredericks, P. E., 1981, Regional cross sections of the Texas Panhandle: Precambrian to mid-Permian: The University of Texas at Austin, Bureau of Economic Geology Cross Sections, 8 p.

McGillis, K. A., and Presley, M. W., 1981, Tansill, Salado, and Alibates Formations: Upper Permian evaporite/carbonate strata of the Texas Panhandle: The University of Texas at Austin, Bureau of Economic Geology Geological Circular 81-8, 31 p.

Presley, M. W., 1981, Middle and Upper Permian salt-bearing strata of the Texas Panhandle: The University of Texas at Austin, Bureau of Economic Geology Cross Sections, 10 p.

Simpkins, W. W., Gustavson, T. C., Alhades, A. B., and Hoadley, A. D., 1981, Impact of evaporite dissolution and collapse on highways and other cultural features in the Texas Panhandle and eastern New Mexico: The University of Texas at Austin, Bureau of Economic Geology Geological Circular 81-4, 23 p.

1982

Baumgardner, R. W., Jr., Hoadley, A. D., and Goldstein, A. G., 1982, Formation of the Wink Sink, a salt dissolution and collapse feature, Winkler County, Texas: The University of Texas at Austin, Bureau of Economic Geology Report of Investigations No. 114, 38 p.

Bein, A., and Land, L. S., 1982, San Andres carbonates in the Texas Panhandle: sedimentation and diagenesis associated with magnesium-calcium-chloride brines: The University of Texas at Austin, Bureau of Economic Geology Report of Investigations No. 121, 48 p.

Dutton, S. P., Goldstein, A. G., and Ruppel, S. C., 1982, Petroleum potential of the Palo Duro Basin, Texas Panhandle: The University of Texas at Austin, Bureau of Economic Geology Report of Investigations No. 123, 87 p.

Gustavson, T. C., Bassett, R. L., Budnik, R. T., Finley, R. J., Goldstein, A. G., McGowen, J. H., Roedder, E., Ruppel, S. C., Baumgardner, R. W., Jr., Bentley, M. E., Dutton, S. P., Fogg, G. E., Hovorka, S. D., McGookey, D. A., Ramondetta, P. J., Simpkins, W. W., Smith, D., Smith, D. A., Duncan, E. A., Griffin, J. A., Merritt, R. M., and Naiman, E. R., 1982, Geology and geohydrology of the Palo Duro Basin, Texas Panhandle, a report on the progress of nuclear waste isolation feasibility studies (1981): The University of Texas at Austin, Bureau of Economic Geology Geological Circular 82-7, 212 p.

Presley, M. W., and McGillis, K. A., 1982, Coastal evaporite and tidal-flat sediments of the upper Clear Fork and Glorieta Formations, Texas Panhandle: The University of Texas at Austin, Bureau of Economic Geology Report of Investigations No. 115, 50 p.

Ramondetta, P. J., 1982, Genesis and emplacement of oil in the San Andres Formation, Northern Shelf of the Midland Basin, Texas: The University of Texas at Austin, Bureau of Economic Geology Report of Investigations No. 116, 39 p.

Ramondetta, P. J., 1982, Facies and stratigraphy of the San Andres Formation, Northern and Northwestern Shelves of the Midland Basin, Texas and New Mexico: The University of Texas at Austin, Bureau of Economic Geology Report of Investigations No. 128, 56 p.

1983

Bassett, R. L., and Bentley, M. E., 1983, Deep brine aquifers in the Palo Duro Basin: regional flow and geochemical constraints: The University of Texas at Austin, Bureau of Economic Geology Report of Investigations No. 130, 59 p.

Gustavson, T. C., Kreitler, C. W., Bassett, R. L., Budnik, R. T., Ruppel, S. C., Baumgardner, R. W., Jr., Caran, S. C., Collins, E. W., Dutton, A. R., Dutton, S. P., Fisher, R. S., Fogg, G. E., Hovorka, S. D., Kolker, A., McGookey, D. A., Orr, E. D., Roberts, M. P., Senger, R. K., Smith, Dale A., and Smith, D. Anderson, 1983, Geology and geohydrology of the Palo Duro Basin, Texas Panhandle: a report on the progress of nuclear waste isolation feasibility studies (1982): The University of Texas at Austin, Bureau of Economic Geology Geological Circular 83-4, 156 p.

1984

Collins, E. W., 1984, Styles of deformation in Permian strata, Texas Panhandle: The University of Texas at Austin, Bureau of Economic Geology Geological Circular 84-4, 32 p.

In press

Fisher, R. S., in press, Amount and nature of occluded water in bedded salt, Palo Duro Basin, Texas: The University of Texas at Austin, Bureau of Economic Geology Geological Circular.

Gustavson, T. C., and Finley, R. J., in press, Late Cenozoic geomorphic evolution of the Texas Panhandle and northeastern New Mexico--case studies of structural control of regional drainage development: The University of Texas at Austin, Bureau of Economic Geology Report of Investigations.

McGookey, D. A., Gustavson, T. C., and Hoadley, A. D., in press, Regional structural cross sections, mid-Permian to Quaternary strata, Texas Panhandle and eastern New Mexico, distribution of evaporites and areas of evaporite dissolution and collapse: The University of Texas at Austin, Bureau of Economic Geology Cross Sections.

Orr, E. D., Kreitler, C. W., and Senger, R. K., in press, Investigation of underpressuring in the deep-basin brine aquifer, Palo Duro Basin, Texas: The University of Texas at Austin, Bureau of Economic Geology Geological Circular 85-1.

Ruppel, S. C., in press, Stratigraphy and petroleum potential of Pre-Pennsylvanian Rocks, Palo Duro Basin, Texas Panhandle: The University of Texas at Austin, Bureau of Economic Geology Report of Investigations.

In preparation

Dutton, A. R., and Orr, E. D., in preparation, Hydrogeology and hydrochemical facies of the San Andres Formation in eastern New Mexico, West-Central Texas, and the Texas Panhandle: The University of Texas at Austin, Bureau of Economic Geology Report of Investigations.

Gustavson, T. C., and others, in preparation, Geomorphology and Quaternary stratigraphy of the Rolling Plains of the Texas Panhandle: The University of Texas at Austin, Bureau of Economic Geology Guidebook 22.

Gustavson, T. C., and others, in preparation, Geology and geohydrology of the Palo Duro Basin, Texas Panhandle, a report on the progress of nuclear waste isolation feasibility studies (1983): The University of Texas at Austin, Bureau of Economic Geology Geological Circular.

Hovorka, S. D., Luneau, B. A., and Thomas, S., in preparation, Stratigraphy of bedded halite in the Permian San Andres Formation, units 4 and 5, Palo Duro Basin, Texas: The University of Texas at Austin, Bureau of Economic Geology Report of Investigations.

Wirojanagud, P., Kreitler, C. W., and Smith, D. A., in preparation, Numerical modeling of regional ground-water flow in the deep-brine aquifers of the Palo Duro Basin, Texas Panhandle: The University of Texas at Austin, Bureau of Economic Geology Report of Investigations.

PUBLICATIONS ASSOCIATED WITH RESEARCH IN THE PALO DURO AND DALHART BASINS

II. Outside Publications and Contract Reports

1978

Galloway, W. E., Gustavson, T. C., Dutton, S. P., Handford, R. J., and Presley, M. W., 1978, Locating field confirmation study areas for isolation of nuclear waste in the Texas Panhandle: The University of Texas at Austin, Bureau of Economic Geology Annual Report, 109 p.

Gustavson, T. C., Finley, R. J., and Woodruff, C. M., Jr., 1978, Geomorphic studies applied to the evaluation of nuclear waste isolation sites (abs.): Geological Society of America, Abstracts with Programs, v. 10, no. 1, p. 6.

Gustavson, T. C., Finley, R. J., Morabito, J. R., and Presley, M. W., 1978, Structural controls on drainage development on the Southern High Plains and Rolling Plains of the Texas Panhandle (abs): Geological Society of America, Abstracts with Programs, v. 10, no. 7, p. 413.

McGowen, J. H., Granata, G. E., and Seni, S. J., 1978, Depositional framework of the Lower Dockum Group (Triassic), Texas Panhandle: The University of Texas at Austin, Bureau of Economic Geology Contract Report, 113 p. (U.S.G.S. Grant).

1979

Dutton, S. P., 1979, Alternating clastic-carbonate deposition in fan delta systems, Lower Pennsylvanian, Palo Duro Basin (abs.): Geological Society of America, Abstracts with Programs, v. 11, no. 2, p. 146-147.

Dutton, S. P., 1979, Depositional models and resource potential, Pennsylvanian System, Palo Duro Basin, Panhandle, Texas (abs.): American Association of Petroleum Geologists Bulletin, v. 63, no. 8, p. 1425.

Dutton, S. P., 1979, Facies patterns and depositional models, Pennsylvanian System, Palo Duro Basin, Panhandle, Texas (abs.): American Association of Petroleum Geologists Bulletin, v. 63, no. 3, p. 442-443.

Dutton, S. P., 1979, Pennsylvanian fan-delta sandstones of the Palo Duro Basin, Texas (abs.): American Association of Petroleum Geologists Bulletin, v. 63, no. 11, p. 2116.

Dutton, S. P., 1979, Pennsylvanian fan-delta sandstones of the Palo Duro Basin, Texas: in Pennsylvanian sandstones of the Mid-Continent: Tulsa Geological Society Special Publication, no. 1, p. 235-245.

Finley, R. J., and Gustavson, T. C., 1979, Geomorphic effects of a major storm on an instrumented drainage basin in the Texas Panhandle (abs.): Geological Society of America, Abstracts with Programs, v. 12, no. 1, p. 426.

Galloway, W. E., Gustavson, T. C., Dutton, S. P., Finley, R. J., Handford, C. R., and Presley, M. W., 1979, Locating field confirmation study areas for isolation of nuclear waste in the Texas Panhandle: The University of Texas at Austin, Bureau of Economic Geology Annual Report, 106 p.

Gustavson, T. C., and Finley, R. J., 1979, Timing and rates of regional salt dissolution in bedded Permian salts in the Texas Panhandle (abs.): Geological Society of America, Abstracts with Programs, v. 11, no. 7, p. 413.

Gustavson, T. C., Finley, R. J., Morabito, J. R., and Presley, M. W., 1979, Regional salt dissolution and subsidence, Texas Panhandle (abs.): Geological Society of America, Abstracts with Programs, v. 11, no. 2, p. 147-148.

Gustavson, T. C., Handford, C. R., Presley, M. W., Baumgardner, R. W., Jr., Dutton, S. P., Finley, R. J., McGillis, K. A., and Simpkins, W. W., 1979, Locating field confirmation study areas for isolation of nuclear waste in the Texas Panhandle: The University of Texas at Austin, Bureau of Economic Geology Annual Report, 99 p.

Gustavson, T. C., Presley, M. W., and Handford, C. R., 1979, A multi-disciplinary geological approach to basin evaluation for nuclear waste management, Palo Duro Basin, northwest Texas (abs.): Proceedings, National Waste Terminal Storage Program Information Meeting, U.S. Department of Energy, Office of Nuclear Waste Isolation, Battelle Memorial Institute, ONWI-62, p. 75-77.

Handford, C. R., 1979, Depositional history of high-constructive delta systems (Wolfcampian), southeastern Palo Duro Basin, Texas (abs.): American Association of Petroleum Geologists Bulletin, v. 63, no. 11, p. 2116-2117.

Handford, C. R., 1979, Depositional and diagenetic history of high-constructive delta systems (Wolfcampian), southeastern Palo Duro Basin, Texas, in Pennsylvanian Sandstones of the Mid-Continent: Tulsa Geological Society Special Publication, no. 1, p. 247-258.

Handford, C. R., 1979, Depositional systems and petroleum potential of Lower Permian strata, Palo Duro Basin, Texas (abs.): American Association of Petroleum Geologists Bulletin, v. 63, no. 8, p. 1426.

Handford, C. R., 1979, Despite a long list of failures, Palo Duro Basin still has hopes: Oil & Gas, v. 77, p. 190-198.

Handford, C. R., 1979, Lower Permian facies tracts and evolution of carbonate shelf margins, Palo Duro Basin, Texas Panhandle (abs.): American Association of Petroleum Geologists Bulletin, v. 63, no. 3, p. 461-462.

Handford, C. R., 1979, Stratigraphy and depositional systems of Lower Permian red-bed evaporite and dolomite facies, Panhandle, Texas (abs.): Geological Society of America, Abstracts with Programs, v. 11, no. 2, p. 148.

Handford, C. R., and Dutton, S. P., 1979, Exploration potential of Pennsylvanian-Permian carbonate-shelf margins and deltaic sandstones, Palo Duro Basin, Texas (abs.): American Association of Petroleum Geologists Bulletin, v. 63, no. 3, p. 461.

Presley, M. W., 1979, San Andres facies patterns, Palo Duro and Dalhart Basins, Texas (abs.): American Association of Petroleum Geologists Bulletin, v. 63, no. 8, p. 1427-1428.

Presley, M. W., 1979, Shelf and supratidal facies of Permian Tubb strata, Texas Panhandle (abs.): Geological Society of America, Abstracts with Programs, v. 11, no. 2, p. 164.

Presley, M. W., 1979, Shelf and supratidal facies in Upper Permian strata, Palo Duro and Dalhart Basins, Texas (abs.): West Texas Geological Society Newsletter, October 1979, p. 4.

Presley, M. W., 1979, Upper Permian evaporites and red-beds of Palo Duro Basin, Texas--facies patterns through time (abs.): American Association of Petroleum Geologists Bulletin, v. 63, no. 3, p. 511-512.

Presley, M. W., Gustavson, T. C., Galloway, W. E., Finley, R. J., Handford, C. R., Dutton, S. P., and McGillis, K. A., 1979, Palo Duro Basin analysis (abs.): American Association of Petroleum Geologists Bulletin, v. 63, no. 3, p. 511.

Seni, S. J., 1979, Geometry and depositional systems of the Neogene Ogallala Formation, Texas (abs.): Geological Society of America, Abstracts with Programs, v. 11, no. 7, p. 514.

Woodruff, C. M., Jr., Gustavson, T. C., and Finley, R.J., 1979, Playas and draws on the Llano Estacado--tentative findings based on geomorphic mapping of a test area in Texas: Texas Journal of Science, v. 31, no. 3, p. 213-223.

1980

Bassett, R. L., 1980, Surface properties of clay minerals and their contributions to waste repository siting (abs.): American Chemical Society, Annual Meeting, Abstracts, p. 16.

Bassett, R. L., and Palmer, D. P., 1980, The clay mineralogy of Palo Duro Basin bedded salts as related to the evaluation of geologic media for nuclear waste disposal (abs.): The Clay Minerals Society, Program and Abstracts, p. 20.

Baumgardner, R. W., Jr., Gustavson, T. C., and Hoadley, A. D., 1980, Salt blamed for new sink in West Texas: Geotimes, v. 25, no. 9, p. 16-17.

Baumgardner, R. W., Jr., and Hoadley, A. D., 1980, Geology and hydrology of the Wink Sink, Winkler County, Texas (abs.): Solution Mining Research Institute meeting, 10 p.

Dutton, S. P., 1980, Source-rock quality and thermal maturity, Palo Duro Basin, Texas (abs.): American Association of Petroleum Geologists Bulletin, v. 64, no. 5, p. 702.

Finley, R. J., and Baumgardner, R. W., Jr., 1980, Fluvial morphology of the Little Red River and erosion of the Caprock Escarpment, Briscoe and Hall Counties, Texas (abs.): Geological Society of America, Abstracts with Programs, v. 12, no. 1, p. 3.

Finley, R. J., Baumgardner, R. W., Jr., and Gustavson, T. C., 1980, Erosion in state parks: Discovery, v. 5, no. 2, p. 12-15.

Gustavson, T. C., Alhades, A. B., Hoadley, A. D., and Simpkins, W. W., 1980, Karstification of the Rolling Plains of the Texas Panhandle due to dissolution of Permian evaporites (abs.): Geological Society of America, Abstracts with Programs, v. 12, no. 1, p. 4.

Gustavson, T. C., and Finley, R. J., 1980, Rates of geomorphic processes in selected areas of the Rolling Plains and Southern High Plains, Texas Panhandle (abs.): Geological Society of America, Abstracts with Programs, v. 12, no. 7, p. 439.

Gustavson, T. C., Finley, R. J., and Baumgardner, R. W., Jr., 1980, Rates of geologic processes in the Texas Panhandle affecting the integrity of underground nuclear waste repositories (abs.): Association of Engineering Geologists Annual Meeting, Program with Abstracts, p. 24-25.

Gustavson, T. C., Bassett, R. L., Baumgardner, R. W., Jr., Bentley, M. E., Dutton, S. P., Goldstein, A. G., McGowen, J. H., and Presley, M. W., 1980, Nuclear waste isolation studies of the Palo Duro and Dalhart Basins, FY 1980: Proceedings, U.S. Department of Energy, Office of Nuclear Waste Isolation, Annual Meeting, p. 269-272.

Handford, C. R., and Dutton, S. P., 1980, Pennsylvanian-Early Permian depositional systems and shelf-margin evolution, Palo Duro Basin, Texas: American Association of Petroleum Geologists Bulletin, v. 64, no. 1, p. 88-106.

Handford, C. R., Presley, M. W., and Dutton, S. P., 1980, Depositional and tectonic evolution of a basement-bounded, intracratonic basin, Palo Duro Basin, Texas (abs.): American Association of Petroleum Geologists Bulletin, v. 64, no. 5, p. 717.

Presley, M. W., and McGillis, K. A., 1980, A Late Permian (Ochoan) carbonate basin in the Texas Panhandle (abs.): Geological Society of America, Abstracts with Programs, v. 12, no. 1, p. 15-16.

Presley, M. W., and McGillis, K. A., 1980, Red-bed, evaporite, and carbonate facies associations in interior basins--a model for resource exploration (abs.): American Association of Petroleum Geologists Bulletin, v. 64, no. 8, p. 1288.

Presley, M. W., Smith, G. E., Mikan, F. M., and McGillis, K. A., 1980, Glorieta-San Andres transition in the Texas Panhandle--facies interpretation of a complex stratigraphic boundary (abs.): Geological Society of America, Abstracts with Programs, v. 12, no. 1, p. 15.

Seni, S. J., 1980, Uranium resource assessment of the Texas Panhandle: The University of Texas at Austin, Bureau of Economic Geology Milestone Report, 15 p.

Simpkins, W. W., Alhades, A. B., Hoadley, A. D., and Gustavson, T. C., 1980, Impact of evaporite dissolution and collapse on cultural features in the Texas Panhandle and eastern New Mexico (abs.): 31st Annual Highway Geology Symposium, Programs and Abstracts, p. 3.

1981

Bassett, R. L., and Bentley, M. E., 1981, Regional flow and geochemistry of brines, Palo Duro Basin, Texas, a framework for nuclear waste isolation studies (abs.): Geological Society of America, Abstracts with Programs, v. 13, no. 7, p. 405.

Bassett, R. L., Duncan, E., and Griffin, J. A., 1981, Predicting the reaction state of brines in proposed regions of nuclear waste disposal sites: Proceedings, Material Research Society Conference Annual Meeting, v. 3, p. 27-34.

Baumgardner, R. W., Jr., 1981, Origin of the "Cup and Saucer," Mitchell County, Texas: American Association of Petroleum Geologists, spring field trip, 5 p.

Baumgardner, R. W., Jr., and Hoadley, A. D., 1981, The Wink Sink: A case history of evaporite dissolution and catastrophic subsidence (abs.): Geological Society of America, Abstracts with Programs, v. 13, no. 5, p. 233-234.

Baumgardner, R. W., Jr., Hoadley, A. D., and Goldstein, A. G., 1981, The formation of the Wink Sink, Winkler County, Texas (abs.): U.S. Department of Energy.

Dutton, S. P., 1981, Combination structural and stratigraphic traps in Pennsylvanian granite wash, Mobeetie Field, Anadarko Basin (abs.): Southwest Section of the American Association of Petroleum Geologists and the Permian Basin Section of the Society of Economic Paleontologists and Mineralogists, Annual Meeting, p. 15-16.

Dutton, S. P., 1981, Diagenesis of Pennsylvanian fan-delta sandstones and interbedded shelf carbonates, Texas Panhandle (abs.): Geological Society of America, Abstracts with Programs, v. 13, no. 7, p. 443.

Dutton, S. P., 1981, Geochemistry of hydrocarbon source rocks, Palo Duro Basin (abs.): American Association of Petroleum Geologists Bulletin, v. 65, no. 4, p. 758-759.

Dutton, S. P., 1981, Pennsylvanian fan-delta and carbonate deposition, Mobeetie Field, Texas Panhandle (abs.): American Association of Petroleum Geologists Bulletin, v. 65, no. 5, p. 922-923.

Dutton, S. P., 1981, Pennsylvanian fan-delta and carbonate deposition, Mobeetie Field, Texas Panhandle: The University of Texas at Austin, Bureau of Economic Geology Milestone Report, 24 p.

Goldstein, A. G., 1981, Laramide-style basement deformation in the Ouachita-Marathon Foreland (abs.): Geological Society of America, Abstracts with Programs, v. 13, no. 5, p. 238.

Goldstein, A. G., 1981, Laramide-style basement deformation in the Ouachita-Marathon Foreland (abs.): Oklahoma Geological Survey, Oklahoma Geology Notes, v. 41, no. 3, p. 93.

Goldstein, A. G., 1981, Plate tectonics of the Ancestral Rocky Mountains: comment: Geology, v. 9, no. 9, p. 387-388.

Goldstein, A. G., and Keller, G. R., 1981, Gravity analysis of Ancestral Rockies in Texas and New Mexico: constraints on Late Paleozoic intraplate tectonics (abs.): Geological Society of America, Abstracts with Programs, v. 13, no. 7, p. 461.

Gustavson, T. C., Finley, R. J., and Baumgardner, R. W., Jr., 1981, Retreat of the Caprock Escarpment and denudation of the Rolling Plains in the Texas Panhandle: Bulletin of the Association of Engineering Geologists, v. 28, no. 4, p. 413-422.

Handford, C. R., 1981, Coastal sabkha and salt pan deposition of the Lower Clear Fork Formation (Permian) Texas: Journal of Sedimentary Petrology, v. 51, no. 3, p. 761-778.

Handford, C. R., 1981, Facies patterns and depositional models of Permian sabkha complex—Red Cave Formation, Texas Panhandle (abs.): American Association of Petroleum Geologists Bulletin, v. 65, no. 4, p. 761.

Palmer, D. P., 1981, Clay mineralogy of Permian sabkha sequences, Palo Duro Basin, Texas: The University of Texas at Austin, Bureau of Economic Geology Milestone Report, 94 p.

Presley, M. W., 1981, Permian salt-bearing units of the Texas Panhandle: lithology and facies: The University of Texas at Austin, Bureau of Economic Geology Milestone Report, 10 p.

Presley, M. W., 1981, Shelf and supratidal facies of the Permian Tubb Formation in the Texas Panhandle: The University of Texas at Austin, Bureau of Economic Geology Milestone Report, 37 p.

Presley, M. W., and McGillis, K. A., 1981, Tansill, Salado, and Alibates Formations: Upper Permian evaporite/carbonate strata of the Texas Panhandle: The University of Texas at Austin, Bureau of Economic Geology Milestone Report, 31 p.

Presley, M. W., and Ramondetta, P. J., 1981, San Andres hydrocarbon potential in the Texas Panhandle (abs.): American Association of Petroleum Geologists Bulletin.

Ramondetta, P. J., 1981, Genesis and emplacement of oil in the San Andres Formation, Northern Shelf of the Midland Basin, Texas: The University of Texas at Austin, Bureau of Economic Geology Milestone Report, 52 p.

Roedder, E., and Bassett, R. L., 1981, Problems in determination of the water content of rock salt samples and its significance in nuclear-waste storage siting: Geology, v. 9, no. 11, p. 525-530.

Simpkins, W. W., Bassett, R. L., Bentley, M. E., and Fogg, G. E., 1981, Processes of salt dissolution and saline ground-water discharge in the Rolling Plains region of the Texas Panhandle (abs.): Geological Society of America, Abstracts with Programs, v. 13, no. 5, p. 262.

Simpkins, W. W., Gustavson, T. C., Alhades, A. B., and Hoadley, A. D., 1981, Impact of evaporite dissolution and collapse on highways and other cultural features in the Texas Panhandle and eastern New Mexico: Proceedings, 31st Annual Highway Geology Symposium, p. 29-56.

1982

Bassett, R. L., and Bentley, M. E., 1982, Geochemistry and hydrodynamics of deep formation brines in the Palo Duro and Dalhart Basins, Texas: Journal of Hydrology, v. 59, p. 331-372.

Bassett, R. L., and Smith, D. A., 1982, Origin, composition, and migration of brines in the Palo Duro Basin, Texas (abs.): American Chemical Society, 183rd National Meeting, Nuclear Chemistry Section, abstract no. 42.

Bassett, R. L., Smith, D. A., and Roberts, M. P., 1982, Utility of computerized data bases of drill-stem test information in hydrogeologic studies (abs.): American Association of Petroleum Geologists Bulletin, v. 66, no. 5, p. 546.

Bein, A., and Land, L. S., 1982, San Andres carbonates in the Texas Panhandle: sedimentation and diagenesis associated with magnesium-calcium-chloride brines: The University of Texas at Austin, Bureau of Economic Geology Milestone Report, 48 p.

Boyd, F. M., and Kreitler, C. W., 1982, Hydrogeology and geochemistry of the northern Salt Basin of West Texas and New Mexico (abs.): Geological Society of America, Abstracts with Programs, v. 14, no. 7, p. 449.

Dutton, S. P., 1982, Facies control of cementation and porosity in Pennsylvanian fan-delta sandstones, Texas Panhandle (abs.): American Association of Petroleum Geologists Bulletin, v. 66, no. 5, p. 565.

Dutton, S. P., 1982, Pennsylvanian fan-delta and carbonate deposition, Mobeetie Field, Texas Panhandle: American Association of Petroleum Geologists Bulletin, v. 66, no. 4, p. 389-407.

Goldstein, A. G., 1982, Late Paleozoic intraplate deformation of North America: constraints on plate tectonic models: The University of Texas at Austin, Bureau of Economic Geology Milestone Report, 40 p.

Goldstein, A. G., and Keller, G. R., 1982, Quantitative analysis of regional gravity data--Texas Panhandle region: The University of Texas at Austin, Bureau of Economic Geology Milestone Report.

Goldstein, A. G., and McGookey, D. A., 1982, Minor fault motions in relation to the Late Paleozoic tectonics of the Wichita-Amarillo Uplift (abs.): Geological Society of America, Abstracts with Programs, v. 14, no. 3, p. 111-112.

Goldstein, A. G., and McGookey, D. A., 1982, Minor fault motions in relation to Late Paleozoic tectonics of the Wichita-Amarillo Uplift (abs.): Oklahoma Geological Survey, Oklahoma Geology Notes, v. 42, no. 2, p. 96.

Gustavson, T. C., Bassett, R. L., Budnik, R. T., Finley, R. J., Goldstein, A. G., McGowen, J. H., Roedder, E., Ruppel, S. C., Baumgardner, R. W., Jr., Bentley, M. E., Dutton, S. P., Fogg, G. E., Hovorka, S. D., McGookey, D. A., Ramondetta, P. J., Simpkins, W. W., Smith, D., Smith, D. A., Duncan, E. A., Griffin, J. A., Merritt, R. M., and Naiman, E. R., 1982, Geology and geohydrology of the Palo Duro Basin, Texas Panhandle: a report on progress of nuclear waste isolation feasibility studies (1981): The University of Texas at Austin, Bureau of Economic Geology Milestone Report, 212 p.

Gustavson, T. C., and Finley, R. J., 1982, Geomorphic development of eastern New Mexico and the Texas Panhandle: a product of subsidence due to regional dissolution of Upper Permian salts (abs.): Geological Society of America, Abstracts with Programs, v. 14, no. 7, p. 504.

Gustavson, T. C., Simpkins, W. W., Alhades, A. B., and Hoadley, A. D., 1982, Evaporite dissolution and development of karst features on the Rolling Plains of the Texas Panhandle: Earth Surface Processes and Landforms, v. 7, p. 545-563.

Ruppel, S. C., 1982, Depositional setting of the lower Carboniferous (Mississippian) in the Palo Duro Basin of the Texas Panhandle (abs.): Geological Society of America, Abstracts with Programs, v. 14, no. 7, p. 605.

Simpkins, W. W., Finley, R. J., and Gustavson, T. C., 1982, Rates of erosion in a semi-arid environment: analysis of a two-year data record in the Texas Panhandle (abs.): Geological Society of America, Abstracts with Programs, v. 14, no. 3, p. 136.

U.S. Department of Interior, Division of Water, Land, and Power, Water Management Branch, 1982, Lake Meredith sediment survey and analysis: The University of Texas at Austin, Bureau of Economic Geology Milestone Report, 194 p.

1983

Baumgardner, R. W., Jr., 1983, Terrace stratigraphy and erosional history of the upper Little Red River, Texas Panhandle (abs.): Geological Society of America, Abstracts with Programs, v. 15, no. 1, p. 41.

Bein, A., and Land, L. S., 1983, Carbonate sedimentation and diagenesis associated with Mg-Ca-chloride brines: the Permian San Andres Formation in the Texas Panhandle: Journal of Sedimentary Petrology, v. 53, no. 1, p. 243-260.

Budnik, R. T., 1983, Recurrent intraplate deformation on the ancestral Rocky Mountain orogenic belt (abs.): Geological Society of America, Abstracts with Programs, v. 15, no. 6, p. 535.

Budnik, R. T., 1983, Recurrent motion of Precambrian-aged basement faults, Palo Duro Basin, Texas Panhandle (abs.): American Association of Petroleum Geologists Bulletin, v. 67, no. 3, p. 433.

Budnik, R. T., 1983, Recurrent motion of Precambrian-aged faults, Palo Duro Basin, Texas Panhandle (abs.): Oklahoma Geological Survey, Oklahoma Geology Notes, v. 43, no. 3, p. 74-75.

Bureau of Business Research, 1983, Texas Panhandle Mineral Assessment: summary report: The University of Texas at Austin, prepared for the Bureau of Economic Geology Milestone Report, 72 p.

Bureau of Business Research, 1983, Texas Panhandle Mineral Assessment: the petroleum industry: The University of Texas at Austin, prepared for the Bureau of Economic Geology Milestone Report, 61 p.

Collins, E. W., 1983, Joints and joint densities at Caprock Canyons State Park, Briscoe County, Texas Panhandle (abs.): Geological Society of America, Abstracts with Programs, v. 15, no. 1, p. 3.

Dutton, A. R., 1983, Regional ground-water flow in San Andres Formation, Texas Panhandle and eastern New Mexico (abs.): Geological Society of America, Abstracts with Programs, v. 15, no. 1, p. 4.

Dutton, S. P., 1983, Palo Duro Basin, an exploration frontier in the Texas Panhandle (abs.): American Association of Petroleum Geologists Bulletin, v. 67, no. 3, p. 454.

Dutton, S. P., and Land, L. S., 1983, Meteoric diagenesis of Pennsylvanian arkosic sandstones, southwestern Anadarko Basin (abs.): Geological Society of America, Abstracts with Programs, v. 15, no. 6, p. 564.

Finley, R. J., and Gustavson, T. C., 1983, Geomorphic effects of a 10-year storm on a small drainage basin in the Texas Panhandle: Earth Surface Processes and Landforms, v. 8, p. 63-77.

Fisher, R. S., and Hovorka, S. D., 1983, Textural and geochemical evidence of primary and altered halite, Permian San Andres Formation, Texas (abs.): Geological Society of America, Abstracts with Programs, v. 15, no. 6, p. 574.

Fracasso, M. A., 1983, Unconformity-bounded cycles in the San Andres Formation, Palo Duro Basin, Texas Panhandle: tectonic/topographic evolution of a middle Permian shallow evaporite basin (abs.): Geological Society of America, Abstracts with Programs, v. 15, no. 6, p. 576.

Gustavson, T. C., 1983, Quaternary surface subsidence, Southern High Plains, Texas Panhandle: a result of dissolution of Permian bedded salts (abs.): Geological Society of America, Abstracts with Programs, v. 15, no. 1, p. 41.

Gustavson, T. C., and Budnik, R. T., 1983, Structural control of geomorphic processes, physiographic features, and lithofacies, Texas Panhandle (abs.): Geological Society of America, Abstracts with Programs, v. 15, no. 6, p. 588.

Gustavson, T. C., Budnik, R. T., Collins, E. W., Dutton, S. P., Hovorka, S. D., and Ruppel, S. C., 1983, Geologic issues in isolating nuclear waste in the Palo Duro Basin, Texas (abs.): Geological Society of America, Abstracts with Programs, v. 15, no. 1, p. 3.

Hovorka, S. D., 1983, Carbonate-anhydrite-halite cycles, San Andres Formation (Permian), Palo Duro Basin, Texas, in Shaw, R. L., and Pollan, B. J., eds., Permian Basin cores--a workshop: Society of Economic Paleontologists and Mineralogists Core Workshop No. 2, p. 197-224.

Hovorka, S. D., and Budnik, R. T., 1983, Normal marine - marine marginal sabkha transition, Lower Permian, Palo Duro Basin, Texas Panhandle (abs.): Geological Society of America, Abstracts with Programs, v. 15, no. 1, p. 6.

Kreitler, C. W., Dutton, A. R., Fisher, R. S., Orr, E. D., Senger, R. K., and Smith, D. A., 1983, Hydrogeochemical issues for high-level nuclear waste isolation in the Permian evaporites of the Palo Duro Basin, Texas (abs.): Geological Society of America, Abstracts with Programs, v. 15, no. 1, p. 3.

McGookey, D. A., and Budnik, R. T., 1983, Tectonic history and influence on sedimentation of rhomb horsts and grabens associated with Amarillo Uplift, Texas Panhandle (abs.): American Association of Petroleum Geologists Bulletin, v. 67, no. 3, p. 511.

McGookey, D. A., and Budnik, R. T., 1983, Tectonic history and influence on sedimentation of rhomb horsts and grabens associated with the Amarillo Uplift, Texas Panhandle (abs.): Oklahoma Geological Survey, Oklahoma Geology Notes, v. 43, no. 3, p. 80-81.

McGowen, J. H., Granata, G. E., and Seni, S. J., 1983, Depositional setting of the Triassic Dockum Group, Texas Panhandle and eastern New Mexico: Society of Economic Paleontologists and Mineralogists, Rocky Mountain Section Meeting, Symposium No. 2, p. 13-38.

Orr, E. D., and Dutton, A. R., 1983, An application of geostatistics to determine regional ground-water flow in the San Andres Formation, Texas and New Mexico: Ground Water, v. 21, no. 5, p. 619-624.

Ruppel, S. C., 1983, Facies and depositional setting of Mississippian rocks in the Palo Duro - Hardeman Basin area, in Shaw, R. L., and Pollan, B. J., eds., Permian Basin cores--a workshop: Society of Economic Paleontologists and Mineralogists Core Workshop No. 2, p. 47-67.

Ruppel, S. C., 1983, Mississippian conodonts from the Texas Panhandle: implications for the depositional and structural history of the region (abs.): Geological Society of America, Abstracts with Programs, v. 15, no. 6, p. 676.

Smith, D. A., 1983, Permeability variation in the Palo Duro Basin from multiple well tests (abs.): Geological Society of America, Abstracts with Programs, v. 15, no. 1, p. 4.

Wermund, E. G., Gustavson, T. C., and Kreitler, C. W., 1983, Unresolved geotechnical issues for deep geological burial of high-level waste in Permian bedded salt, Palo Duro Basin, Texas (abs.): Geological Society of America, Abstracts with Programs, v. 15, no. 6, p. 717.

Wirojanagud, P., Kreitler, C. W., and Smith, D. A., 1983, Numerical modeling of regional ground-water flow in the Wolfcamp (Lower Permian) aquifers of the Palo Duro Basin, Texas Panhandle (abs.): Geological Society of America, Abstracts with Programs, v. 15, no. 6, p. 720.

1984

Baumgardner, R. W., Jr., Caran, S. C., and Gustavson, T. C., 1984, Quaternary stratigraphy of the Western Rolling Plains, Briscoe, Floyd, Hall, and Motley Counties, Texas (abs.): Geological Society of America, Abstracts with Programs, v. 16, no. 2, p. 78.

Budnik, R. T., 1984, Basin and Range-age reactivation of the Ancestral Rocky Mountains in the Texas Panhandle: evidence from the Ogallala Formation (abs.): American Association of Petroleum Geologists Bulletin, v. 68, no. 4, p. 459.

Budnik, R. T., 1984, Basin and Range-age reactivation of the Ancestral Rocky Mountains in the Texas Panhandle: evidence from the Ogallala Formation (abs.): Oklahoma Geological Survey, Oklahoma Geology Notes, v. 44, no. 4, p. 145.

Budnik, R. T., 1984, Recurrent intraplate deformation on the Ancestral Rocky Mountain orogenic belt (abs.): Oklahoma Geological Survey, Oklahoma Geology Notes, v. 44, no. 1, p. 20-21.

Budnik, R. T., 1984, Seismic reflection evidence of a late Proterozoic basin in the Texas Panhandle (abs.): Geological Society of America, Abstracts with Programs, v. 16, no. 2, p. 79.

Budnik, R. T., 1984, Seismic reflection evidence of a late Proterozoic basin in the Texas Panhandle (abs.): Oklahoma Geological Survey, Oklahoma Geology Notes, v. 44, no. 3, p. 90-91.

Caran, S. C., Baumgardner, R. W., Jr., McGookey, D. A., Gustavson, T. C., and Neck, R. W., 1984, Late Quaternary stratigraphy of the Western Rolling Plains of Texas—recent findings (abs.), in Proceedings, TER-QUA '84 Symposium on Interdisciplinary Research relating to the changing environments of the Great Plains - Gulf Coast: Nebraska Academy of Sciences, Inc., Institute for Tertiary-Quaternary Studies, Program with Abstracts, p. 6.

Caran, S. C., Baumgardner, R. W., Jr., Neck, R. W., McGookey, D. A., and Gustavson, T. C., 1984, Quaternary lacustrine basins in the Western Rolling Plains of Texas—paleoecologic, paleoclimatic, and structural history (abs.): Geological Society of America, Abstracts with Programs, v. 16, no. 6, p. 462-463.

Caran, S. C., and Neck, R. W., 1984, Late Pleistocene and Holocene paleoclimatology of the Southern High Plains of Texas—implications for disposal of nuclear waste (abs.): Geological Society of America, Abstracts with Programs, v. 16, no. 2, p. 80.

Collins, E. W., 1984, Joints and joint densities at Caprock Canyons State Park, Briscoe County, Texas Panhandle (abs.): Oklahoma Geological Survey, Oklahoma Geology Notes, v. 44, no. 3, p. 81-82.

Collins, E. W., and Goldstein, A. R., 1984, Deformation associated with salt dissolution and collapse, Texas Panhandle (abs.): Geological Society of America, Abstracts with Programs, v. 16, no. 2, p. 81.

Conti, R. D., and Wirojanagud, P., 1984, Porosity distribution trends in Wolfcamp strata, Palo Duro Basin, Texas Panhandle: implications for deep-basin ground-water flow (abs.): American Association of Petroleum Geologists Bulletin, v. 68, no. 4, p. 465.

Dutton, A. R., 1984, Regional ground-water flow in the San Andres Formation, Texas Panhandle and eastern New Mexico (abs.): Oklahoma Geological Survey, Oklahoma Geology Notes, v. 44, no. 3, p. 83.

Ewing, T. E., 1984, Late Paleozoic structural evolution of Permian Basin (abs.): American Association of Petroleum Geologists Bulletin, v. 68, no. 4, p. 474-475.

Fisher, R. S., and Kreitler, C. W., 1984, Isotopic and geochemical composition of deep-basin brines, Palo Duro Basin, Texas (abs.): Geological Society of America, Abstracts with Programs, v. 16, no. 6, p. 509.

Fracasso, M. A., 1984, Phases of medial Permian structural activity in the Texas Panhandle--evidence from cyclic deposits of the San Andres and Blaine Formations (abs.): Geological Society of America, Abstracts with Programs, v. 16, no. 6, p. 511.

Goldstein, A. G., and Collins, E. W., 1984, Deformation of Permian strata overlying a zone of salt dissolution and collapse in the Texas Panhandle: Geology, v. 12, no. 5, p. 314-317.

Gustavson, T. C., Budnik, R. T., Collins, E. W., Dutton, S. P., Hovorka, S. D., and Ruppel, S. C., 1984, Geological issues in isolating nuclear waste in the Palo Duro Basin, Texas (abs.): Oklahoma Geological Survey, Oklahoma Geology Notes, v. 44, no. 3, p. 78-79.

Herron, M. J., and Conti, R. D., 1984, Upper Wolfcampian Brown Dolomite: thickness, porosity distribution, and reservoir potential in the Palo Duro Basin, Texas Panhandle (abs.): Geological Society of America, Abstracts with Programs, v. 16, no. 2, p. 86.

Hovorka, S. D., 1984, Textures formed during shallow water halite deposition--an example from Permian of Palo Duro Basin, Texas (abs.): American Association of Petroleum Geologists Bulletin, v. 68, no. 4, p. 487-488.

Hovorka, S. D., and Budnik, R. T., 1984, Normal marine - marine marginal sabkha transition, Lower Permian, Palo Duro Basin, Texas Panhandle (abs.): Oklahoma Geological Survey, Oklahoma Geology Notes, v. 44, no. 3, p. 86.

Jackson, M. P. A., 1984, Centrifuge modeling of the internal structure of mushroom-shaped diapirs (abs.): Geological Society of America, Abstracts with Programs, v. 16, no. 6, p. 549.

Johns, D. A., 1984, Structure and depositional patterns of the Late Triassic Dockum Group, Palo Duro Basin, Texas (abs.): Geological Society of America, Abstracts with Programs, v. 16, no. 2, p. 87.

Kreitler, C. W., and Dutton, A. R., 1984, Hydrogeology of the Palo Duro Basin: interactions with the Ogallala Aquifer: Conference in Lubbock, Texas, entitled "Ogallala Aquifer Symposium II."

Kreitler, C. W., and Dutton, A. R., 1984, Hydrogeology of the Palo Duro Basin: interactions with the Ogallala Aquifer (abs.): Conference in Lubbock, Texas, entitled "Ogallala Aquifer Symposium II."

Kreitler, C. W., Dutton, A. R., Fisher, R. S., Orr, E. D., Senger, R. K., and Smith, D. A., 1984, Hydrogeochemical issues for high-level nuclear waste isolation in the Permian evaporites of the Palo Duro Basin, Texas (abs.): Oklahoma Geological Survey, Oklahoma Geology Notes, v. 44, no. 3, p. 79-80.

Machenberg, M. D., 1984, Modern rates of eolian erosion and deposition on the Southern High Plains (abs.): Geological Society of America, Abstracts with Programs, v. 16, no. 2, p. 106.

McGookey, D. A., 1984, Cenozoic epeirogenic uplift of the Palo Duro Basin, Texas, and its influence on structure, salt dissolution, and topography (abs.): American Association of Petroleum Geologists Bulletin, v. 68, no. 4, p. 505.

McGookey, D. A., 1984, Cenozoic epeirogenic uplift of the Palo Duro Basin, Texas, and its influence on structure, salt dissolution, and topography (abs.): Oklahoma Geological Survey, Oklahoma Geology Notes, v. 44, no. 4, p. 150.

McGookey, D. A., Hovorka, S. D., and Kolker, A., 1984, Depositional environments and source areas of Middle and Late Permian terrigenous clastic rocks, Palo Duro Basin, Texas (abs.): Geological Society of America, Abstracts with Programs, v. 16, no. 2, p. 108.

Orr, E. D., and Kreitler, C. W., 1984, Interpretation of underpressuring using pressure-depth profiles, Palo Duro Basin, Texas (abs.): American Association of Petroleum Geologists Bulletin, v. 68, no. 4, p. 514.

Presley, M. W., 1984, Evolution of the Permian evaporative basin in the Texas Panhandle: Permian Basin Symposium.

Richter, B. C., and Kreitler, C. W., 1984, Geochemical characteristics of salt springs and shallow subsurface brines in the Rolling Plains of Texas and southwest Oklahoma (abs.): Geological Society of America, Abstracts with Programs, v. 16, no. 2, p. 112.

Richter, B. C., and Kreitler, C. W., 1984, Geochemical characteristics of salt springs and shallow subsurface brines in the Rolling Plains of Texas and southwest Oklahoma (abs.): Oklahoma Geological Survey, Oklahoma Geology Notes, v. 44, no. 3, p. 103-104.

Ruppel, S. C., 1984, The Chappel Formation (Mississippian) of the eastern Palo Duro Basin: development of a carbonate shoal, in Harris, P. M., ed., Carbonate sands--a core workshop: Society of Economic Paleontologists and Mineralogists Core Workshop No. 5, p. 58-93.

Senger, R. K., and Fogg, G. E., 1984, Subnormal pressures in the Palo Duro Basin caused by regional hydrodynamic conditions (abs.): Geological Society of America, Abstracts with Programs, v. 16, no. 6, p. 650.

Simpkins, W. W., and Gustavson, T. C., 1984, Rates of hillslope erosion and deposition at six stations on the High Plains and Rolling Plains of the Texas Panhandle, 1978-1982 (abs.): Geological Society of America, Abstracts with Programs, v. 16, no. 2, p. 256.

Smith, D. A., 1984, Permeability variation in the Palo Duro Basin from multiple well tests (abs.): Oklahoma Geological Survey, Oklahoma Geology Notes, v. 44, no. 3, p. 82.

1985

Dutton, S. P., and Land, L. S., 1985, Meteoric burial diagenesis of Pennsylvanian arkosic sandstones, southwestern Anadarko Basin, Texas: American Association of Petroleum Geologists Bulletin, v. 69, no. 1, p. 22-38.

Fracasso, M. A., and Kolker, Allan, 1985, Late Permian volcanic ash beds in the Quartermaster - Dewey Lake Formations, Texas Panhandle: West Texas Geological Society Bulletin, v. 24, no. 6, p. 5-10.

Gustavson, T. C., and Budnik, R. T., 1985, Structural influences on geomorphic processes and physiographic features, Texas Panhandle: technical issues in siting a nuclear waste repository: Geology, v. 13, p. 173-176.

Ruppel, S. C., 1985, Facies and geochemical characterization of Mississippian rocks in Palo Duro and Hardeman Basins, Texas (abs.): American Association of Petroleum Geologists Bulletin, v. 69, no. 2, p. 303-304.

OPEN-FILED CSRs AND TECHNICAL REPORTS

OF #	Title, Deliverable & Author	Originally Submitted to DOE	Open-Filed	Re-submitted to DOE
OF-WTWI-1984-1	A Comparison of the Depositional Environment of the San Andres Formation in the Palo Duro Basin to Recent Evaporitic Environments (332 FJ) Geochemistry (6.0) and (332 FJ) Natural Analogs (6.4) Chapman	4-27-84	5-7-84	5-25-84
OF-WTWI-1984-2	Uplift, Tilting and Subsidence of the Palo Duro Basin Area (3.3.2.2 A,C,E,I) Tectonic History McGookey	5-15-84	5-15-84	5-25-84
OF-WTWI-1984-3	Salt Dissolution: Examples from Beneath the Southern High Plains (3.3.2.2 G) Geomorphic Processes and (3.3.2.2 R) Salt Dissolution Gustavson & Budnik	5-15-84	5-15-84	5-25-84
OF-WTWI-1984-4	Active Stress Field in the Texas Panhandle (3.3.2.2 B) Tectonic History Budnik	5-21-84	5-21-84	5-28-84
OF-WTWI-1984-5	Status of Borehole Sealing Research and Its Application to the Palo Duro Basin (332 FI) Relationships Among Hydrogeologic Units (5.6.2) Simpkins	1-30-84	5-24-84	5-28-84
OF-WTWI-1984-6	Investigation of Underpressuring in the Deep-Basin Brine Aquifer, Palo Duro Basin, Using Pressure/Depth Profiles (332 FI) Relationships Among Hydrogeologic Units (5.6.2) Orr	1-30-84	5-23-84	5-28-84

OPEN-FILED CSRs AND TECHNICAL REPORTS

OF #	Title, Deliverable & Author	Originally Submitted to DOE	Open-Filed	Re-submitted to DOE
OF-WTWI-1984-7	Potentiometric Level of the Deep-Basin Brine Aquifer, Palo Duro Basin, Texas Panhandle (332 FI) Potentiometric Level (5.6.3) Smith	2-14-84	5-23-84	5-29-84
OF-WTWI-1984-8	Numerical Modeling of Regional Ground-Water Flow in the Deep-Basin Aquifers of the Palo Duro Basin, Texas Panhandle (332 FI) Regional Ground Water Flow System (5.7) and (332 FI) Principal Ground-Water Flowpaths (5.7.2) Wirojanagud, Kreitler & Smith	2-24-84	6-1-84	6-1-84
OF-WTWI-1984-9	Structural Control of Physiography, Geomorphic Processes, and Lithofacies, Texas Panhandle (332 FH) Geomorphology (3.1) and (332 FH) Physiography and Topography (3.1.1) Gustavson & Budnik	3-12-84	5-23-84	5-29-84
OF-WTWI-1984-10	Late Quaternary Paleoclimatology of the Southern High Plains of Texas -- Implications for Disposal of Nuclear Waste (332 FJ) Long-Term Climate Assessment (7.2), (332 FJ) Paleoclimatology (7.2.1) and (332 FJ) Future Climatic Variation (7.2.2) Caran & Neck	3-12-84	5-23-84	5-29-84
OF-WTWI-1984-11	Host Rock Geochemistry of the Palo Duro Basin, Texas (332 FJ) Host Rock Geochemistry (6.1) Fisher	3-14-84	5-24-84	5-25-84

SUPERSEDED

OPEN-FILED CSRs AND TECHNICAL REPORTS

OF #	Title, Deliverable & Author	Originally Submitted to DOE	Open-Filed	Re-submitted to DOE
OF-WTWI-1984-12	Quaternary Faulting in Southeastern Briscoe County, Texas (332 FH) Geomorphic Units (3.1.2) Baumgardner & Caran	3-21-84	5-23-84	5-29-84
OF-WTWI-1984-13	Stratigraphy of a Significant Quaternary Alluvial Sequence, Briscoe, Floyd, Hall, and Motley Counties, Texas (332 FH) Geomorphic Units (3.1.2) Caran & Baumgardner	3-21-84	5-23-84	5-29-84
OF-WTWI-1984-14	Historic Seismicity In and Around the Texas Panhandle (332 FH) Long-Term Regional Stability with Respect to Tectonic and Geologic Processes (3.5) Pennington & Davis	3-28-84	5-23-84	5-31-84
OF-WTWI-1984-15	Long-Term Rates of Denudation Based on Hypsometric Analysis of Drainage Basins and Underlying Salt Beds in the Texas Panhandle and Northeast New Mexico (332 FH) Geomorphic Processes (3.1.3) Baumgardner	4-4-84	5-31-84	5-31-84
OF-WTWI-1984-16	Modern Eolian Processes on the Southern High Plains (332 FH) Geomorphic Processes (3.1.3) Machenberg & Caran	4-4-84	5-23-84	5-31-84
OF-WTWI-1984-17	Analysis of Dust Trap Sediments Collected on the Southern High Plains (332 FH) Geomorphic Processes (3.1.3) Machenberg	4-4-84	5-23-84	5-31-84

OPEN-FILED CSRs AND TECHNICAL REPORTS

OF #	Title, Deliverable & Author	Originally Submitted to DOE	Open-Filed	Re-submitted to DOE
OF-WTWI-1984-18	Statistical Analysis of Erosion Pin Measurements: I. Description of Erosion and Deposition at Six Stations in the Texas Panhandle (332 FH) Geomorphic Processes (3.1.3) Simpkins	4-4-84	5-31-84	5-31-84
OF-WTWI-1984-19	Statistical Analysis of Erosion Pin Measurements: II. Calculation and Projection of Erosion and Deposition Rates at Six Stations in the Texas Panhandle (332 FH) Geomorphic Processes (3.1.3) Simpkins	4-4-84	5-31-84	5-31-84
OF-WTWI-1984-20	Jointing History of the Palo Duro Basin (3.3.2.2 M) Tectonic History - Jointing History Collins	6-11-84	6-11-84	N/A
OF-WTWI-1984-22	Geostatistical Analysis of Potentiometric Surface of the San Andres Formation, Texas Panhandle (3.3.2.4 A) Hydrogeologic Units Dutton & Orr	6-21-84	6-21-84	N/A
Of-WTWI-1984-23	Chemical Composition of Dockum Group Ground Water, Texas Panhandle (3.3.2.4 A) Hydrogeologic Units Dutton & Simpkins	6-21-84	6-21-84	N/A
OF-WTWI-1984-24	Determination of Chemical Composition of San Andres Brine at the Zeeck No. 1 Well near Tulia, Texas (3.3.2.4 A) Hydrogeologic Units Dutton	6-21-84	6-21-84	N/A

OPEN-FILED CSRs AND TECHNICAL REPORTS

OF #	Title, Deliverable & Author	Originally Submitted to DOE	Open-Filed	Re-submitted to DOE
OF-WTWI-1984-25	Status Report on Identification of Discharge Areas of Deep-Basin Brine Aquifers, Hardeman Basin, Texas (332GN D) Identification of Recharge-Discharge Areas Richter, Smith & Orr	6-25-84	6-25-84	N/A
OF-WTWI-1984-26	Geochemical Environment of the Evaporite Aquitard and Deep-Basin Brine Aquifer, Palo Duro Basin, Texas (332GP A) Geochemical Stability Fisher	6-25-84	6-25-84	N/A
OF-WTWI-1983-4	Identification of Recharge-Discharge Areas of the Palo Duro Basin, Texas Panhandle (332 FI) Identification of Recharge-Discharge Areas (5.7.1) Senger & Richter	9-22-83	6-29-84	6-29-84
OF-WTWI-1983-5	Texas Panhandle Mineral Assessment: Summary Report (332 FH) Mineral and Hydrocarbon Resources (3.7) and (332 FH) Mineral Resources (3.7.1) Bureau of Business Research (for the Bureau of Economic Geology)	12-19-83	7-3-84	7-3-84
OF-WTWI-1983-6	Texas Panhandle Mineral Assessment: The Petroleum Industry (332 FH) Hydrocarbon Resources (3.7.2) Bureau of Business Research (for the Bureau of Economic Geology)	12-19-83	7-3-84	7-3-84

OPEN-FILED CSRs AND TECHNICAL REPORTS

OF #	Title, Deliverable & Author	Originally Submitted to DOE	Open-Filed	Re-submitted to DOE
OF-WTWI-1983-1	Tectonic History of the Palo Duro Basin, Texas Panhandle (332 FH) Tectonic History (3.3.2) Budnik	9-15-83	7-9-84	7-9-84
OF-WTWI-1983-2	Tectonic Framework of the Palo Duro Basin, Texas Panhandle (332 FH) Tectonic Framework (3.3.1) Budnik	9-15-83	7-9-84	7-9-84
OF-WTWI-1983-3	Fracture Studies of the Palo Duro Basin, Texas Panhandle (332 FH) Tectonic History (3.3.2) Collins	9-15-83	7-9-84	7-9-84
OF-WTWI-1983-9	Hydrocarbon Resources of the Palo Duro Basin, Texas Panhandle (3.7.2) Hydrocarbon Resources (3.9.3) Dutton	1-5-83	7-9-84	7-9-84
OF-WTWI-1983-14	Hydrocarbon Resources of the Palo Duro Basin, Texas Panhandle (332 FH) Hydrocarbon Resources (3.7.2) Ruppel and Dutton	12-21-83	7-9-84	7-9-84
OF-WTWI-1982-1	Hydrology of the Palo Duro Basin, Texas Panhandle (5.6.1) Hydrogeologic Units (5.1 & 5.1.1); (5.6.2) Relationship Among Hydrogeologic Units (5.1.2); (5.6.3) Potentiometric Level (5.1.3); (5.6.4) Hydraulic Characteristics of Principal Hydrogeologic Units (5.1.4); (5.7.1) Identification of Recharge and Discharge Areas (5.2.1); (5.7.2) Principal Ground-Water Flow Paths (5.2 & 5.2.2); and (5.7.3) Isotopic and Regional Hydrochemistry (5.2.3, 5.3.2, 6.2A, 6.2D) WTWI Staff, The Bureau of Economic Geology	10-26-82	7-18-84	7-18-84

OPEN-FILED CSRs AND TECHNICAL REPORTS

OF #	Title, Deliverable & Author	Originally Submitted to DOE	Open-Filed	Re-submitted to DOE
OF-WTWI-1982-3	Use of Kriging to Estimate the Wolfcampian and San Andres Potentiometric Surfaces, Palo Duro Basin, Texas Panhandle (5.6.1) Hydrogeologic Units Smith & Orr	12-22-82	7-18-84	7-18-84
OF-WTWI-1983-8	Mineral Resources of the Palo Duro Basin and Surrounding Areas, Texas Panhandle (3.7.1) Mineral Resources (3.9); Surface Mining (3.9.1); Analysis of Resources-Determine Uranium Potential in the Ogallala Formation, Dockum Group, and Permian Rocks in the Palo Duro Basin (3.9.4E); and Host-Rock Geochemistry - Resource Investigation, Copper Sabkha Model, Uranium, Non-Metallic (6.1B) Kolker	1-5-83	7-18-84	7-18-84
OF-WTWI-1983-10	Geomorphic Processes of the Texas Panhandle (3.1.3) Geomorphic Processes (3.4.2.2) Baumgardner	1-20-83	7-18-84	7-18-84
OF-WTWI-1983-11	Surface Geology of the Palo Duro and Dalhart Basins Area, Texas (3.2.1) Surface Geology (3.5.7) Smith	1-27-83	7-18-84	7-18-84
OF-WTWI-1983-13	Hydrogeochemistry of the Palo Duro Basin, Texas Panhandle (3.3.2.5) Hydrogeochemistry (6.2) Fisher	6-28-83	7-18-84	7-18-84
OF-WTWI-1984-31	Composition of Unit 4 Halite in Deaf Smith and Swisher Counties, Texas Panhandle Hovorka	7-23-84	7-23-84	N/A

OPEN-FILED CSRs AND TECHNICAL REPORTS

OF #	Title, Deliverable & Author	Originally Submitted to DOE	Open-Filed	Re-submitted to DOE
OF-WTWI-1984-27	Preliminary Results of Porosity and Permeability of Cores from DOE Wells in the Palo Duro Basin, Texas Panhandle (332GN C) Hydraulic Characteristics of Principal Hydrogeologic Units Senger, Smith & Conti	8-7-84	8-7-84	N/A
OF-WTWI-1984-28	Evaluation of the J. Friemel #1 Vertical Well Test, Deaf Smith County, Palo Duro Basin, Texas Panhandle (332GN C) Hydraulic Characteristics of Principal Hydrogeologic Units Smith	8-7-84	8-7-84	N/A
OF-WTWI-1984-32	Modeling the Effects of Regional Hydrostratigraphy and Topography on Ground-water Flow, Palo Duro Basin, Texas Technical Report Senger & Fogg	8-7-84	8-7-84	N/A
OF-WTWI-1984-34	Analysis of Dust Trap Sediments Collected on the Southern High Plains (332 GM G) Geomorphic Processes and (332GM N) Physiography and Topography Machenberg	8-15-84	8-15-84	N/A
OF-WTWI-1984-35	Drainage Density in Five Representative Drainage Basins, Texas Panhandle and Northeast New Mexico (332GM G) Geomorphic Processes and (332GM N) Physiography and Topography Baumgardner	8-15-84	8-15-84	N/A

OPEN-FILED CSRs AND TECHNICAL REPORTS

OF #	Title, Deliverable & Author	Originally Submitted to DOE	Open-Filed	Re-submitted to DOE
OF-WTWI-1984-29	Experimental Modeling of Diapirs: Initial Report (332HE C) Initial Report of Findings Jackson	8-17-84	8-17-84	N/A
OF-WTWI-1984-30	Stratigraphy of the Palo Duro Basin - A Status Report (332FH D1) Stratigraphy (3.2) Ruppel and others	8-21-84	8-17-84	N/A
OF-WTWI-1984-36	Regional and Isotopic Hydrogeochemistry: Deep-Basin Brine Aquifer, Palo Duro Basin, Texas Panhandle (332GN B) Isotopic and Regional Hydrogeochemistry Fisher	8-23-84	8-22-84	N/A
OF-WTWI-1984-37	Regression Analysis of Erosion and Deposition at Six Stations in the Texas Panhandle (332GM G) Geomorphic Processes (332GM K) Erosion Rates Simpkins	8-24-84	8-24-84	N/A
OF-WTWI-1984-21	Cyclicity in the Middle Permian San Andres Formation, Palo Duro Basin, Texas Panhandle Technical Report Fracasso & Hovorka	8-30-84	8-30-84	N/A
OF-WTWI-1984-38	Potentiometric Level of the Deep-Basin Brine Aquifer - A Status Report (332GN E) Potentiometric Level Smith	9-6-84	8-28-84	N/A

SUPERSEDED

OPEN-FILED CSRs AND TECHNICAL REPORTS

OF #	Title, Deliverable & Author	Originally Submitted to DOE	Open-Filed	Re-submitted to DOE
OF-WTWI-1984-39	Late Cenozoic Geomorphic Evolution of the Texas Panhandle and Northeastern New Mexico: Case Studies of Structural Controls of Regional Drainage Development Technical Report Gustavson & Finley	9-14-84	9-14-84	N/A
OF-WTWI-1984-40	Saponite and Chlorite-rich Clay Assemblage in Permian Sabkha Evaporite/Red Bed Strata, Palo Duro Basin, Texas Panhandle Technical Report Palmer	9-14-84	9-14-84	N/A
OF-WTWI-1984-41	Chemical and Isotopic Composition of Waters from the Salina Ometepec, Baja California (332GP B) Natural Analogs Kreitler, Chapman & Knauth	9-14-84	9-14-84	N/A
OF-WTWI-1984-43	Stratigraphic Studies of the Palo Duro Basin: An Update (1984) (332GM L) Stratigraphic Framework of the Candidate Area Ruppel, Fracasso & Johns	9-19-84	9-19-84	N/A
OF-WTWI-1984-42	Hydrologic Test Data, J. Friemel #1 Well, Deaf Smith County, Palo Duro Basin, Texas Panhandle (332GN C) Hydraulic Characteristics of Principal Hydrogeologic Units Smith	9-21-84	9-21-84	N/A
OF-WTWI-1984-44	Vertical Hydraulic Conductivity, Flux, and Flow in the Deep-Basin Brine Aquifer, Palo Duro Basin, Texas (332GN F) Relationships Among Hydrogeologic Units Orr & Senger	9-21-84	9-21-84	N/A

OPEN-FILED CSRs AND TECHNICAL REPORTS

OF #	Title, Deliverable & Author	Originally Submitted to DOE	Open-Filed	Re-submitted to DOE
OF-WTWI-1984-45	Core and Sample Analysis of the Dockum Group, DOE-Gruy Federal #1 Grabbe, Swisher County, Texas Topical Report Johns & Hovorka	9-28-84	9-28-84	N/A
OF-WTWI-1984-48	Textural and Chemical Zones in Bedded Halite, Permian Lower San Andres Formation, Palo Duro Basin, Texas (332GP D) Host-Rock Geochemistry Fisher & Hovorka	10-2-84	10-2-84	N/A
OF-WTWI-1984-46	Potential for Petroleum Resources in the Palo Duro Basin Area, Texas Panhandle (332GM U) Mineral Resources and (332GM V) Hydrocarbon Resources Ruppel & Dutton	10-9-84	10-9-84	N/A
OF-WTWI-1983-12	Supplemental Report for Pressure-Depth Relationships, Potentiometric Levels, and Hydrochemistry of the Palo Duro Basin, Texas Supplement to: (5.6.2) Relationships Among Hydrogeologic Units, (5.6.3) Potentiometric Level, (5.6.3.1) Potentiometric Level of the Deep-Basin Brine Aquifer, (5.7.3) Isotopic and Regional Hydrochemistry, (5.7.3.1) Isotopic and Regional Hydrochemistry of the Deep-Basin Brine Aquifer Orr, Senger, Smith & Fisher	2-28-83	10-9-84	10-9-84
OF-WTWI-1984-49	Quaternary Stratigraphy and Geologic Mapping, Western Rolling Plains of Texas (332GM F) Geomorphic Units and (332GM H) Surface Geology Caran & Baumgardner	10-11-84	10-11-84	N/A

OPEN-FILED CSRs AND TECHNICAL REPORTS

OF #	Title, Deliverable & Author	Originally Submitted to DOE	Open-Filed	Re-submitted to DOE
OF-WTWI-1984-47	Lower Permian (Wolfcampian) Stratigraphy and Paleogeography, Palo Duro Basin, Texas Topical Report Herron	10-18-84	10-17-84	N/A
OF-WTWI-1984-50	Amount and Nature of Occluded Water in Bedded Salt, Palo Duro Basin, Texas Topical Report Fisher	10-29-84	10-29-84	N/A
OF-WTWI-1984-51	Experimental Modeling of Salt Diapirs: Interim Report (332HE D) Interim Report of Conclusions Jackson	10-31-84	10-31-84	N/A
OF-WTWI-1984-33	Porosity Distribution Trends in Wolfcampian Strata of the Palo Duro Basin, Texas Panhandle—Implications for Ground-Water Flow through Lower Permian and Deep-Basin Aquifers Topical Report Conti & Wirojanagud	11-5-84	11-5-84	N/A
OF-WTWI-1984-52	Hydrology of an Evaporite Aquitard: Permian Evaporite Strata, Palo Duro Basin, Texas (332GP) Hydrogeochemistry Kreitler, Fisher, Senger, Hovorka & Dutton	11-15-84	11-15-84	N/A
OF-WTWI-1984-55	Structural Geology and Tectonic History of the Palo Duro Basin, Texas Panhandle (332GM) D. Tectonic History - Faulting History; O. Tectonic Framework; Q. Tectonic History - Folding History; S. Faulting History - Overview of Faulting; and T. Tectonic History - Long-Term Regional Stability with Respect to Tectonic and Geologic Processes Budnik	12-21-84	12-21-84	N/A

SUPERSEDED

OPEN-FILED CSRs AND TECHNICAL REPORTS

OF #	Title, Deliverable & Author	Originally Submitted to DOE	Open-Filed	Re-submitted to DOE
OF-WTWI-1984-54	Hydrodynamic Development of the Palo Duro Basin and Other Mechanisms Creating Possible Transient Flow Conditions (332GN G) Principal Ground-Water Flow Paths Senger	1-18-85	12-18-84	N/A
OF-WTWI-1984-53	Reconstruction of the Late Quaternary Paleoclimate of Northwestern Texas -- Progress Report, 1984 (332GM J) Paleoclimatology Caran	1-28-85	12-19-84	N/A
OF-WTWI-1985-1	Radiocarbon Age of Quarternary Deposits, Western Rolling Plains of Texas (332GM A.) Milestone Report Caran and Baumgardner	1-30-85	1-30-85	N/A
OF-WTWI-1985-2	Hydrogeology and Hydrochemical Facies of the San Andres Formation in Eastern New Mexico, West-Central Texas, and the Texas Panhandle Topical Report Dutton and Orr	2-6-85	2-6-85	N/A
OF-WTWI-1985-3	Hydrologic Testing in the Salt-Dissolution Zone of the Palo Duro Basin, Texas Panhandle Topical Report Dutton and others	2-13-85	2-13-85	N/A
OF-WTWI-1985-4	Evaluation of Numerical Codes for Fracture Flow Modeling (332GN A.) Milestone Report Senger	2-22-85	2-22-85	N/A

OPEN-FILED REPORTS

OF #	Title, Report Type, Author	Date Submitted to DOE	Date Open-Filed
OF-WTWI-1985-5	Initial Results of the Wolfcamp Pilot Study (332GP A.) Milestone Report Posey, Fisher and Tweedy	2/28/85	2/28/85
OF-WTWI-1985-7	Structure Control of the Development of the Canadian River Valley, Texas Panhandle: An Example of Regional Salt Dissolution and Subsidence (332GM B.) Milestone Report Gustavson	3/7/85	3/7/85
OF-WTWI-1985-8	Summary Well Report Supplements (No. 1 Rex White, No. 1 Grabbe, No. 1 Sawyer, No. 1 Mansfield, No. 1 J. Friemel, No. 1 G. Friemel, No. 1 Detten, No. 1 Harman, No. 1 Zeeck, No. 1 Woods-Holtzclaw) (332FG H) Milestone Report WTWI Staff	3/8/85	3/8/85
OF-WTWI-1985-6	The Pre-Pennsylvanian of the Palo Duro Basin, Texas Panhandle: Stratigraphy and Petroleum Potential Topical Report Ruppel	3/11/85	3/11/85
OF-WTWI-1985-9	Stratigraphy of Bedded Halite in the Permian San Andres Formation, Units 4 and 5, Palo Duro Basin, Texas Topical Report Hovorka, Luneau and Thomas	4/3/85	4/3/85

OPEN-FILED REPORTS

OF #	Title, Report Type, Author	Date Submitted to DOE	Date Open-Filed
OF-WTWI-1984-8 Revision 1	Numerical Modeling of Regional Ground-Water Flow in the Deep-Brine Aquifers of the Palo Duro Basin, Texas Panhandle Topical Report Wirojanagud, Kreitler, and Smith	4-18-85	4-18-85
OF-WTWI-1985-10	The Internal Structure of Model and Natural Salt Domes - Experimental Modeling of Salt Diapirs: Final Report (332HE E) Final Report of Conclusions CSR Jackson and Talbot	4-23-85	4-23-85
OF-WTWI-1984-33 Revision 1	Wolfcampian Series Porosity Distribution: Implications for Deep-Basin Ground-Water Flow in the Palo Duro Basin, Texas Panhandle Topical Report FY85 Milestone (332GN, Subtask V, B) Conti, Senger, Wirojanagud, Herron	5-20-85	5-20-85
OF-WTWI-1984-21 Revision 1	Cyclicity in the Middle Permian San Andres Formation, Palo Duro Basin, Texas Panhandle Topical Report FY85 Milestone (332GP, Subtask II, A) Fracasso and Hovorka	6-20-85	6-20-85
OF-WTWI-1983-3 Revision 1	Fracture Analyses of the Palo Duro Basin Area, Texas Panhandle and Eastern New Mexico Topical Report Collins and Luneau	7-29-85	7-29-85

SUMMARY OF WELLS DRILLED AND TESTED BY SWEC

1. Sawyer No. 1, Donley County, started June 23, 1981, completed October 15, 1981. T.D.: 4806 ft. Present status: Final plugged.

a. Casing Program - 13 3/8 in. conductor to 66 ft, 9 5/8 in. surface to 337 ft, 5 1/2 in. production to 3938 ft, 4 in. liner from 3938 ft to 4806 ft.

b. Rock Coring (all 4 in. OD core) - Total of 3872 ft, from 66 ft to 3938 ft, Yates through Pennsylvanian.

MAJOR SALT SECTION

o	Upper San Andres	438 ft to 652 ft, thickness	214 ft
o	LSA - Unit 5	652 ft to 756 ft, thickness	104 ft
o	LSA - Unit 4	756 ft to 840 ft, thickness	84 ft
o	LSA - Unit 3	840 ft to 894 ft, thickness	54 ft
o	LSA - Unit 2	894 ft to 947 ft, thickness	53 ft

Unusual features - Fault zone at 756-762 ft - 155 ft of missing section.

c. Drill Stem Tests (DSTs)

No. 1 2950 ft to 3123 ft - Wolfcamp, PI = 816 psi, k = 0.15 md

d. Geophysical Logging - Complete suites of cased and open hole logs.

e. Long-Term Pump Testing and Fluid Sampling

Zone 1 - Ellenburger Sand, 4716 ft - 4746 ft, unable to obtain data to determine PI or K, 4 downhole and 2 surface samples.

Zone 2 - Ellenburger Top, 4604 ft - 4640 ft, PI = 1390 psi, K = 0.3 md., 4 surface samples.

Zone 3 - Penn. Limestone, 4500 ft - 4535 ft, PI = 1531 psi, K = 5.4 md., 4 downhole and 2 surface samples.

Zone 4 - Penn. Limestone, 4258 ft-4342 ft, PI = 1350 psi, K = 2.7 md., 7 downhole and 10 surface samples.

Zone 5 - Wolfcamp, 3189 ft - 3172 ft, PI = 977 psi, K = 6.1 md., 3 downhole and 20 surface samples.

f. Dissolution Zone Water Well

Sawyer No. 2, 784 ft, 20 ft screen section at bottom of hole in LSA Unit 4. Testing by TBEG scheduled to begin April 1983.

2. Mansfield No. 1, Oldham County, started October 19, 1981, completed December 19, 1982. T.D. 4995 ft by SWEC, 7409 ft by Baker & Taylor (dry hole). Present status: Final plugged.

a. Casing Program - 13 3/8 in. conductor to 41 ft, 9 5/8 in. surface to 1212 ft, 5 1/2 in. tubing to 5180 ft.

b. Rock Coring (All 4 in. OD core) - Total of 4196 ft.

- 46 ft to 3540 ft - Dockum to Red Cave
- 4023 ft to 4123 ft - Wichita
- 4393 ft to 4995 ft - Wichita and Wolfcamp

MAJOR SALT SECTION

o	Upper San Andres	985 ft to 1373 ft, thickness	388 ft
o	LSA - Unit 5	1373 ft to 1546 ft, thickness	173 ft
o	LSA - Unit 4	1546 ft to 1815 ft, thickness	269 ft
o	LSA - Unit 3	1815 ft to 1940 ft, thickness	125 ft
o	LSA - Unit 2	1940 ft to 1978 ft, thickness	38 ft
o	LSA - Unit 1	1978 ft to 2001 ft, thickness	23 ft

c. Drill Stem Tests (DSTs)

No. 1	4800 ft - 4996 ft -	Wolfcamp PI = 1322 psi K = 26.6 md.
No. 2	4550 ft - 4650 ft -	Wolfcamp - Did not produce sufficient fluid.
No. 3	4550 ft - 4650 ft -	Wolfcamp - Did not produce sufficient fluid.
No. 4	4550 ft - 4650 ft -	Wolfcamp - Unable to set packers.
No. 5	6994 ft - 7409 ft -	Granite Wash - Did not produce sufficient fluid.
No. 6	6612 ft - 6640 ft -	Penn. Carbonates, PI = 2230, K = 21.4 md.
No. 7	4812 ft - 4840 ft -	Wolfcamp, PI = 1404, K = 30.22 md.

d. Geophysical Logging - Complete suites of cased and open hole logs.

e. Long-Term Pump Testing and Fluid Sampling

Zone 1 - Wolfcamp, 4818-4890, PI = 1470 psi, K = 3.3 md., 8 downhole and 24 surface samples.

Zone 2 - Wolfcamp, 4514-4638, PI = 1150 psi, K = 0.6 md., 9 downhole and 8 surface samples.

f. Dissolution Zone Water Well

Mansfield No. 2, 780 ft, 30 ft screen at bottom in Queen/Grayburg. Testing by TBEG scheduled to begin May 1983.

3. Detten No. 1 - Deaf Smith County, started February 26, 1982, completed May 5, 1982. T.D. 2839.3 ft. Status: Final plugged.

a. Casing Program - 13 3/8 in. conductor to 53 ft, 9 5/8 in. surface to 1122 ft.

b. Rock Coring (all 4 in. OD core) - Total of 1249 ft

- 1129.2 ft to 1423.0 ft - Salado, Yates, Upper Seven Rivers
- 1884 ft to 2839.3 ft - Upper San Andres, Lower San Andres to Unit 3

MAJOR SALT SECTION

o	Upper San Andres	1866 ft to 2374 ft, thickness	508 ft
o	LSA - Unit 5	2374 ft to 2575 ft, thickness	201 ft
o	LSA - Unit 4	2575 ft to 2830 ft, thickness	255 ft

c. Drill Stem Tests (DSTs)

No. 1	1160 ft - 1360 ft -	Upper Seven Rivers - Unsuccessful - Poor packer seat.
No. 2	1299 ft - 1366 ft -	Upper Seven Rivers - Unsuccessful - Poor packer seat.
No. 3	2749 ft - 2839 ft -	LSA Unit 4 Dolomite, P.I. = 1150 psi, K = 0.16 md.

d. Geophysical Logging - Complete suites of cased and open hole logs.

e. Long-Term Pump Testing and Fluid Sampling - None.

f. Dissolution Zone Water Well

Detten No. 2, 1325 ft, 20 ft of screen at bottom in Yates. Testing by TBEG scheduled to begin May 1983.

4. G. Friemel No. 1 - Deaf Smith County, started February 23, 1982, completed March 31, 1982. T.D. 2710 ft. Present status: Final plugged.

a. Casing Program - 13 3/8 in. conductor to 50 ft, 9 5/8 in. surface to 1058 ft.

b. Rock Coring (all 4 in. OD core) - Total of 1121.7 ft

- o 1191.5 ft to 1312.0 ft - Yates, Upper Seven Rivers
- o 1709.0 ft to 2710.2 ft - Queen/Grayburg, Upper San Andres, and Lower San Andres to Unit 3

MAJOR SALT SECTION

o	Upper San Andres	1742 ft to 2331 ft, thickness	589 ft
o	LSA - Unit 5	2331 ft to 2435 ft, thickness	104 ft
o	LSA - Unit 4	2435 ft to 2688 ft, thickness	253 ft

c. Drill Stem Tests (DSTs)

No. 1 2600 ft - 2710 ft, LSA Unit 4 Dolomite, P.I. = 975 psi, K = 0.07 md.

d. Geophysical Logging - Complete suites of cased and open hole logs.

e. Long-Term Pump Testing and Fluid Sampling - None.

f. Dissolution Zone Water Well None.

5. Zeeck No. 1 - Swisher County, started April 9, 1982, completed August 12, 1982. T.D. 7652 ft. Scheduled completion of pump testing is April 1983. Well will be final plugged at completion of pump testing.

a. Casing Program - 13 3/8 in. conductor to 26 ft, 9 5/8 in. surface at 1024 ft, 5 1/2 in. to 7421 ft.

b. Coring (all 4 in. OD core) - Total of 1993 ft

- 1035 ft to 1144 ft - Salado
- 1885 ft to 3102 ft - Queen/Grayburg, Upper San Andres, Lower San Andres Units 5, 4, 3, and Upper Section of Unit 2.
- 5309 ft to 5780 ft - Wichita/Wolfcamp Contact and Upper Wolfcamp
- 5910 ft to 6058 ft - Wolfcamp
- 7300 ft to 7387 ft - Pennsylvanian Carbonates

MAJOR SALT SECTION

o	Upper San Andres	2014 ft to 2574 ft, thickness	560 ft
o	LSA - Unit 5	2574 ft to 2732 ft, thickness	158 ft
o	LSA - Unit 4	2732 ft to 3014 ft, thickness	282 ft
o	LSA - Units 3,2,&1	3014 ft to 3188 ft, thickness	174 ft

c. Drill Stem Tests (DSTs)

No. 1	1019 ft - 1044 ft -	Salado, Unsuccessful.
No. 2	1019 ft - 1044 ft -	Salado, Did not produce sufficient fluid.
No. 3	3035 ft - 3103 ft -	LSA, Unit 3, Did not produce sufficient fluid.
No. 4	2932 ft - 3103 ft -	LSA Unit 3, Unsuccessful.
No. 5	2927 ft - 3103 ft -	LSA Unit 4 Dolomite, P.I. = 1250 psi, K = 0.25 md.
No. 6	5365 ft - 5542 ft -	Upper Wolfcamp, PI = 1875 psi, K = 6.77 md.
No. 7	7146 ft - 7225 ft -	Pennsylvanian, PI = 2559 psi, K = 2.83 md.

d. Geophysical Logging - Complete suites of open and cased hole logs.

e. Long-Term Pump Testing and Fluid Sampling

Zone 1 - Penn. Carbonates, 7140 ft - 7230 ft, P.I. = 2500 psi, K = 15 md., 7 downhole and 33 surface samples.

Zone 2 - Wolfcamp, 5603 ft - 5640 ft, PI = 1960 psi, K = 1 md.; 8 downhole samples.

Zone 3 - Wolfcamp, 5470 ft - 5550 ft, P.I. = 1890 psi, K = 7 md., 8 downhole and 4 surface samples.

Zone 4 - LSA Unit 4 Dolomite, 2930 Ft - 2970 ft, P.I. = 1300 psi, pumping and sampling in progress.

f. Dissolution Zone Water Well - None.

5. Harmon No. 1 - Swisher County, started July 29, 1982, completed September 7, 1982. T.D. 3052 ft, hole completed as Shallow Dissolution Zone Water Well (see below).

a. Casing Program - 13 3/8 in. conductor to 40 ft, 9 5/8 in. surface to 1063, cement to plug 1220 ft ± to 1400 ft ±.

b. Rock Coring (all 4 in. OD core) - Total of 1481 ft

- o 1070 ft to 1303 ft - Alibates, Salado, Yates, and Upper Seven Rivers
- o 1804 ft to 3052 ft (T.D.) - Queen/Grayburg, Upper San Andres, and Lower San Andres into Unit 2.

MAJOR SALT SECTION

o	Upper San Andres	1949 ft to 2466 ft, thickness	517 ft
o	LSA - Unit 5	2466 ft to 2651 ft, thickness	185 ft
o	LSA - Unit 4	2651 ft to 2931 ft, thickness	280 ft
o	LSA - Unit 3	2931 ft to 3012 ft, thickness	81 ft

c. Drill Stem Tests (DSTs)

No. 1 2840 ft - 3050 ft - Unit 4 Dolomite, P.I. = 1203 psi, K = 0.011 md., minor leakage noted around packers.

No. 2 2830 ft - 3050 ft (T.D.) - Unit 4 Dolomite, P.I. 1315, K = 0.186 md.

d. Geophysical Logging - Complete suites of cased and open hole logs.

e. Long-Term Pump Testing and Fluid Sampling - None.

f. Dissolution Zone Water Well

Installed in existing borehole with open hole section from bottom of surface casing at 1064 ft ± to top of cement plut at 1220 ft ±. Gravel packed screen (30 ft long) set in Yates. Pump tests and fluid sampling by TBEG scheduled to start late spring 1983.

7. J. Friemel No. 1 - Deaf Smith County, started October 15, 1982, completed March 18, 1983. T.D. 8283 ft, pump testing scheduled to start June 1983..

a. Casing Program - 22 in. conductor to 48 ft, 16 in. surface to 1210 ft, 10 3/4 in. intermediate salt string to 4695 ft, 5 1/2 in. to 8283 ft.

b. Rock Coring (all 4 in. OD core) - Total of 3043 ft

o	352 ft to 1464 ft -	Dockum, Dewey Lake, Alibates, Salado, Yates, and Upper Seven Rivers
o	1846 ft to 2830 ft -	Upper San Andres, LSA Units 5, 4, and Upper Section of Unit 3
o	5519 ft to 6032 ft -	Wolfcamp
o	6421 ft to 6537 ft -	Penn. Carbonates
o	7698 ft to 7780 ft -	Granite Wash.
o	8047 ft to 8283 ft (T.D.) -	Granite Wash

MAJOR SALT SECTION

o	Upper San Andres	1880 ft to 2372 ft, thickness	492 ft
o	LSA - Unit 5	2372 ft to 2560 ft, thickness	188 ft
o	LSA - Unit 4	2560 ft to 2822 ft, thickness	262 ft
o	LSA - Units 3,2,&1	2822 ft to 3018 ft, thickness	196 ft

c. Drill Stem Tests (DSTs)

No. 1	958 ft - 1216 ft -	Santa Rosa - Too high Producer..
No. 2	787 ft - 850 ft -	Santa Rosa - Unsuccessful.
No. 3	1279 ft - 1464 ft -	Upper Seven Rivers - Did not Produce Sufficient Fluid.
No. 4	1279 ft - 1464 ft -	Upper Seven Rivers - Did not Produce Sufficient Fluid.
No. 5	2753 ft - 2830 ft -	LSA Unit 4 Dolomite - Did not Produce Sufficient Fluid.
No. 6	5630 ft - 5909 ft -	Wolfcamp, PI = 1756 psi, K = 10.3 md.
No. 7	Penn. Carbonates and Granite Wash - Unsuccessful, tool stuck.	

d. Geophysical Logging - Complete suites of open and cased hole logs.

e. Long-Term Pump Testing and Fluid Sampling

Scheduled to start June 1983. Propose testing Granite Wash, Penn. Carbonates, Wolfcamp, and LSA Unit 4 Dolomite.

8. Holtzclaw No. 1 - Randall County, started February 28, 1983, scheduled completion April 1983. Planned T.D. 2800 ft ±. Present status: Coring Lower San Andres.

a. Casing Program - 20 in. conductor to 41 ft, 10 3/4 in. surface to 1400 ft ±.

b. Rock Coring (All 4 in. OD)

1080 ft - 1401 ft - Salado, Yates, and Upper Seven Rivers

Planned - Contact of LSA Unit 5 into LSA Unit 3.

MAJOR SALT SECTION

Unavailable at present.

c. Drill Stem Tests (DSTs)

No. 1	1276 ft - 1322 ft	-	Upper Seven Rivers
No. 2	1140 ft - 1186 ft	-	Salado
No. 3	702 ft - 748 ft	-	Santa Rosa

Planned - LSA Unit 4 Dolomite. If indication of porosity contact of LSA 4 and 5, contact U.S.A. and Unit 5, and upper contact of U.S.A.

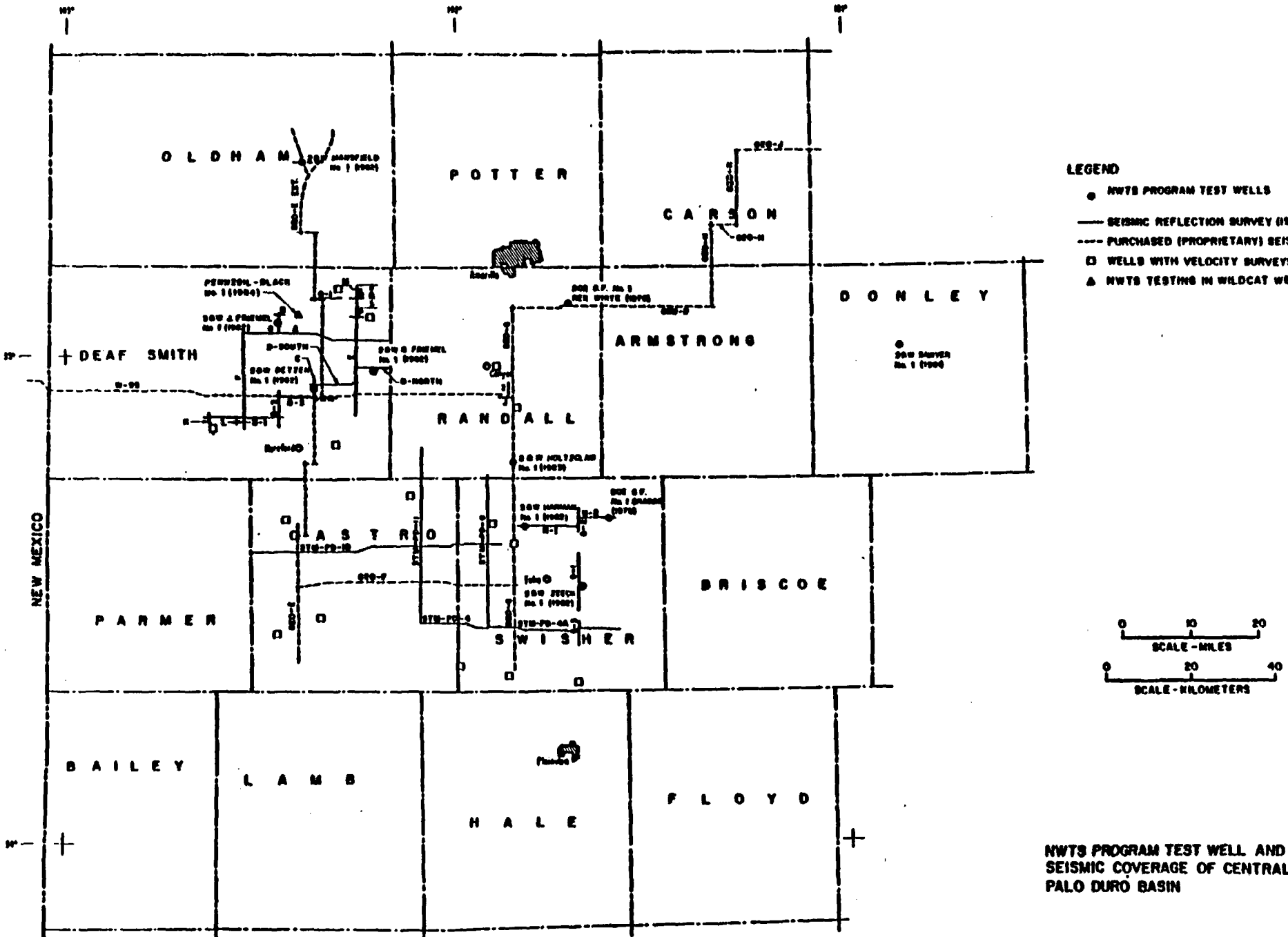
d. Geophysical Logging - Complete suites to T.D. planned.

e. Long-Term Pump Testing and Fluid Sampling

None presently planned.

f. Dissolution Zone Water Well

None presently planned.



NWTS PROGRAM TEST WELL AND SEISMIC COVERAGE OF CENTRAL PALO DURO BASIN

CONTRACT E512-05000
STONE & WEBSTER ENGINEERING CORPORATION

ONGOING TECHNICAL TASKS
FY1985 - FY1986

HYDROGEOLOGY
- EXTEND REGIONAL 2D MODEL INTO SW OKLAHOMA
- BEGIN 3D MODEL FOR 20 MI RADIUS OF SITE
- ANALYSIS OF PUMP TEST DATA, ZEECK AND J. FRIEMEL WELLS

GEOLOGY
- STRUCTURAL ANALYSES OF PALO DURO BASIN
- HYDROGEOLOGIC SUBDIVISIONS OF PALO DURO BASIN
- SALT DISSOLUTION IN THE INTERIOR OF THE PALO DURO BASIN

GEOPHYSICS
- MAINTAIN AND UPGRADE THE SEISMIC NETWORK

GEOTECHNICAL ENGINEERING
- GEOTECHNICAL PROFILES - DEAF SMITH COUNTY
- GEOPHYSICAL LOG ANALYSIS / ROCK MECHANICS LAB DATA
- COMPLETE LAB TESTING OF ROCK CORE

COMPUTER DATA BASES MAINTAINED BY STONE & WEBSTER

- OGALLALA WELL DATA FILE
- DOCKUM WELL DATA FILE
- DEEP BASIN DST FILES: PRESSURE, PERMEABILITY
- FORMATION FLUID CHEMISTRY FILE
- FORMATION TOPS, MAJOR SALT UNIT TOPS
- HYDROGEOLOGIC UNIT TOPS
- ROCK MECHANICS LAB TESTING DATA
- TEST SAMPLE DESCRIPTIONS
- GEOPHYSICAL LOG DATA (SWEC WELLS) REFORMATTED FOR IBM

STONE & WEBSTER TECHNICAL REPORTS

REPORT NO.	DATE	REPORT TYPE	TITLE	
G82-16	11/23/82	Characterization Report	Area Geological Characterization Report (AGCR)	1.13
T-1	03/22/83	Topical Report	Ogallala Aquifer Mapping Report Revised 10/21/83 (T-16)	1.17 1.18
T-2	03/07/83	Topical Report	Maps of Selected Formations Deaf Smith County (Draft)	1.22 1.23
T-3	02/23/83	Well Completion Report	Detten Final Core Log and Core Photographs	1.27 1.28
T-4	04/12/83	Well Completion Report	G. Friemel Final Core Log and Core Photographs	1.32 1.33
T-5	04/25/83	Well Completion Report	Sawyer No. 1 Pumping Test and Fluid Sampling Report Revised 9/7/84 (T-25)	1.37 1.38 1.39
T-6	05/26/83	Well Completion Report	Zeeck No. 1 Final Core Log and Core Photographs	1.42 1.43
T-8	06/17/83	Topical Report	Major Salt Beds (Revision of Report G82-12, 10/29/82)	1.45 1.46
T-9	08/01/83	Well Completion Report	Mansfield No. 1 Pumping Test and Fluid Sampling Report Revised 7/25/84 (T-26)	1.48 1.49 1.50
T-10	07/07/83	Well Completion Report	Dissolution Zone Water Wells	1.52 1.53
T-11	12/29/83	Well Completion Report	J. Friemel No. 1 (PD-9) Well Completion Report	1.56 1.57
T-12	12/15/83 and 12/16/83	Well Completion Report	Holtzclaw No. 1 Well (PD - 10) Completion Report	2.3 2.4
T-14	05/29/84	Topical Report	Hydrogeologic Investigations Based On Drill-Stem Tests	2.8 2.9
T-15	08/01/83	Well Completion Report	Harman No. 1 Final Core Log and Core Photographs	2.13 2.14
T-16	10/21/83	Topical Report	Ogallala Aquifer Mapping Program	2.17
T-17	09/14/83	Topical Report (Draft)	Geoengineering Evaluation for the Intermediate Shaft Liner Seal	2.21 2.22

STONE & WEBSTER TECHNICAL REPORTS

REPORT NO.	DATE	REPORT TYPE	TITLE	
T-18	11/16/83	Well Completion Report	Sawyer No. 1 Well (PD-3)	2.25
			Replaces draft of 3/8/82	2.26
T-19	11/18/83	Well Completion Report	Mansfield No. 1 Well (PD-4)	2.28
			Replaces draft of 6/24/82	2.29
T-20	04/05/84	Well Completion Report	G. Friemel No. 1 Well (PD-5)	2.31
T-21	07/19/84	Well Completion Report	Detten No. 1 Well (PD-6)	2.33
			Revision 1	2.34
T-22	06/29/84	Well Completion Report	Zeeck No. 1 Well (PD-7)	2.37
			Revision 1	2.38
T-23	08/20/84	Well Completion Report	Harman No. 1 Well (PD-8)	2.42
			Revision 1	2.43
T-24	12/22/83	Well Completion Report	Dissolution Zone Water	2.47
			Wells (PD-8, 11, 12, 13)	2.48
			Revision 1	2.49
T-25	09/07/84	Well Completion Report	Sawyer No. 1 Well (PD-3)	2.52
			Pumping Test and Fluid	2.53
			Sampling Report	2.54
			Revision 1	2.55
T-26	07/25/84	Well Completion Report	Mansfield No. 1 Well (PD-4)	2.58
			Pumping Test Revision 1	2.59
T-27	11/09/84	Topical Report	Origin of the Salado, Seven	3.4
			Rivers, and San Andres	3.5
			Salt Margins in Texas	3.6
			and New Mexico	3.7
T-28	12/04/84	Topical Report	Geotechnical Borehole	3.11
			Testing Report, Holtzclaw	3.12
			No. 1 Well	3.13
T-29	05/15/85	Well Completion Report	Zeeck No. 1 Well (PD-7)	3.17
			Pumping Test and Fluid	3.18
			Sampling Report	3.19
T-30	11/16/84	Topical Report	Structural Analysis of the	3.23
			Northern Palo Duro Basin	3.24
T-31	08/85	Well Completion Report	J. Friemel No. 1 Well (PD-9)	3.27
			Pumping Test and Fluid	3.28
			Sampling Report	3.29

STONE & WEBSTER TECHNICAL REPORTS

REPORT NO.	DATE	REPORT TYPE	TITLE	
T-32	12/21/84	Topical Report	Regional Permeability Determinations	3.33 3.34
T-33	01/03/85 Revised 07/85	Topical Report	Historical Seismicity of the Texas Panhandle from an Examination of Lubbock Station Records	3.38 3.39 3.40 3.41
T-34	01/03/85 Revised 04/85	Topical Report	Palo Duro Microearthquake Network Operation Report for April-July 1984	3.45 3.46 3.47
T-35	04/26/85	Topical Report	A Preliminary Simulation Model to Determine Ground-Water Flow and Ages Within the Palo Duro Basin Hydrogeologic Province	3.51 3.52 3.53 3.54 3.55 3.56
T-36	04/08/85	Field Test Activities Report	Black No. 1 Well, Deaf Smith County, Texas	4.1 4.2
T-37	04/01/85	Topical Report	Velocity Study: J. Friemel No. 1 and Zeeck No. 1 Wells	4.6 4.7
T-38	06/10/85	Topical Report	Geologic Database Management and Computer Mapping	4.10 4.11
T-39	08/85	Topical Report	Pumping Test Analyses - Sawyer No. 1 and Mansfield No. 1 Wells	4.14 4.15
T-40	04/22/85	Topical Report	Palo Duro Microearthquake Network Operation Report August-December 1984	4.19 4.20 4.21
T-41	06/12/85	Topical Report	Hydrogeologic Subdivision of the Wolfcamp Series and Pennsylvanian System of Eastern New Mexico	4.25 4.26 4.27 4.28
T-42	06/10/85	Topical Report	Hydrodynamic Investigations in the Texas Panhandle Area - geochem. information	4.32 4.33
T-43	Sept 85	Topical Report	A Report on Fracturing in the Deaf Smith Area	4.37 4.38
T-44	Aug 85	Topical Report	Hydrogeologic Subdivision of the Wolfcamp Series and Pennsylvanian System of the Deaf Smith County Area, Texas	4.42 4.43 4.44 4.45

ROCK MECHANICS LABORATORY TESTING REPORTS

Report Title	Testing Lab	Report No. and Date	Presents Results of:
Laboratory Testing on Rock Core Samples from Mansfield No. 1 Well, Permian Basin Project	SWEC	13A-1 1-6-84	Density, Porosity, Water Content, Rebound Hardness, Tensile Strength, Slake Durability and Atterberg Limits Testing from the Mansfield No. 1 Well
Laboratory Testing on Rock Core Samples from Detten No. 1 Well, Permian Basin Project	SWEC	13A-2 5-22-84 BMI/SRP 5023 Aug 84	Density, Porosity, Water Content, Rebound Hardness, Tensile Strength, Slake Durability and Atterberg Limits Testing from the Detten No. 1 Well
Laboratory Testing on Rock Core Samples from G. Friemel No. 1 Well, Permian Basin Project	SWEC	13A-3 6-14-84 BMI/SRP 5025 Aug 84	Density, Porosity, Water Content, Rebound Hardness, Tensile Strength, Slake Durability and Atterberg Limits Testing from the G. Friemel No. 1 Well
Laboratory Testing on Rock Core Samples from Zeeck No. 1 Well, Permian Basin Project	SWEC	13A-4 9-21-84	Density, Porosity, Water Content, Rebound Hardness, Tensile Strength, Slake Durability and Atterberg Limits Testing from the Zeeck No. 1 Well
Laboratory Testing on Rock Core Samples from J. Friemel No. 1 Well Permian Basin Project	SWEC	13A-5 2-25-85	Density Porosity, Water Content, Rebound Hardness Tensile Strength, Slake Durability and Atterberg Limits Testing from the J. Friemel No. 1 Well
Report of Direct Shear Testing on Rock Core Samples from Mansfield No. 1 Well, Permian Basin Project	SWEC	13A-11 6-14-84 BMI/SRP 5027 Aug 84	Shear Strength Determinations of Naturally Occurring Discontinuities from the Mansfield No. 1 Well
Report of Direct Shear Testing on Rock Core Samples form Detten No. 1 Well Permian Basin Project	SWEC	13A-12 6-14-84 BMI/SRP 5026 Aug 84	Shear Strength Determinations of Naturally Occurring Discontinuities from the Detten No. 1 Well

Report Title	Testing Lab	Report No. and Date	Presents Results of:
Report of Direct Shear Testing on Rock Core Samples from Zeeck No. 1 Well Permian Basin Project	SWEC	13A-13 11-30-84	Shear Strength Determination of Naturally Occurring Discontinuities from the Zeeck No. 1 Well
Report of Liquid Permeability Measurements on Rock Core Samples from Mansfield No. 1 Well - Permian Basin Project	SWEC	13A-21 2-26-85	Measurement of permeability of selected samples from the Mansfield No. 1 Well
Laboratory Testing of Rock and Salt Samples for Static Moduli, Dynamic Moduli and Triaxial Compressive Strength	ARA	Vol. 1 7-26-83 BMI/SRP 5015 Sept 84	Unconfined Compression and Pulse Velocity Measurements for Samples from the Mansfield No. 1 Well
Laboratory Testing of Rock and Salt Samples for Static Moduli, Dynamic Moduli and Triaxial Compressive Strength	ARA	Vol. 2 7-26-84 BMI/SRP 5015 Sept 84	Unconfined Compression and Pulse Velocity Measurements for Samples from the Detten No. 1 Well
Laboratory Testing of Rock and Salt Samples for Static Moduli, Dynamic Moduli and Triaxial Compressive Strength	ARA	Vol. 3 7-26-84 BMI/SRP 5015 Sept 84	Unconfined Compression and Pulse Velocity Measurements for Samples from the G. Friemel No. 1 Well
Laboratory Testing of Rock and Salt Samples for Static Moduli, Dynamic Moduli and Triaxial Compressive Strength	ARA	Vol. 4 2-7-84 BMI/SRP 5015 Sept 84	Triaxial Compression and Pulse Velocity Measurements for Samples from the G. Friemel No. 1 Well
Laboratory Testing of Rock and Salt Samples for Static Moduli, Dynamic Moduli and Triaxial Compressive Strength	ARA	Vol. 5 2-7-84 BMI/SRP 5015 Sept 84	Triaxial Compression and Pulse Velocity Measurements for Samples from the Mansfield No, 1 Well
Laboratory Testing of Rock and Salt Samples for Static Moduli, Dynamic Moduli and Triaxial Compressive Strength	ARA	Vol. 6 2-7-84 BMI/SRP 5015 Sept 84	Triaxial Compression and Pulse Velocity Measurements for Samples from the Detten No. 1 Well

Report Title	Testing Lab	Report No. and Date	Presents Results of:
Laboratory Testing of Rock and Salt Samples for Static Moduli, Dynamic Moduli and Triaxial Compressive Strength	ARA	Vol. 7 4-4-84 BMI/SRP 5015 Sept 84	Unconfined Compression and Pulse Velocity Measurements for Samples from the Zeeck No. 1 Well
Laboratory Testing of Rock and Salt Samples for Static Moduli, Dynamic Moduli and Triaxial Compressive Strength	ARA	Vol. 8 4-4-84 BMI/SRP 5015 Sept 84	Triaxial Compression and Pulse Velocity Measurements for Samples from the Zeeck No. 1 Well
Laboratory Testing of Rock and Salt Samples for Static Moduli Dynamic Moduli & Triaxial	ARA	Vols. 9-15 11-16-84	Unconfined and Triaxial Compression and Pulse Velocity Measurements for Samples from the J. Friemel No. 1 Well
Laboratory Testing of Rock and Salt Samples for Static Moduli, Dynamic Moduli & Triaxial	ARA	Vols. 16-20 1-10-85	Unconfined and Triaxial Compression and Pulse Velocity Measurements for Samples from the Harman No. 1 Well
Laboratory Testing of Rock and Salt Samples for the Determination of Rebound Hardness, Abrasion Hardness and Unconfined Compressive Strength	ARA	Vol. 1 7-23-84 BMI/SRP 5029 Nov. 84	Schmidt Rebound Hardness, Taber Abrasion Hardness and Unconfined Compressive Strength for Samples from the Zeeck No. 1 Well
Laboratory Testing of Rock and Salt Samples for the Determination of Rebound Hardness, Abrasion Hardness and Unconfined Compressive Strength	ARA	Vol. 2 7-23-84 BMI/SRP 5029 Nov. 84	Schmidt Rebound Hardness, Taber Abrasion Hardness and Unconfined Compressive Strength for Samples from the J. Friemel No. 1 Well
Laboratory Testing of Rock and Salt Samples for the Determination of Rebound Hardness, Abrasion Hardness and Unconfined Compressive Strength	ARA	Vol. 3 7-23-84 BMI/SRP 5029 Nov. 84	Schmidt Rebound Hardness, Taber Abrasion Hardness and Unconfined Compressive Strength for Samples from the Harman No. 1 Well

Report Title	Testing Lab	Report No. and Date	Presents Results of:
Laboratory Testing of Rock and Salt Samples for the Determination of Rebound Hardness, Abrasion Hardness and Unconfined Compressive Strength	ARA	Vol. 4 2-4-85	Schmidt Rebound Hardness, Taber Abrasion Hardness and Unconfined Compressive Strength for Samples from the Lower portion of the J. Friemel No. 1 Well
Laboratory Testing of Rock Samples for the Determination of Clay Mineralogy	Dartmouth College	Vol. 1 1-10-84 BMI/SRP 5018 Sept 84	Clay Mineralogy Determinations of Selected Samples from the Mansfield, Detten and G. Friemel Wells
Laboratory Testing of Rock Samples for the Determination of Clay Mineralogy	Dartmouth College	Vol. 2 7-12-84 BMI/SRP 5018 Sept 84	Clay Mineralogy Determinations of Selected Samples from the Zeeck No. 1. Well
Laboratory Testing of Rock Samples for the Determination of Clay Mineralogy	Dartmouth College	Vol. 3 1-1-85	Clay Mineralogy Determinations of Selected Samples from the J. Friemel No. 1 Well
Laboratory Testing of Rock and Salt Samples for Determination of Specific Gravity and Total Porosity	REI	1 9-20-83 BMI/SRP 5022 July 84	Water Content, Bulk Density, Apparent Specific Gravity, Specific Gravity, Effective Porosity and Total Porosity Determinations from the Mansfield No. 1 Well
Laboratory Testing of Rock and Salt Samples for Determination of Specific Gravity and Total Porosity	REI	2 7-12-84	Water Content, Bulk Density, Apparent Specific Gravity, Specific Gravity, Effective Porosity and Total Porosity Determinations from the G. Friemel and Detten Wells
Laboratory Testing of Rock and Salt Samples for Determination of Specific Gravity and Total Porosity	REI	3 5-7-84 BMI/SRP 5021 July 84	Water Content, Bulk Density, Apparent Specific Gravity, Specific Gravity, Effective Porosity and Total Porosity Determinations from the Zeeck No. 1 Well
Suspected Presence of Solid Hydrocarbon in Bedded Salt Samples from the Permian Basin	REI	4 3-5-84	Laboratory Efforts to Identify Material Previously Suspected to be Hydrocarbons

Report Title	Testing Lab	Report No. and Date	Presents Results of:
Suspected Presence of Solid Hydrocarbon in Bedded Salt Samples from the Permian Basin	RE1	4 (rev. 1) 11-28-84	Laboratory Efforts to Identify Material Previously Suspected to be Hydrocarbons

PERMIAN BASIN CORE EXAMINATION MEETING

TEXAS BUREAU OF ECONOMIC GEOLOGY

Review of status of Palo Duro Basin Studies

August 7, 1985

Surface/Subsurface Geology

A. Quaternary stratigraphy of the western Rolling Plains (Gustavson)

B. Paleoenvironmental and paleoclimatic reconstructiion (Caran)

C. Characterization of the Blackwater Draw and Ogallala Formations (Gustavson)

D. Characterization of Dockum Group strata (Johns)

E. Depositional systems analysies of post-San Andres strata (Permian) (Nance)

F. Effects of interior salt dissolution in post-San Andres strata (Nance)

G. Petrography of post-San Andres Formation evaporites (Hovorka)

H. Diagenesis of the San Andres Formation (Hovorka)

I. Porosity and permeability analyses of Wolfcampian strata (Conti)

J. Regional stratigraphy of the San andres Formation (Fracasso)

K. Regional stratigraphy early Paleozoic strata (Ruppel)

L. Structure and tectonic history, Palo Duro Basin (Budnik)

M. Interion and peripheral salt dissolution (Gustavson)