BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

RECORD

Record 1986/8

BMR STRATIGRAPHIC DRILLING IN THE AMADEUS BASIN, NORTHERN TERRITORY, 1985

by

M. Owen

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CONTENTS

SUMMARY

Two continuously cored stratigraphic holes were drilled for the Bureau of Mineral Resources in the Amadeus Basin in April and May 1985 to investigate the Early Ordovician Horn Valley Siltstone and the Cambrian Tempe Formation and Chandler Limestone in the Gardiner Range, about 200 km. west of Alice Springs.

Hermannsburg #41 was spudded in the upper part of the Deception Siltstone and penetrated a complete section of the Illara Sandstone, Tempe Formation, and Chandler Limestone before being completed in the uppermost Arumbera Sandstone. The total depth was 444.54 metres. An important result from the hole was the demonstration of a disconformity between the Tempe Formation and the Chandler Limestone.

Mount Liebig #2 spudded in the middle Stairway Sandstone and provided a complete section in the Horn Valley Siltstone before terminating in the upper Pacoota Sandstone with a total depth of 471.77 metres.

INTRODUCTION

The Amadeus Basin is a large (about 155 000 sq. km.) intra-cratonic basin which has had a complex geological history from the Late Proterozoic to Carboniferous (Wells et al. 1969). The Division of Continental Geology commenced a multidisciplinary research program in the Basin in 1983, with the Cambro-Ordovician interval being the focus of attention. As part of this study, four shallow stratigraphic holes were drilled in late 1983, (Owen & Morris, 1985) and a further two fully cored stratigraphic holes were drilled in April and May 1985. Preliminary results from the 1985 drilling are presented in this record.

The stratigraphic sequence in the Cambro-Ordovician part of the Amadeus Basin is described in Wells et al., 1969; it is shown in summary in figure 1.

Figure I

GENERALIZED STRATIGRAPHIC TABLE

AMADEUS BASIN

ORDOVICIAN	UPPER	LARAPINTA	UPPER ORDOVICIAN ?	Ss unit		
			CARMICHAEL	Ss., Sltst.		
			STOKES	Sltst., Sh., Ls.		
	MIDDLE		STAIRWAY	Ss., Sltst.		
	LOWER		HORN VALLEY	Sltst., Sh., Dol.		
			PACOOTA	Ss., Slst.		
CAMBRIAN	UPPER	PERTAOORRTA	GOYDER	Ss. Dol., Sh.		
	MIDDLE		PETERMANN	Ss.	SHANNON	Ls.
			DECEPTION	Sltst.	HUGH RIVER	Sltst
			ILLARA	Ss.	GILES CREEK	Dol
			TEMPE	Sh., Ls Sltst.		
	LOWER		CHANDLER			Salt, Sh., Ls.
					TODO RIVER	Dol
			ARUMBERA		Ss Sltst Cgl	

The drilling programme undertaken by the Bureau of Mineral Resources has been designed to improve our understanding of two intervals, the Horn Valley Siltstone and the Tempe Formation/Chandler Limestone. The former is known to be the major hydrocarbon source rock in the Amadeus Basin (Gorter, 1983) while the latter have also been considered to have some source rock potential. Both intervals form very poor outcrop and are deeply weathered, hence drilling is an essential adjunct to any study of their sedimentology, source rock potential or palaeontology.

DETAILS OF HOLES DRILLED

All holes were named after the 1:250 000 Sheet areas they occur on, thus BMR Hermannsburg #41 was the forty-first hole drilled by BMR on the Hermannsburg 1:250 000 Sheet.

The holes were drilled vertically and continuously cored to total depth, once thin surficial sediments had been penetrated and cased. Drilling was done under contract on behalf of BMR by B.H.F. Drilling Pty. Ltd. (South Australia) using a Vickers Keogh model VK 1000H drilling rig, equiped with wire-line core barrels providing either HQ or NQ sized core. The crews worked a seven day week and usually two ten hour shifts each day. Recovery was generally excellent, averaging well over 95%. The core obtained is housed in the BMR Core and Cuttings Laboratory, Fyshwick, A.C.T.

All core was described in the field and the accompanying logs to this record were drawn up from these descriptions. In addition each box of core was photographed on site before being packed for shipment to Canberra. At least a quarter of all core will be permanently kept in the Core and Cuttings Laboratory. No geophysical logging of the holes was done because of financial constraints on the programme.

DESCRIPTION OF HOLES

BMR HERMANNSBURG #41

Location:-On the Hermannsburg 1:250 000 sheet, in the Gardiner Range about 6 km west of Katapata Gap, and 270 metres on a bearing of 185° from the intersection of seismic lines P84-A2 and P84-A3. (23° 56' 03"S 132° 05' 36"E). Elevation of ground estimated as 750m ASL.

Objective:- To provide a continuous core through the Deception Siltstone, Illara Sandstone, Tempe Formation and Chandler Limestone.

Drilling Details;- Drilling began on the 19th. April, 1985 and the hole was initially cased with PQ casing to 9.5 metres before coring with a HQ core barrel commenced. Subsequently the total loss of water return at a depth of 23.75 metres resulted in the PQ casing being extended to 24.00 metres. There were no further major problems and coring with HQ size core continued to the total depth at 444.54 metres, which was reached on the 4th May. Over much of the hole there was a slight loss of water return and a total of fourteen loads of water, each of 12,000 litres, were used. The water supply was from a dam about 25km. from the drill site. Upon abandonment a cover was tack-welded over the top of the hole but it was otherwise left open.

Results: The hole was spudded about 65 metres below the contact of the Deception Siltstone and the overlying Petermann Sandstone. The Deception Siltstone consisted for the most part of thinly interbedded brown micaceous siltstone and sandstone with occasional thicker beds of fine to medium grained sandstone. A feature of the Formation was the abundance of water escape structures and mud flakes. A grey, poorly bedded, vuggy dolomite was also intersected from 46.75 to 48.50 metres. The Deception Siltstone was unfossiliferous, although indications of bioturbation were seen at several horizons.

The boundary with the underlying Illara Sandstone has been placed at 112.68 metres, although the contact is gradational over several tens of metres, with sandstone beds gradually becoming thicker and more common downwards. The horizon selected as the boundary correlates with that in nearby surface outcrops. The Illara Sandstone consists dominantly of cross-bedded, fine to medium grained quartz sandstone, generally fairly well sorted, and with abundant mud flakes. Thin mudstone laminae are quite common, and several thicker mudstone beds, up to 5 metres thick are also present. The sandstones often have an indistinct lamination caused by slight concentrations of heavy minerals, provisionally identified as magnetite. Glauconite is absent from the unit, except about 15 metres above the base, where both glauconite and limestone grains were seen and are thought to have been re-worked from the underlying Tempe Formation. No fossils were seen in the unit.

The contact of the Illara Sandstone with the Tempe Formation is also gradational, the boundary being placed at the base of the lowest major sandstone horizon, at 256.81 metres.

The Tempe Formation consists of dark grey mudstone with interbedded limestone, dolomite and cross-bedded sandstone. Limestone forms about 20% of the Formation and is usually grey, though sometimes becoming light brown, is often dolomitic, and some beds are glauconitic. Stylolites are present in the thicker beds, and comminuted fossil debris occurs at several levels. Siltstone and fine sandstone are common as thin laminae in mudstone, and are often rich in glauconite. Sandstone, which is often glauconitic, becomes increasingly more major downwards and the base of the Formation is marked by a 23 metre thick bed of glauconitic, cross-bedded sandstone. Two beds of intraclast breccia are also present, at 272.8 and 278.9 metres.

The contact of the Tempe Formation with the underlying Chandler Limestone is at 372.97 metres, and is considered to be a disconformity, with cross-bedded fine sandstone of the Tempe Formation resting on dark reddish-brown siltstone of the upper Chandler Limestone. The siltstone of the Chandler is mostly poorly bedded, may be dolomitic in part, and contains several horizons up to 15 cm. thick of small-scale intra-clast brecciation, with some thin, vertical, infilled fissures also present. This passes down at 384.60 metres into a breccia of dolomite, limestone and chert in a brown sandy matrix, with clasts up to 5 cm. across, which in turn passes down at 387.98 metres into limestone.

The limestone is light to dark grey in colour, may be dolomitic, and contains chert as both clasts and as irregular interbeds. Stylolites are common and there are several zones of thin intraclast breccia. The basal 25.5 metres of the Chandler Limestone is made up of poorly bedded to un-bedded brown siltstone, which has a gradational contact with both the overlying limestone and with the underlying Arumbera Sandstone at 426.94 metres.

The Arumbera Sandstone in the Gardiner Range has previously been called the Eninta Sandstone, although its correlation with the Arumbera Sandstone to the north was suspected (Wells et al. 1970). Recent work on the seismic stratigraphy of the intervening areas (J. Lindsay, pers comm.) has demonstrated that the two sandstone units are continuous under the Missionary Plains and that the name Eninta Sandstone is not needed.

The Arumbera Sandstone was penetrated from 426.94 metres to the total depth of the hole at 444.54 metres, and consists of interbedded, brown, fine to medium grained sandstone with minor silstone and mudstone. Cross-bedding, mudflakes, water escape structures and contorted bedding are common.

The dip of the intersected rocks shows considerable and rapid variation down the hole from about 26° in the top 30 metres to less than 3° at 350 metres. Although no deviation survey was performed, the driller in charge's judgement was that this was not due to deviation of the hole but must reflect an actual change in the dip.

BMR MOUNT LIEBIG #2

Location:- On the Mount Liebig 1:250 000 sheet, in the Gardiner Range about 25 km. east-southeast of Camel's Hump, and 20 metres east of seismic line P83-A1 at shot point 690. 23° 54' 12"S 131° 50' 05"E, ground elevation about 800 metres ASL.

Objective:- To provide continuous core through the Horn Valley Siltstone and, if time permitted, to core the upper Pacoota Sandstone.

Drilling Details:- Drilling commenced on the 6th. May with PQ casing being run to 9.00 metres before coring with a HQ core barrel was started. The interval from 9.00 to about 25.00 metres proved to be very weathered, resulting in some core loss, together with only part water return. Firmer rock below 25 metres resulted in both quicker drilling and less core loss. Water loss still caused concern however, since the dam being used for the water supply had only a limited amount remaining, and it became necessary to case the hole to 121.10 metres. This was accomplished by leaving the HQ drill stem in the hole and changing to NQ, which was able to run inside the HQ drill stem. Coring then continued with NQ down to the total depth of 471.77 metres, which was reached on the 15th. May. Water return continued to be poor, with several porous sandstones in the Pacoota Sandstone being a particular problem. A total of 21 loads (each 12,000 litres) of water were used.

Upon completion of the hole it proved impossible to pull the HQ rods being used as casing and these had to be left in the hole. Upon abandonment a cover was tack-welded over the top of the hole but it was otherwise left open.

Results:- The hole was spudded in the middle part of the Stairway Sandstone, an estimated 115 metres below its contact with the Stokes Formation. Most of the middle Stairway Sandstone, which forms a marked recessive interval in outcrop around the drill site, is composed of thin to medium interbedded mudstone and fine sandstone, which appeared un-weathered below 31.5 metres. A feature of the unit was the abundant and at times extreme bioturbation. Often bedding has been completely disrupted, giving a mottled appearance to the rock.

Thin horizons of phosphate nodules are common between 41 and 120 metres, with only the more major ones being shown on the accompanying logs. Individual nodules ranged to up to 5 mm. across and were in beds up to 10 cm. thick. The beds usually had sharp, erosive bases, and often gradational tops into fine sandstone lacking nodules. Beds rich in large pelecypods are common between 64 and 74 metres, while several isoloated nautiloid cones were also present at this level. Sandstone becomes dominant below about 90 metres, though it always contains thin mudstone laminae, and usually shows signs of bioturbation.

The contact with the underlying Horn Valley Siltstone, which has been placed at 181.41 metres, is gradational over several metres. It has been placed where mudstone starts to dominate over siltstone and sandstone. The Horn Valley Siltstone is formed dominantly of black, highly fossiliferous, pyritic mudstone with thin interbeds of fine micritic limestone, which are more common in the upper part of the Formation. Fossils present include trilobites, brachiopods, pelecypods, and graptolites in the lower half.

A minor fault at 296.30 metres has had an unknown, though probably small, effect on the unit. The fault plane dipped about 65° towards the south, and was marked by minor calcite veins for about 15 cm. either side of the fault.

The basal part of the Horn Valley Siltstone is marked by the present of calcareous siltstone interbedded with mudstone, marking a gradational contact with the underlying Pacoota Sandstone at 317.18 metres. The contact has been placed at the top of the highest sandstone bed, which also marks the lowest calcareous siltstone beds, however most of the uppermost Pacoota Sandstone is similar to the basal part of the Horn Valley Siltstone.

Much of the upper Pacoota Sandstone penetrated in the hole is composed of interbedded siltstone and mudstone, which is often highly bioturbated, but which lacks any macrofossils. Pyrite is common throughout, and a thin phosphate nodule bed occurs at 321.88 metres. Sandstone is a minor constituent, only dominating between 331 and 350 metres and again below 433 metres. Glauconite is a significant component of the sandstone below 456 metres, while pyrite also occurs commonly.

In contrast to the Hermannsburg #41 hole, the dip remains fairly constant throughout, varying from 30° near the top to around 20° near the bottom of the hole.

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Owen M. and Morris, D.G., 1985 - BMR Stratigraphic Drilling in the Amadeus Basin, Northern Territory, 1983. Bureau of Mineral Resources, Australia, Record 1985/9.

Wells, A.T., Forman, D.J., Ranford, L.C. and Cook, P.J., 1970 - Geology of the Amadeus Basin, Central Australia. Bureau of Mineral Resources, Australia, Bulletin 100.

Figure 2, LEGEND FOR LITHOLOGIC LOGS

LITHOLOGY

▰▰▰	BRECCIA
▒	SANDSTONE
▤	SILTSTONE
☰	MUDSTONE
▦	LIMESTONE
▨	DOLOMITE
●●●●●●●●	PHOSPHATE NODULES

BEDDING

	PLANAR	CROSS-BEDDED
V. THICK	中	中
THICK	▭	凸
MEDIUM	⊏	⊏
THIN	=	≐
LAMINATED	≡	≡

BEDDING STRUCTURES

BIOTURBATED	θ
ASSYM. RIPPLES	ʌʌʌ
MUD PELLETS	⬬
DE-WATERING STRUCTURES	∀
CONTORTED BEDDING	∿
CALC. NODULES	⦶
VUGS	⊗
LOAD CASTS	Ʊ
STYLOLITES	ɯ

FOSSILS

MACROFOSSILS	∂
COMMINUTED FOSSIL DEBRIS	∂
NAUTILOID	◅
BIVALVE	Ʊ

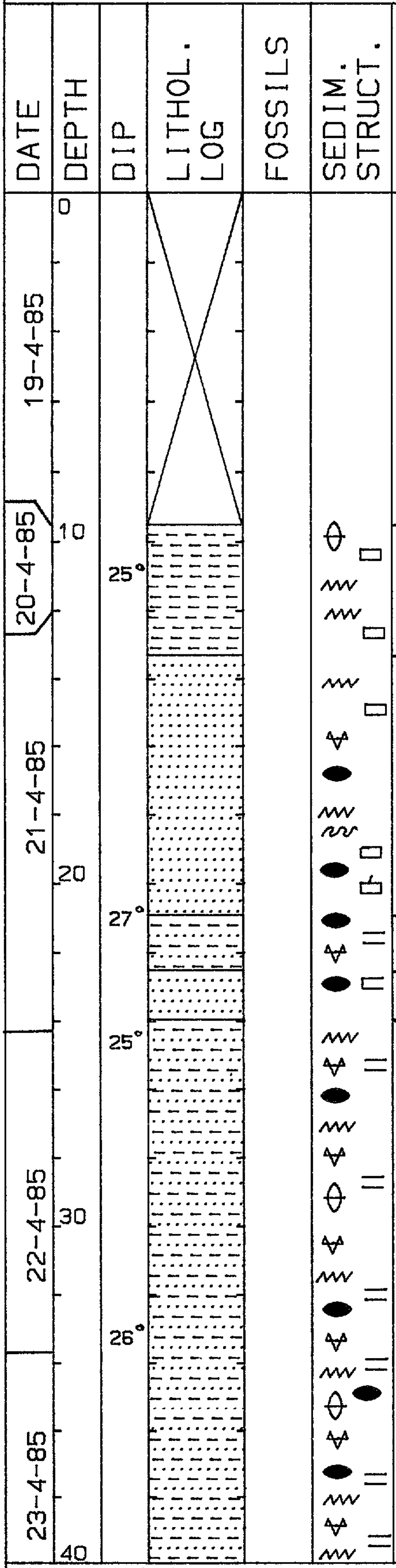
MINERALS

PYRITE	py
GLAUCONITE	gl

WELL NAME HERMANNSBURG # 41

SHEET 1 OF 12

BASIN AMADEUS STATE N.T. LONG. 132 05 36 LAT. 23 56 03
DRILLER B.H.F. Ltd. GEOLOGIST M. OWEN GR (AMG) 041-500



LITHOLOGY

0.00 - 9.50: INTERVAL NOT CORED
ABOUT 1 METRE OF SOIL RESTING ON DEEPLY WEATHERED SST. AND SLTST.

9.50-13.30: THICKLY BEDDED BR. MIC. SLTST., LAM. THROUGHOUT. RIPPLE X-LAM. COMMON BETWEEN 10.90-12.02. 5cm THICK BED FINE BR. SST. WITH SHARP BASE AT 12.45.

13.30-20.90: THICKLY BEDDED BR. MIC. FINE SST., THINLY LAM. THROUGHOUT WITH OCCASIONAL RIPPLE X-LAM. SOME BR. SLTST. INTERBEDS AND MUD FLAKES

20.90-22.50: THINLY INTERBEDDED BR. MIC. SST. AND SLTST.

22.50-23.94: LT. BR. MIC. MEDIUM GRAINED SST. CALC. CEMENT IN PLACES. MUD FLAKES NEAR TOP AND BOTTOM

23.94-44.90: BR. MIC. LAM. SLTST. THINLY INTERBEDDED WITH LT. BR. FINE SST. MUD FLAKES COMMON IN SST. BEDS AND DE-WATERING STRUCTURES COMMON THROUGHOUT

INTERVAL 30.50-31.75 BROWNISH-GREY IN COLOUR

BIOTURBATION PRESENT, PARTICULARLY AROUND 35.00

ROCK UNIT

DECEPTION SILTSTONE

COMMENTS PQ CASING INITIALLY TO 9.50m. LATER EXTENDED TO 24.00m. BECAUSE OF TOTAL WATER LOSS AT 23.75m.
CORE RECOVERY 100% EXCEPT FOR 9.50-12.02 - 95%
15.21-18.20 - 40% (CORE BARREL MALFUNCT.)
19.20-20.90 - 85%

WELL NAME HERMANNSBURG # 41

SHEET 2 OF 12

BASIN AMADEUS STATE N.T. LONG. 132 05 36 LAT. 23 56 03
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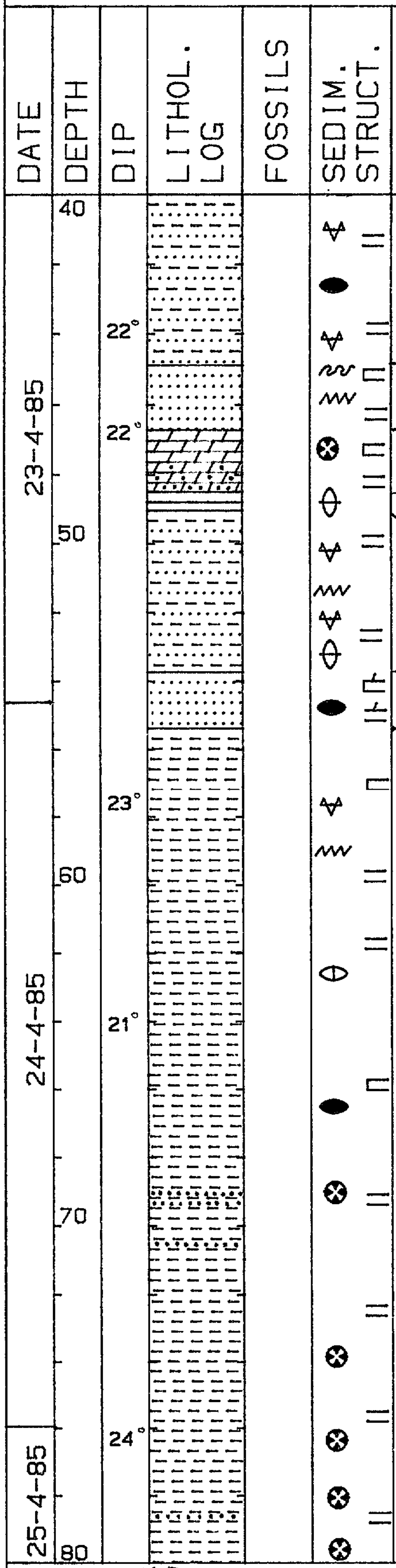

LITHOLOGY

23 .94-44.90: THINLY INTERBEDDED BR. MIC. SST. AND SLTST. SST. BECOMING LESS COMMON TOWARDS BASE OF INTERVAL

44.90-46.75: FINE GREY TO LT. BR. SST. WITH SLTST. BEDS BECOMING MORE COMMON TOWARDS BASE.

46.75-48.50: POORLY BEDDED GREY TO BR. DOLOMITE, VUGS COMMON IN UPPER PART, BECOMES SANDY NEAR BASE

48.50-49.05: GREY LAM. BIOTURBATED SLTST. AND MDST.

49.05-53.75: BR. MIC. SLTST. WITH THIN,BR., V. FINE SST. INTERBEDS. SOME RIPPLE X-LAM., DE-WATERING FEATURES AND BIOTURBATION

53.75-55.39: FINE TO MED. GRAINED BR. MIC. SST. WITH SHARP EROSIVE BASE AND MUD FLAKES

55.39-82.03: LAM. BR. MIC. SLTST. MEDIUM TO THINLY INTERBEDDED WITH MIC. FINE SST. BEDS <5cm. THICK CALCITE-LINED VUGS SCATTERED THROUGHOUT. WHITE CALCITE-RICH NODULES TO 1cm. ACROSS ALSO PRESENT.

SOME BEDS VERY POROUS, PARTICULARLY AT 68.94, 69.30, 70.26, AND 78.45

VUGS BECOME MORE COMMON BELOW 70.00m.

ROCK UNIT

DECEPTION SILTSTONE

COMMENTS

TEMPORARY WATER LOSS IN INTERVAL 68.94-78.45 DUE TO POROUS SST. BEDS
CORE RECOVERY 100% THROUGHOUT

WELL NAME HERMANNSBURG # 41 SHEET 3 OF 12

BASIN AMADEUS STATE N.T. LONG. 132 05 36 LAT. 23 56 03

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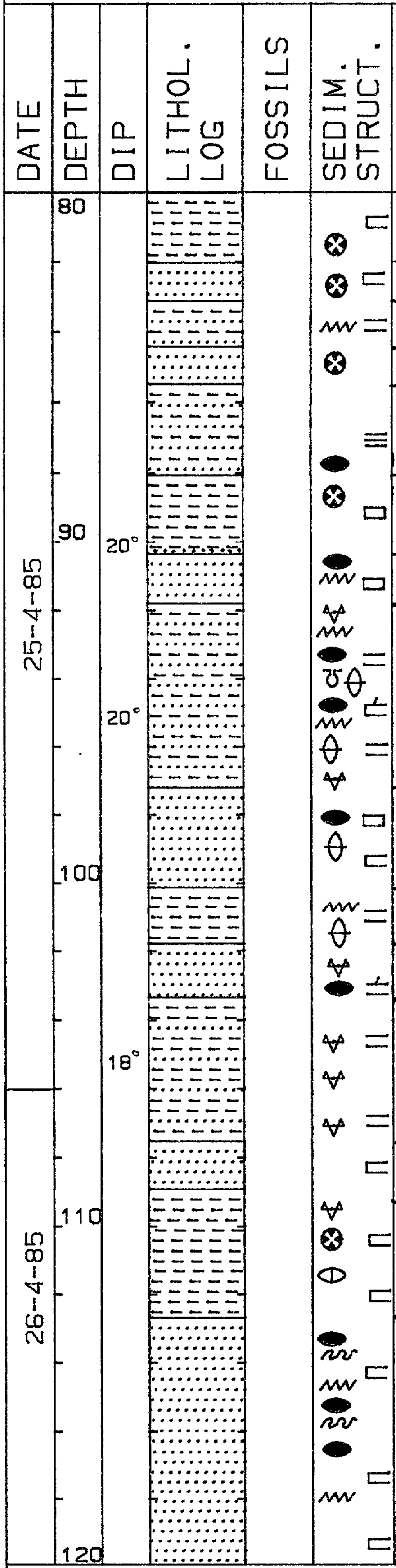

LITHOLOGY

55.39-82.03: LAM. BR. MIC. SLTST. WITH SOME BR. FINE SST. INTEBEDS

82.03-83.10: V. FINE BR. MIC. SST.

83.10-84.43: INTERBEDDED F. SST. AND SLTST.

84.43-85.50: V. FINE BR. MIC. SST.

85.50-88.06: INTERBEDDED BR. LAM. SLTST. AND SST. BEDS <1cm. THICK, SOME SLIGHTLY CALCAREOUS.

88.06-90.36: POORLY BEDDED BR. MIC. SLTST., IN PART CALCAREOUS. GRADES INTO FINE SST. IN BASAL 15cm.

90.36-91.81: FINE BR. MIC. SST. WITH CALC. CEMENT. INDISTINCT RIPPLE X-LAM. COMMON.

91.81-97.20: THINLY BEDDED BR. (RARELY GREY) SLTST. AND SST. BEDS GENERALLY <5cm. THICK BUT A 65cm. X-BEDDED FINE SST. BED IN MIDDLE OF INTERVAL. RIPPLE X-LAM., DE-WATERING FEATURES AND MUD FLAKES COMMON.

97.20-100.13: MED. TO THICKLY BEDDED BR. MIC. FINE SST. WITH SOME BR. MIC. SLTST. BETWEEN 98.83-99.50

100.13-101.79: BR. LAM. SLTST. WITH SOME THIN (<1cm.) FINE SST. LAMINAE. SOME SLTST. GREYISH.

101.79-103.35: BR. TO GREY MIC. FINE SST. WITH CALC. CEMENT. SHARP EROSIVE BOTTOM CONTACT.

103.35-107.52: BR. (AT TIMES GREY) LAM. MIC. SLTST. WITH THIN (<2cm.) FINE SST, INTERBEDS. DE-WATERING STRUCTURES COMMON THROUGHOUT.

107.52-108.92: V. FINE TO FINE BR. MIC. SST. WITH SOME THIN MED. GRAINED SST. BEDS. SHARP EROSIVE BASE TO INTERVAL.

108.92-112.68: BR. LAM. MIC. SLTST. WITH THIN FINE SST. BEDS BECOMING SIGNIFICANT TOWARDS BASE. VUGS TO 2cm. ACROSS AT 110.40

112.68-122.39: MED. BEDDED FINE MIC. SST. WITH THIN LAM. OF SLTST. INTERVAL BR. IN UPPER PART, BECOMING GREYISH DOWNWARDS. RIPPLE X-LAM. SCATTERED THROUGHOUT.

ROCK UNIT

DECEPTION SILTSTONE

ILLARA SANDSTONE

COMMENTS CORE RECOVERY 100% THROUGHOUT

SHEET 4 OF 12

WELL NAME HERMANNSBURG # 41

BASIN AMADEUS STATE N.T. LONG. 132 05 36 LAT. 23 56 03
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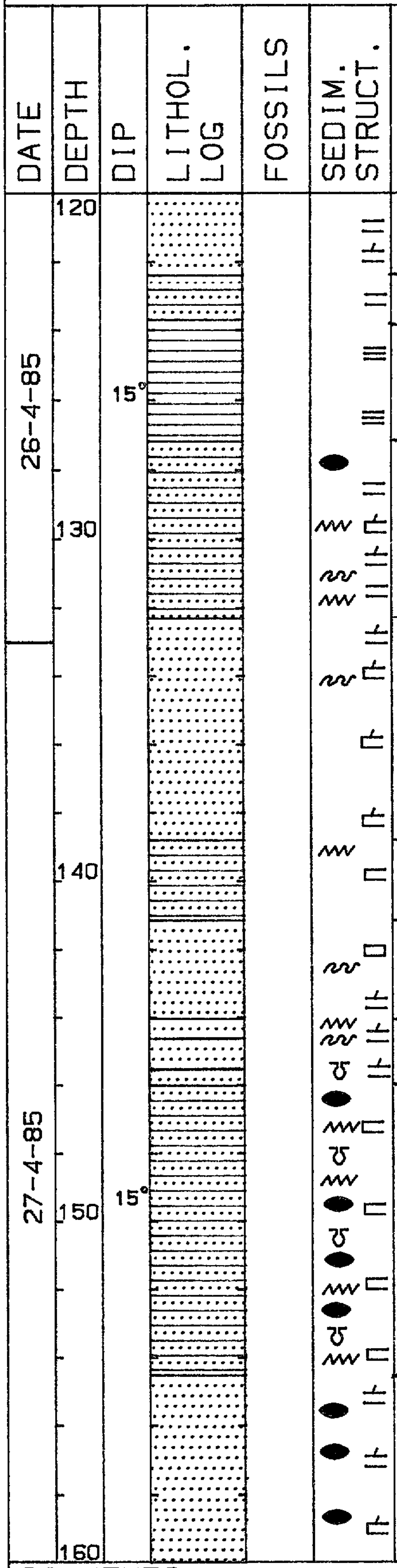

LITHOLOGY

ROCK UNIT: ILLARA SANDSTONE

112.68-122.39: FINE MIC SST. DK. GREY MDST. BETWEEN 120.10-120.60

122.39-123.70: DK. GREY MDST. AND LT. GREY FINE SST. WITH WAVY BEDDING PLANES

123.70-127.18: DK. GREY THINLY LAM. MDST. WITH DISCONTINUOUS THIN VERY FINE SST. LAMINAE.

127.18-132.31: LT. GREY FINE TO MEDIUM SST. AND DK. GREY MDST.. SST. BECOMES BROWN TOWARDS BASE. RIPPLE X-LAM. ESPECIALLY COMMON TOWARDS BASE.

132.31-138.80: LT.BR. POROUS FINE TO MED. GRAINED SST. RARE THIN GREY MDST. LAMINAE THROUGHOUT. MOST OF INTERVAL X-BEDDED.

138.80-141.15: BR. V.FINE LAM. SST. WITH GREY MDST. INTERBEDS.

141.15-144.03: POROUS BR. FINE SST. GRADATIONAL CONTACT WITH INTERVAL ABOVE.

144.03-146.00: BR. FINE SST. IN BEDS TO 40cm. AND GREY LAM. MDST. IN BEDS TO 10cm.

146.00-154.52: DK. GREY, GREENISH GREY AND DK. PURPLE LAM. MDST. AND LT. GREY FINE SST.
MDST.>SST. NEAR TOP WITH SST. INCREASING TOWARDS BASE TO FORM ABOUT 50%
MDST. FORMS BEDS 1-40cm. THICK WITH THIN, V. FINE SST. LAMINAE THROUGHOUT.
SST. IN BEDS 3-55cm. THICK WITH SHARP TOP AND BOTTOM CONTACTS,

154.52-164.04: LT. BR. FINE TO MED. GRAINED SST. WITH OCCASIONAL GREY LAM. MDST. BEDS <15cm. THICK INDISTINCT LAMINATION IN SST. CAUSED BY SLIGHT CONCENTRATIONS OF HEAVY MINERALS

COMMENTS CORE RECOVERY 100% EXCEPT FOR:- 152.00-153.00 - 95%

WELL NAME HERMANNSBURG # 41 SHEET 5 OF 12
BASIN AMADEUS STATE N.T. LONG. 132 05 36 LAT. 23 56 03
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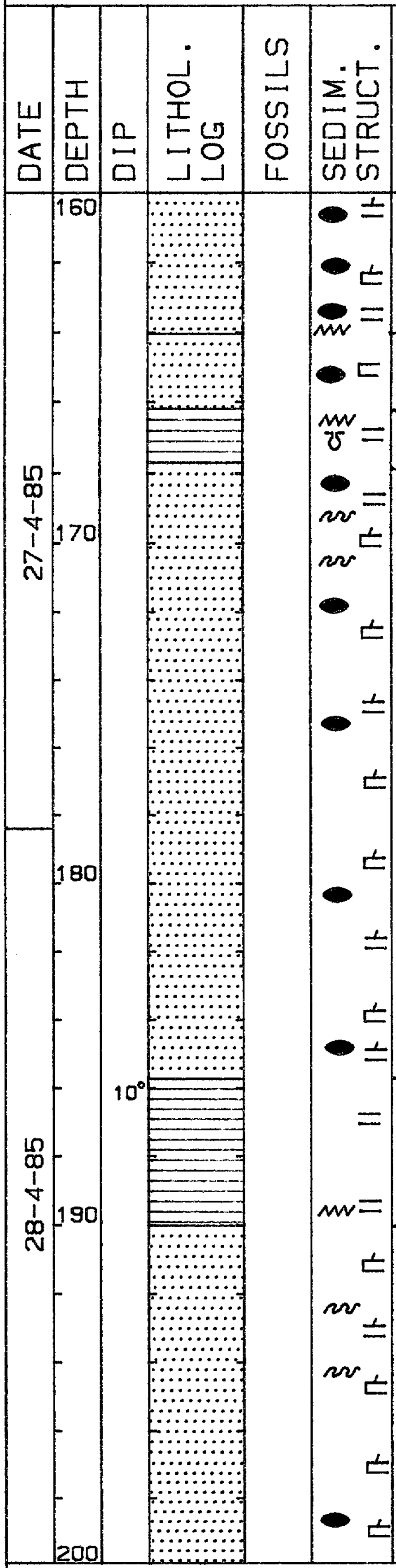

LITHOLOGY

154.52-164.04: X-BEDDED LT. BR. FINE SST. WITH MINOR THIN MDST. BEDS. MUD FLAKES BECOME MORE COMMON TOWARDS BASE.

164.04-166.09: POROUS LT. BR. MED. GRAINED SST. WITH INDISTINCT LAM. CAUSED BY SLIGHT CONCENTRATIONS OF HEAVY MINERALS.

166.09-167.73: GREENISH-GREY TO DK. PURPLE LAM. MDST. WITH THIN (<2cm.) LT. GREY V. FINE SST. INTERBEDS.

167.73-185.72: LT. BR. OR GREY FINE SST. WITH OCCASIONAL GREY MDST. LAMINAE.
X-BEDDED THROUGHOUT WITH LAMINATION IN SST. MARKED BY SLIGHT CONCENTRATIONS OF HEAVY MINERALS.

185.72-190.03: LAM. MDST. WITH A POORLY DEFINED DK. GREY TO DK. PURPLE BANDING 1-3cm. THICK.
SOME V. THIN V. FINE SST. LAMINAE TOWARDS BASE, WITH SOME STARVED RIPPLES WITH LOW ANGLE RIPPLE X-LAM..

190.03-226.30: BR. (GREY IN TOP METRE) FINE SST. WITH X-BEDDING COMMON THROUGHOUT.
AN INDISTINCT LAMINATION IS CAUSED BY SLIGHT CONCENTRATIONS OF HEAVY MINERALS.

ROCK UNIT

ILLARA SANDSTONE

COMMENTS CORE RECOVERY 100% THROUGHOUT

WELL NAME HERMANNSBERG # 41 SHEET 6 OF 12
BASIN AMADEUS STATE N.T. LONG. 132 05 36 LAT. 23 56 03
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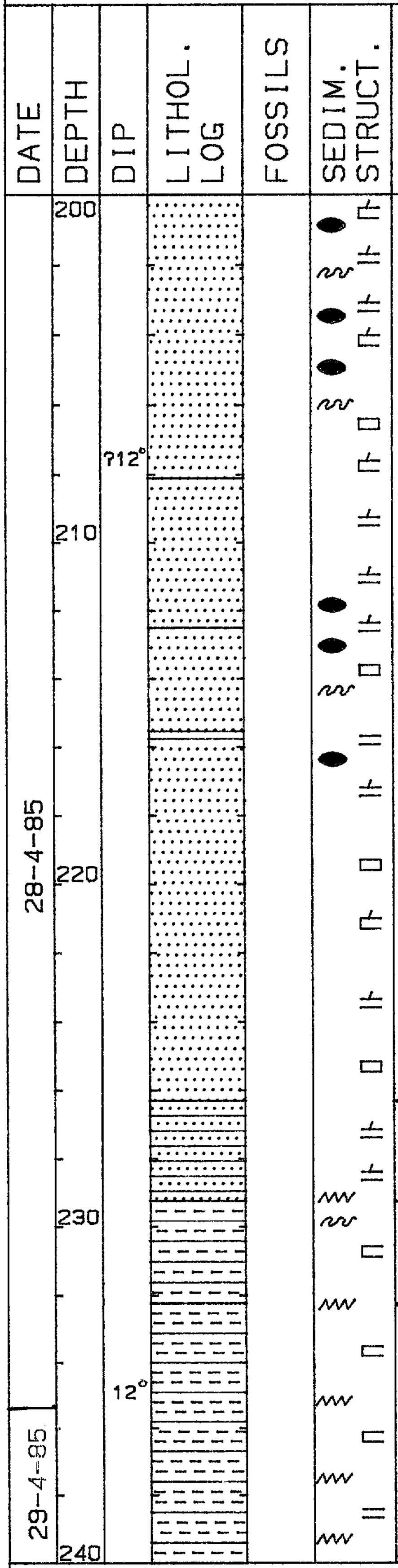


LITHOLOGY

190.03-226.36: FINE BROWN SST. WITH SCATTERED MUDFLAKES AND THIN GREY MDST. LAMINAE

BEDDING IN SST. DEFINED BY SLIGHT CONCENTRATIONS OF HEAVY MINERALS.

GREY MDST. BED 5cm. THICK AT 208.10

GREY MDST. BED 5cm. THICK AT 212.40 AND 212.63

GREY MDST. 215.55-215.77

226.30-229.22: LT. BR. THIN TO MEDIUM BEDDED V. FINE SST. WITH DK. GREY LAM. MDST. INTERBEDS 1 TO 5cm. THICK

229.22-232.20: INTERBEDDED DK. PURPLE TO GREY MDST. AND LT. GREY COARSE SLTST. RIPPLE X-LAM. COMMON IN SLTST.

232.20-241.04: LT.BROWN SLTST. WITH COMMON DK. GREY MDST. IN BEDS ABOUT 1cm. THICK AND 5 TO 15cm. APART

RIPPLE X-LAMINATION COMMON IN SLTST.

MDST. BECOMES MORE COMMON TOWARDS BASE OF INTERVAL

ROCK UNIT

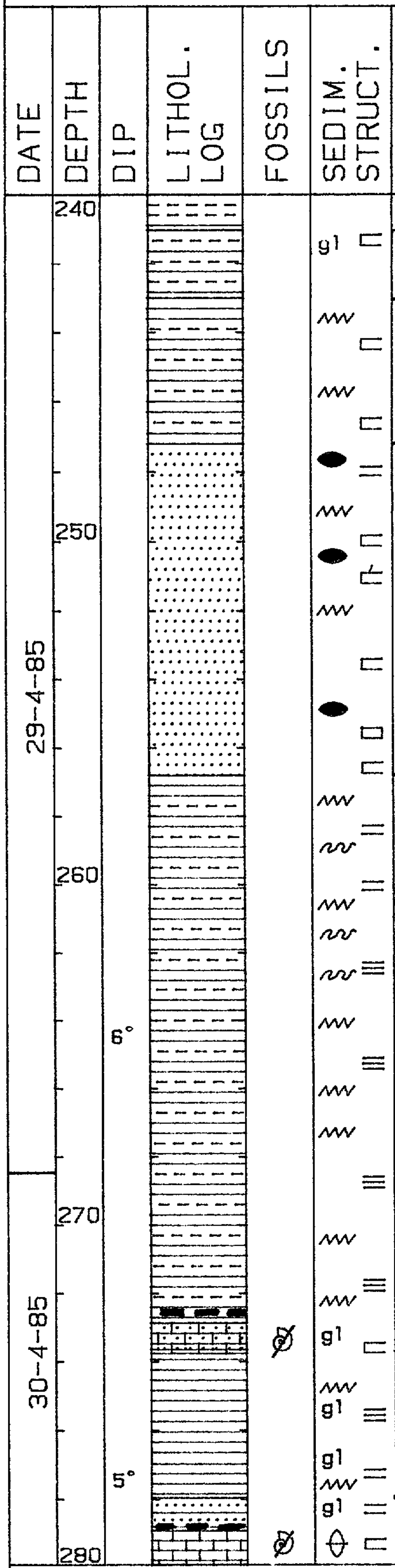
ILLARA SANDSTONE

COMMENTS CORE RECOVERY 100% THROUGHOUT INTERVAL

WELL NAME HERMANNSBURG # 41 SHEET 7 OF 12

BASIN AMADEUS STATE N.T. LONG. 132 05 36 LAT. 23 56 03

DRILLER B.H.F. Ltd. GEOLOGIST M. OWEN GR (AMG) 041-500



LITHOLOGY

232.20-241.04: LT. BR. SLTST. AND DK. GREY MDST.

241.04-243.00: DK. GREY MDST. AND LT. GREY COARSE SLTST. WITH RE-WORKED GLAUCONITE AND LST. GRAINS

243.00-247.20: DK. GREY MDST. WITH GREY SLTST. LAMINAE WITH RIPPLE X-LAMINATION.

247.20-256.81: LT. BROWN V. FINE SST. WITH MDST. LAMINAE COMMON TOWARDS TOP AND BOTTOM BUT RARE IN MOST OF INTERVAL. MUDFLAKES COMMON THROUGHOUT.

256.81-272.86: THINLY BEDDED TO LAM. DK. GREY MDST. WITH GREY SLTST. LAMINAE RIPPLE X-LAM. THROUGHOUT

BED OF INTRACLAST BRECCIA, 21cm. THICK, AT BASE, COMPOSED OF TABULAR LAMINATED MDST. CLASTS UP TO 4cm. x 0.5cm. AND CALC. SST. CLASTS IN A V. FINE SST. MATRIX

272.86-273.63: GLAUC. SANDY LST. WITH FINE FOSSIL FRAGMENTS <2mm. ACROSS.

273.63-277.96: DK. GREY MDST. WITH MINOR LT. GREY SLTST. AND GLAUC. FINE SST. BEDS

277.96-278.95: GLAUC. SST. AND DK. GREY MDST. WITH THIN INTRACLAST BRECCIA AT BASE.

278.95-280.80: LT. GREY GLAUC. LST. WITH FOSSIL FRAG.

ROCK UNIT

ILLARA SANDSTONE

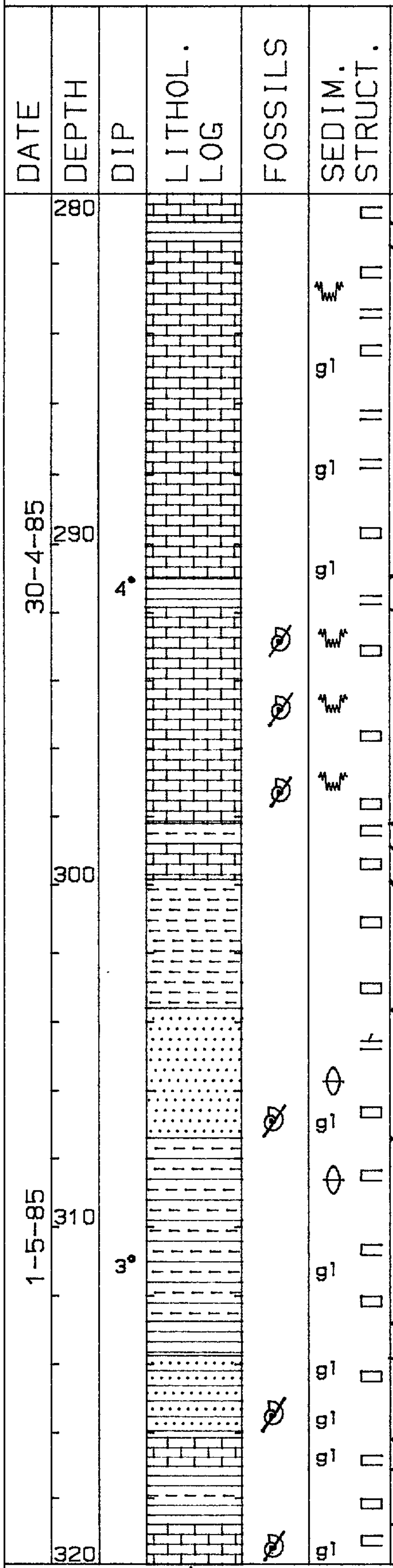
TEMPE FORMATION

COMMENTS CORE RECOVERY 100% THROUGHOUT INTERVAL.

WELL NAME HERMANNSBURG # 41 SHEET 8 OF 12

BASIN AMADEUS STATE N.T. LONG. 132 05 36 LAT. 23 56 03

DRILLER B.H.F. Ltd. GEOLOGIST M. OWEN GR (AMG) 041-500



LITHOLOGY

280.80-281.37: GREY LAM. MDST. WITH MINOR SLTST.

281.37-291.00: GREY THIN TO MEDIUM BEDDED DOLOMITIC LST. WITH SCATTERED MDST. LAMINAE. GLAUCONITE BECOMES MORE ABUNDANT TOWARDS BASE. STYLOLITES PRESENT 282.55-283.35

291.00-291.85: INTERBEDDED LT. GREY AND LT. BROWN LAMINATED CALC. MDST.

291.85-298.20: LT. BROWN LST. WITH FINE FOSSIL FRAGMENTS <2mm. ACROSS THROUGHOUT INTERVAL. STYLOLITES PRESENT AT SEVERAL HORIZONS.

298.20-298.80: GREY CALC. SLTST.

298.80-299.85: BROWN SILTY LST.

299.85-303.60: GREY LAM. CALC. SLTST., GRADING DOWNWARDS INTO CALC. V. FINE SST.

303.60-307.40: GREY CALC. FINE SST. WITH POORLY DEFINED THIN DARK LAMINAE. BECOMES GLAUCONITIC TOWARDS BASE. BIOTURBATED IN PART.

307.40-312.75: GREY CALC. SLTST. AND DK. GREY MDST. WITH SOME THIN GLAUCONITIC SST. LAMINAE

312.75-313.75: DK. GREY UNBEDDED MDST.

313.75-316.15: GLAUC. CALC. SST. AND GREY MDST.

316.15-317.03: GREY GLAUCONITIC LST.

317.03-318.80: GREY MDST. WITH FINE CALC. SLTST. LAMELLA

318.80-321.58: GREY GLAUCONITIC LST.

ROCK UNIT

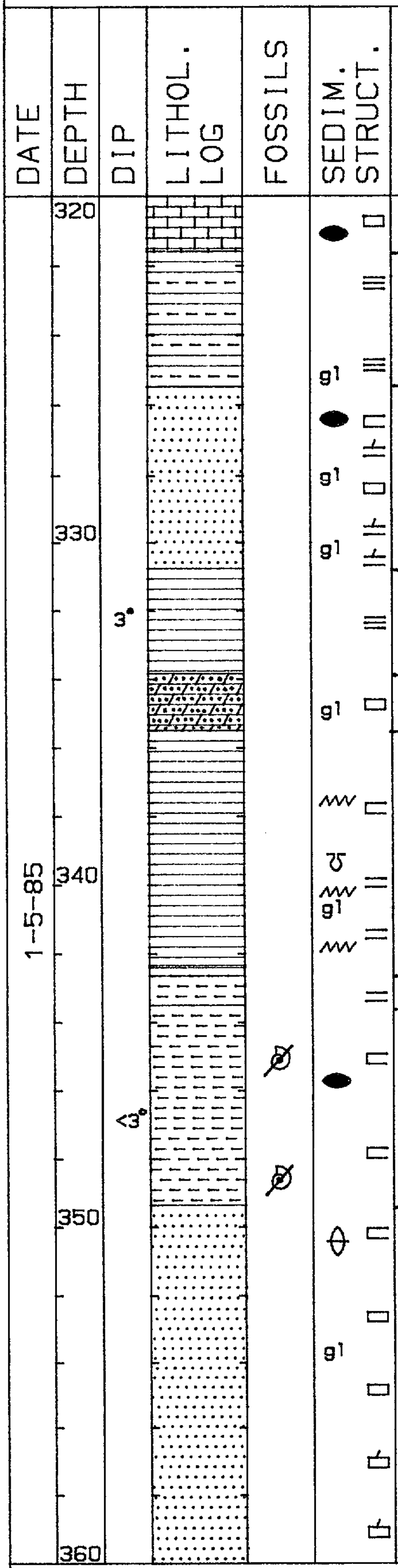
TEMPE FORMATION

COMMENTS CORE RECOVERY 100% THROUGHOUT INTERVAL

WELL NAME HERMANNSBURG # 41 SHEET 9 OF 12

BASIN AMADEUS STATE N.T. LONG. 132 05 36 LAT. 23 56 03

DRILLER B.H.F. Ltd. GEOLOGIST M. OWEN GR (AMG) 041-500



LITHOLOGY

318.80-321.58: GREY GLAUC. LST. WITH DK. GREY MDST. INTERBEDS AND SOME MDST. CLASTS

321.58-325.48: GREY LAM. MDST. WITH FREQUENT THIN LT. GREY SLTST. LAMINAE
THIN GLAUC. SST. BED NEAR BASE OF INTERVAL

325.48-330.76: LT. BROWN TO GREENISH GLAUC. SST. WITH SOME LAM. MDST. INTERBEDS AND MUDFLAKES NEAR TOP OF INTERVAL.
LAMINATION IN SST. DEFINED BY GLAUCONITE-RICH LAMINAE

330.76-333.84: DK. GREY MDST., UNBEDDED AT TOP, BECOMING LAMINATED TOWARDS BASE.

333.84-335.50: GLAUC. DOLOMITIC SST. WITH IRREGULAR MDST. LAMINAE BECOMING MORE COMMON TOWARDS BASE

335.50-342.64: DK. GREY LAMINATED MDST. WITH SOME THIN SLTST. BEDS AND LAMINAE.

GLAUC. FINE SST. AT 340.70, 14cm. THICK

342.34-343.50: LT. GREY SLTST. WITH MINOR MDST. LAM.

343.50-349.35: REDDISH-BR. SLTST. WITH SOME HORIZONS OF FINE FOSSIL DEBRIS.
GLAUCONITE-RICH LAMINAE AND SMALL MUDFLAKES ALSO PRESENT.
BECOMES GREY IN COLOUR BELOW 347.45

349.35-372.97: GREY FINE SST. WITH IRREGULAR THIN MDST. LAMINAE WHICH BECOME RARER DOWNWARDS.
X-BEDDED FOR MUCH OF INTERVAL, AND GLAUCONITIC IN PART. BIOTURBATED AT TOP OF INTERVAL.

ROCK UNIT

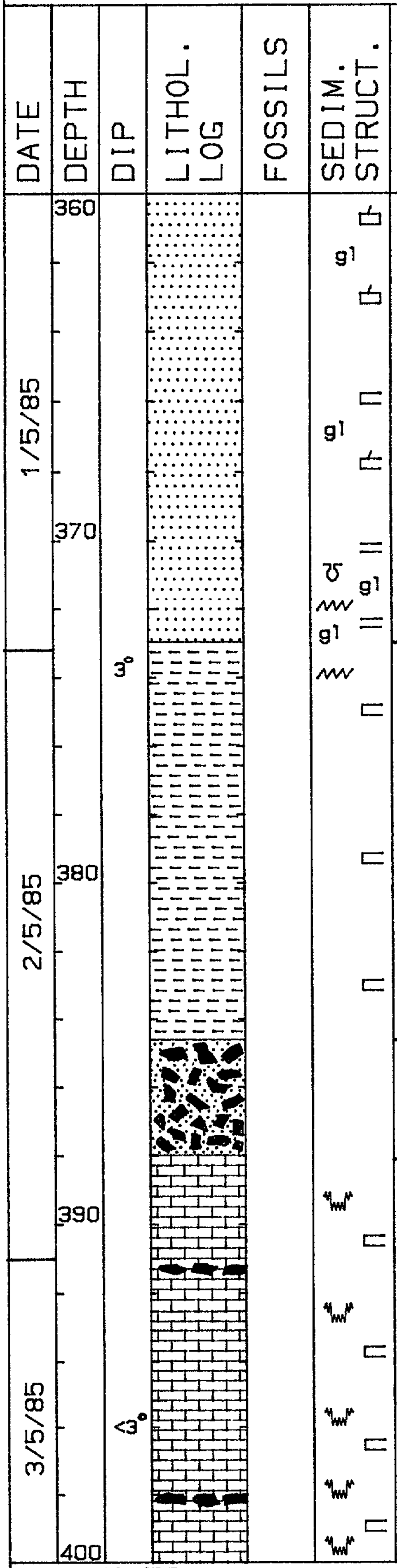
TEMPE FORMATION

COMMENTS CORE RECOVERY 100% THROUGHOUT INTERVAL

WELL NAME HERMANNSBURG # 41 SHEET 10 OF 12

BASIN AMADEUS STATE N.T. LONG. 132 05 36 LAT. 23 56 03

DRILLER B.H.F. Ltd. GEOLOGIST M. OWEN GR (AMG) 041-500



LITHOLOGY

ROCK UNIT

<u>349.35-372.97:</u> LT GREY X-BEDDED FINE SST., GLAUC. IN PART.

MDST. LAMINAE RARE IN MOST OF INTERVAL, BECOMING MORE FREQUENT TOWARDS BASE.

BASAL 16cm. A GREENISH GREY MDST. INTERBEDDED WITH A GLAUCONITIC SLTST.

TEMPE FORMATION

<u>372.97-384.60:</u> DARK REDDISH-BROWN SLTST., POSSIBLY DOLOMITIC IN PART, MOSTLY INDISTINCT TO THICKLY BEDDED

ZONES OF SMALL-SCALE INTRACLAST BRECCIATION WITH THIN VERTICAL FISSURES ALSO PRESENT IN BEDS 5 TO 15cm. THICK AND 20 TO 50cm. APART.

SOME BEDS GREY IN COLOUR BETWEEN 382.20-384.50

<u>384.60-387.98:</u> BRECCIA OF DOL. LST. AND CHERT IN A BROWN FINE SST. MATRIX.
BEDDING POORLY DEFINED, MARKED BY VARIATION IN THE SIZE OF CLASTS, WHICH RANGE UP TO 5cm. ACROSS.

<u>387.98-401.55:</u> LIGHT GREY TO DARK GREY LST., AT TIMES DOLOMITIC, WITH CHERT PRESENT AS BOTH CLASTS AND IRREGULAR INTERBEDS. MINOR MDST. AND SLTST. ALSO PRESENT.

STYLOLITES COMMON THROUGHOUT.

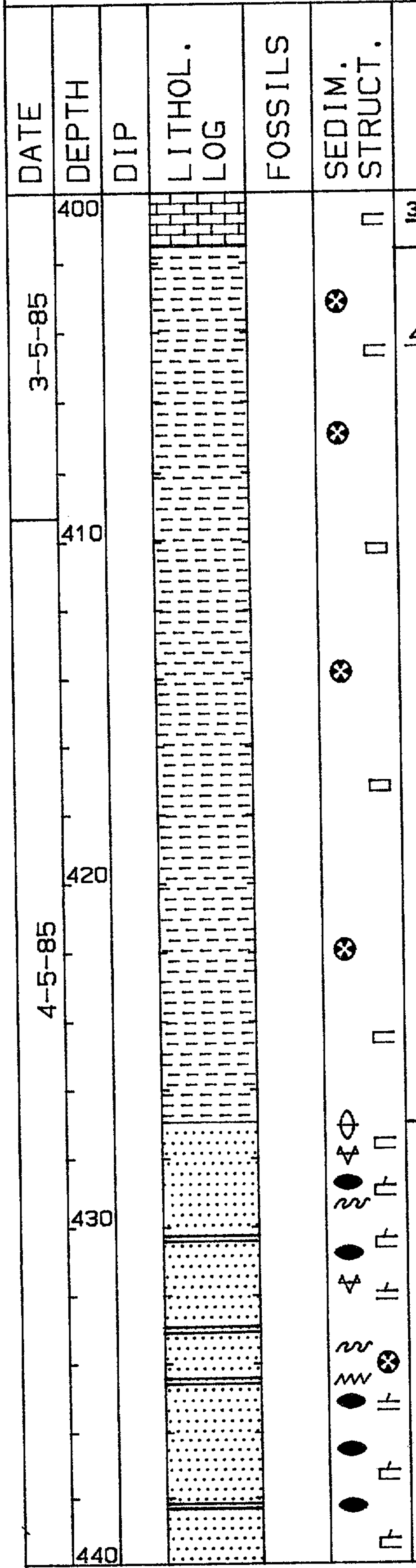
OCCASIONAL THIN HORIZONS OF INTRACLAST BRECCIA.

CHANDLER LIMESTONE

COMMENTS CORE RECOVERY 100% EXCEPT 391.14-394.00 - 98%

SHEET 11 OF 12

WELL NAME HERMANNSBURG # 41
BASIN AMADEUS STATE N.T. LONG. 132 05 36 LAT. 23 56 03
DRILLER B.H.F. Ltd. GEOLOGIST M. OWEN GR (AMG) 041-500



LITHOLOGY

ROCK UNIT

387.98-401.55: GREY DOLOMITIC LST. PASSING DOWN INTO CALC. GREY MDST. TOWARDS BASE OF INTERVAL

401.55-426.94: BROWN POORLY BEDDED TO UNBEDDED SLTST. WITH POORLY DEFINED INTERNAL LAMINATION.

GRADATIONAL CONTACT WITH BOTH OVERLYING AND UNDERLYING UNITS.

CHANDLER LIMESTONE

426.94-444.54: INTERBEDDED BROWN FINE TO MEDIUM SST. SLTST. AND MDST. SST. DOMINANT LITHOLOGY. X-BEDDING AND MUDFLAKES COMMON IN SST. TOP 1m. BIOTURBATED.

ARUMBERA SST.

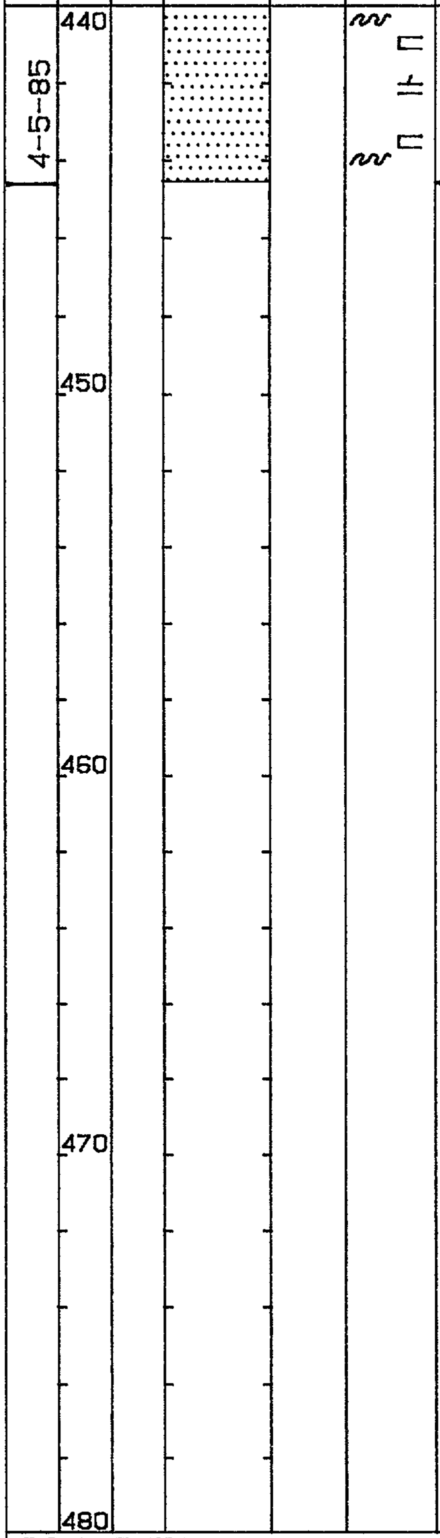
COMMENTS CORE RECOVERY 100% THROUGHOUT INTERVAL

SHEET 12 OF 12

WELL NAME HERMANNSBURG # 41

BASIN AMADEUS STATE N.T. LONG. 132 05 36 LAT. 23 56 03
DRILLER B.H.F. Ltd. GEOLOGIST M. OWEN GR (AMG) 041-500

DATE	DEPTH	DIP	LITHOL. LOG	FOSSILS	SEDIM. STRUCT.	LITHOLOGY	ROCK UNIT
4-5-85						426.94-444.54: BROWN SST. WITH INTERBEDS OF SLTST. AND MDST.	ARUMBERA
						BOTTOM OF HOLE AT 444.54m.	

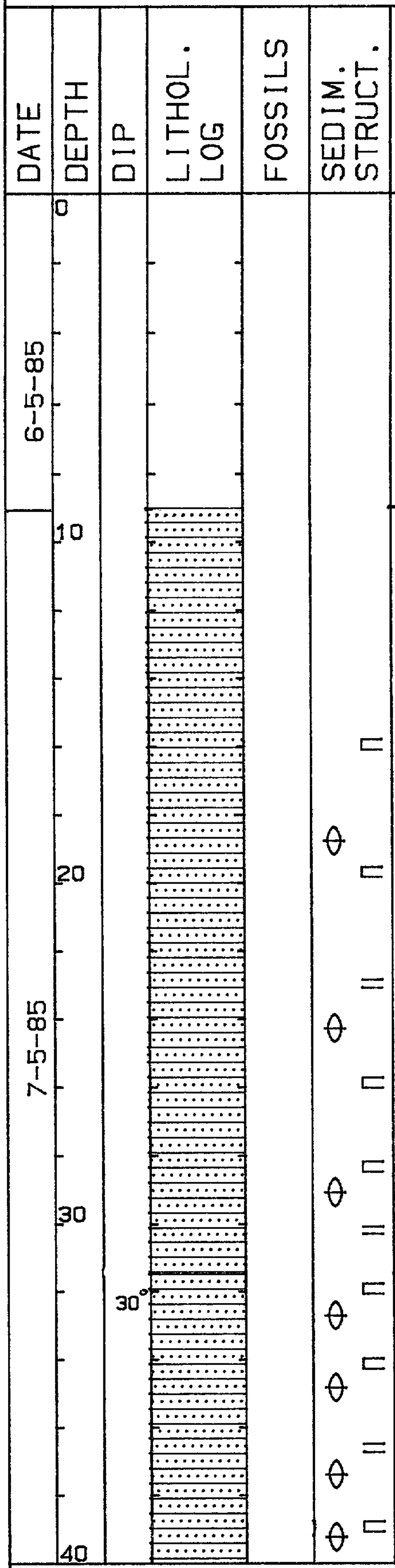


COMMENTS CORE RECOVERY 100%

WELL NAME Mt. LIEBIG # 2

SHEET 1 OF 12

BASIN AMADEUS STATE N.T. LONG. 131 50 05 LAT. 23 54 12
DRILLER B.H.F. Ltd. GEOLOGIST M. OWEN GR (AMG) 862-535



LITHOLOGY

0.00-9.00 INTERVAL NOT CORED

DEEPLY WEATHERED FINE SST. AND MDST.

9.00-31.50 STRONGLY WEATHERED, INTERBEDDED LT. BR. FINE SST. AND MDST.
DETAILS OF LITHOLOGY IN UPPER PART OF INTERVAL LARGELY OBSCURED BY WEATHERING

TOWARDS BASE, THE WEATHERING BECOMES LESS INTENSE AND BOTH SST. AND MDST. ARE HIGHLY BIOTURBATED. IN BEDS NOT AFFECTED BY BIOTURBATION, BOTH SST. AND MDST. ARE LAMINATED.

31.50-40.00 INTERBEDDED, USUALLY HIGHLY BIOTURBATED, DK. GREY MDST. AND LT. GREY V. FINE SST.
MDST. AND SST. LAMINATED WHERE NOT AFFECTED BY BIOTURBATION.
LITHOLOGY WITHIN INTERVAL IDENTICAL TO THE OVERLYING INTERVAL EXCEPT FOR THE ABSENCE OF WEATHERING.

ROCK UNIT

STAIRWAY SANDSTONE

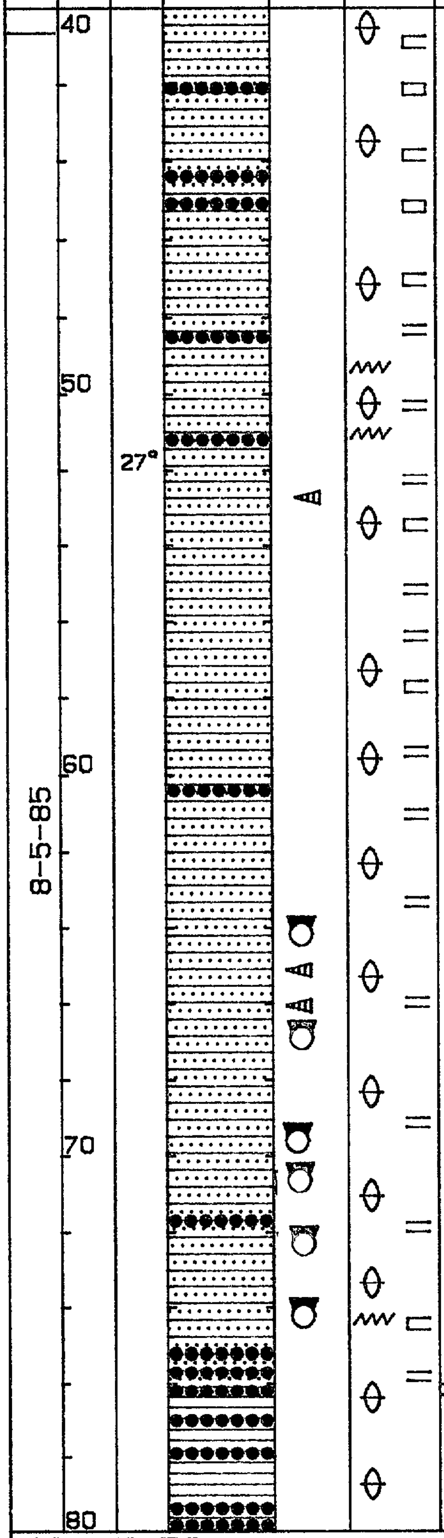
COMMENTS PQ CASING 0.00-9.00m. HQ CORE TAKEN BELOW 9.00m.

CORE RECOVERY 100% EXCEPT FOR:-

9.00-10.00	85%	12.00-15.00	95%
15.00-17.00	85%	17.00-19.10	45%
19.10-22.06	98%	22.06-25.10	55%
25.10-28.10	90%	28.10-31.10	97%

WELL NAME Mt. LIEBIG # 2 SHEET 2 OF 12
BASIN AMADEUS STATE N.T. LONG. 131 50 05 LAT. 23 54 12
DRILLER B.H.F. Ltd. GEOLOGIST M. OWEN GR (AMG) 862-535

DATE | DEPTH | DIP | LITHOL. LOG | FOSSILS | SEDIM. STRUCT. | LITHOLOGY | ROCK UNIT



40.00-76.35 STRONGLY BIOTURBATED DARK GREY MDST. AND LT. GREY FINE SST.
BEDDING SURFACES IRREGULAR DUE TO BOTH LOADING AND BIOTURBATION.
SST. BEDS <20cm. THICK, OFTEN <5cm., MOST BEDS USUALLY <10cm.
PHOSPHATIC SST. BEDS SCATTERED THROUGHOUT (ONLY THE MORE MAJOR BEDS INDICATED). PHOSPHATIC NODULES UP TO 5mm. ACROSS. MOST PHOSPHATIC SST. BEDS HAVE SHARP BASES AND GRADATIONAL TOPS INTO FINE SST. WITHOUT PHOSPHATE.

HORIZONS OF LARGE PELECYPODS, IN A SANDY MATRIX, COMMON NEAR BASE OF INTERVAL. RARE NAUTILOIDS ALSO PRESENT.

76.35-89.65 DK. GREY MDST, HEAVILY BIOTURBATED SO THAT SLTST. LAMINAE ORIGINALLY PRESENT ARE COMPLETELY DISRUPTED. THIN PHOSPHATIC BEDS THROUGHOUT.

STAIRWAY SANDSTONE

COMMENTS CORE RECOVERY 100% THROUGHOUT INTERVAL

WELL NAME Mt. LIEBIG #2

SHEET 3 OF 12

BASIN AMADEUS STATE N.T. LONG. 131 50 05 LAT. 23 54 12
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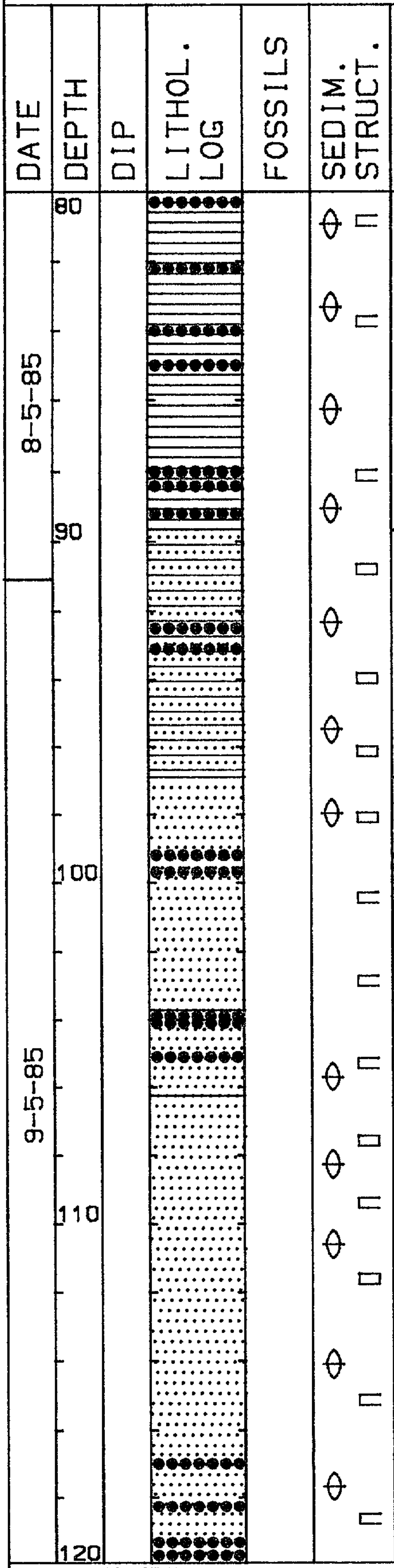


LITHOLOGY

76.35-89.65 DARK GREY MDST. WITH SLTST. LAMINAE WHICH HAVE BEEN COMPLETELY DISRUPTED BY BIOTURBATION.
LAYERS OF PHOSPHATE NODULES COMMON, WITH MOST BEING OF COARSE TO VERY COARSE SAND IN SIZE.

89.65-96.90 THICKLY INTERBEDDED VERY FINE LIGHT GREY SST. AND DARK GREY MDST., ALL HIGHLY BIOTURBATED.

96.90-103.70 LIGHT GREY VERY FINE SST. WITH THIN, DARK GREY MDST. LAMINAE WHICH ARE OFTEN DISRUPTED BY BIOTURBATION. SOME THIN PHOSPHATIC NODULE HORIZONS.

103.70-106.24 MEDIUM TO COARSE SST. WITH SEVERAL PHOSPHATE NODULE HORIZONS CONTAINING NODULES UP TO 3mm. ACROSS. SOME THIN MDST. LAMINAE TOWARDS BASE.

106.24-124.30 THICK TO MEDIUM BEDDED LIGHT GREY SST. WITH THIN MDST. LAMINAE. BIOTURBATED THROUGHOUT.

HORIZONS OF PHOSPHATE NODULES UP TO 20cm. THICK PRESENT BETWEEN 117.00-120.00m.

ROCK UNIT

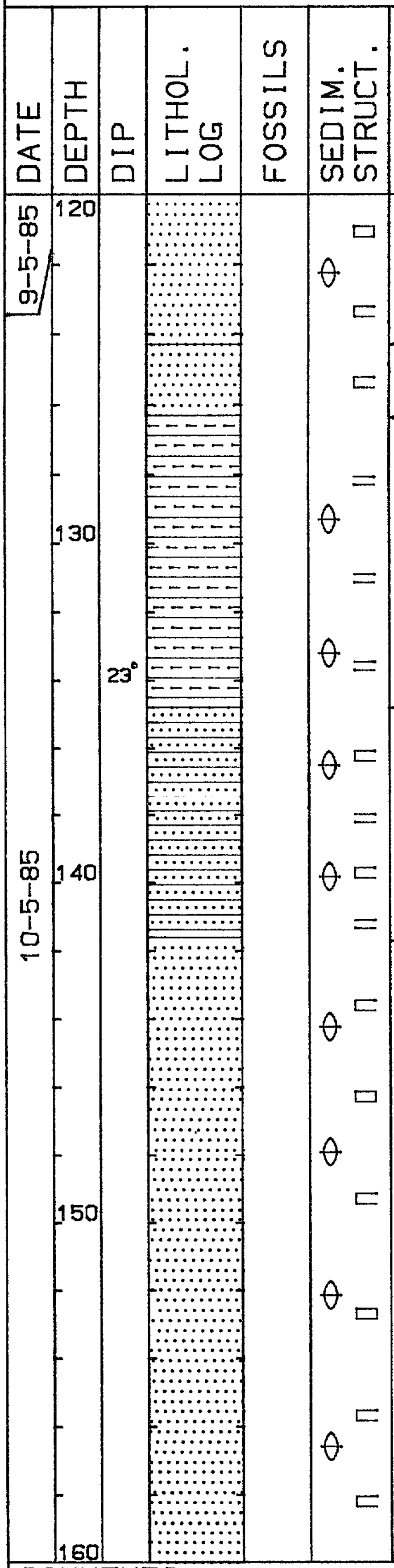
STAIRWAY SANDSTONE

COMMENTS CORE RECOVERY 100% THROUGHOUT

WELL NAME Mt. LIEBIG #2

SHEET 4 OF 12

BASIN AMADEUS STATE N.T. LONG. 131 50 05 LAT. 23 54 12
DRILLER B.H.F. LTD. GEOLOGIST M. OWEN GR (AMG) 886-536



LITHOLOGY

106.24-124.30 GREY, FINE GRAINED SST. WITH SOME DARK GREY MDST. LAMINAE, ESPECIALLY 120.00-120.43m.
NO PHOSPHATIC BEDS BELOW 120m.
BEDS OF MED. TO COARSE SST., 5 TO 15cm. THICK AT 122.00, 122.50, 122.90, AND 123.64m.

124.30-126.30 MED. TO COARSE LIGHT GREY SST., AT TIMES POORLY CEMENTED AND POROUS.

126.30-134.80 THINLY INTERBEDDED GREY MDST. AND LIGHT GREY SLTST. WHICH IS AT TIMES STRONGLY BIOTURBATED.

134.80-141.60 MEDIUM BEDDED, FINE TO MED. GRAINED SST. INTERBEDDED WITH DARK GREY MDST. AND GREY SLTST.
SST. BEDS GENERALLY 10 TO 60cm. THICK, MDST. OR SLTST. BEDS 1 TO 5cm. THICK, AND OFTEN BIOTURBATED.

141.60-162.37 FINE TO VERY FINE LIGHT GREY SST. WITH DARKER GREY LAMINAE OF MDST.
BIOTURBATION IS EXTENSIVE AND BEDDING IS OFTEN DESTROYED, RESULTING IN A 'MOTTLED' APPEARANCE TO THE ROCK. BIOTURBATION DECREASES TOWARDS THE BASE.

ROCK UNIT

STAIRWAY SANDSTONE

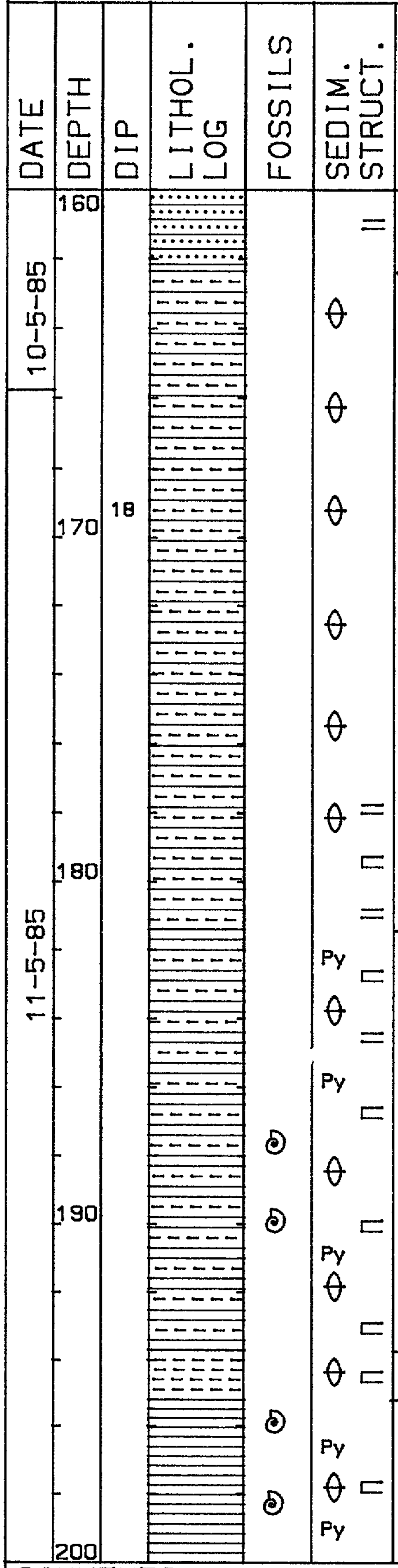
COMMENTS CORE RECOVERY 100% EXCEPT 123.80-126.30 85%
138.95-140.20 90%

CORE SIZE CHANGED FROM HQ TO NQ AT 121.10m.

WELL NAME Mt. LIEBIG #2

SHEET 5 OF 12

BASIN AMADEUS STATE N.T. LONG. 131 50 05 LAT. 23 54 12
DRILLER B.H.F. LTD. GEOLOGIST M. OWEN GR (AMG) 886-536



LITHOLOGY

141.60-162.37 FINE TO V. FINE LT. GREY SST. WITH DK. GREY MDST. LAMINAE. ONLY SLIGHTLY BIOTURBATED BELOW 160m.

162.37-181.41 INTERBEDDED DK. GREY MDST. AND LIGHT GREY SLTST. STRONGLY BIOTURBATED, WITH BEDDING COMPLETELY DESTROYED IN MOST OF INTERVAL. PROPORTION OF MDST. GRADUALLY INCREASES DOWNWARDS. AND SEVERAL BEDS OF MDST TO 30cm. THICK PRESENT NEAR BASE.

SOME SCATTERED PHOSPHATE GRAINS TO 1mm. IN THIN SLTST. BEDS NEAR BASE.

CONTACT WITH HORN VALLEY SILTSTONE GRADATIONAL.

181.41-193.70 BLACK PYRITIC MDST. WITH INTERBEDS OF GREY FINE SLTST., WHICH IS BIOTURBATED.

193.70-195.20 STRONGLY BIOTURBATED GREY SLTST.

195.20-213.93 BLACK PYRITIC MDST. WITH THIN INTERBEDS OF GREY SLTST., CALC. SLTST., AND FOSS. GREY LST.

ROCK UNIT

STAIRWAY SANDSTONE

HORN VALLEY SILTSTONE

COMMENTS CORE RECOVERY 100% THROUGHOUT INTERVAL

WELL NAME Mt. LIEBIG #2

SHEET 6 OF 12

BASIN AMADEUS STATE N.T. LONG. 131 50 05 LAT. 23 54 12
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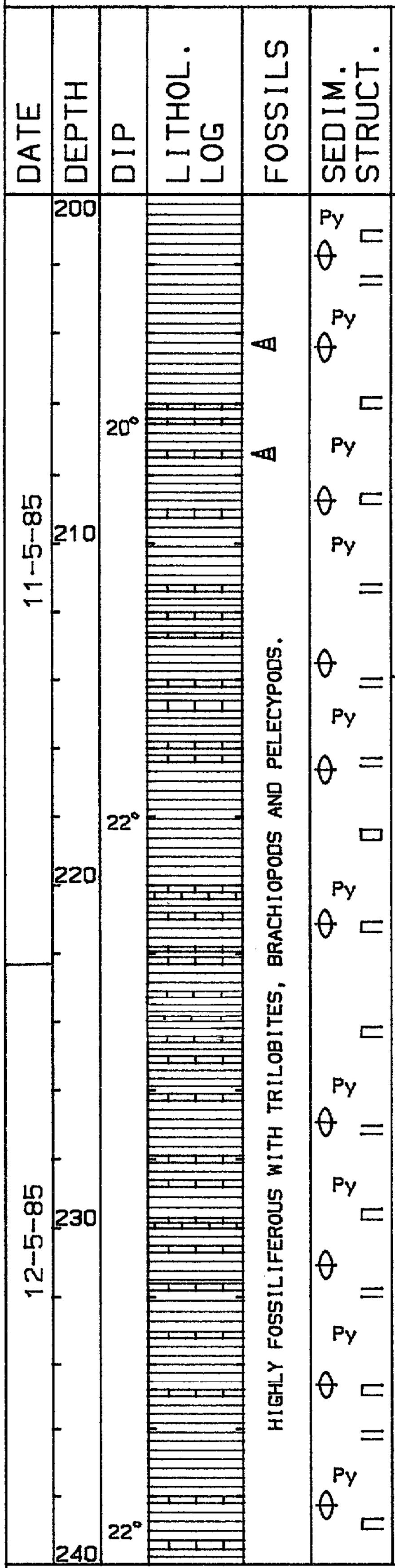


LITHOLOGY

195.20-213.93 BLACK PYRITIC MDST. WITH THIN INTERBEDS OF GREY SLTST., CALC. SLTST., AND FOSSILIFEROUS GREY LST.
FOSSILS COMMON THROUGHOUT, PARTICULARLY IN SILTY LST. AND BELOW 208m.

213.93-239.55 BLACK PYRITIC MDST. WITH FREQUENT THIN BEDS (1 to 15cm.) OF SILTY FOSSILIFEROUS LST.
MDST. HAS LITTLE INTERNAL LAMINATION, AND IS HIGHLY FOSSILIFEROUS

ROCK UNIT

HORN VALLEY SILTSTONE

COMMENTS CORE RECOVERY 100% THROUGHOUT INTERVAL

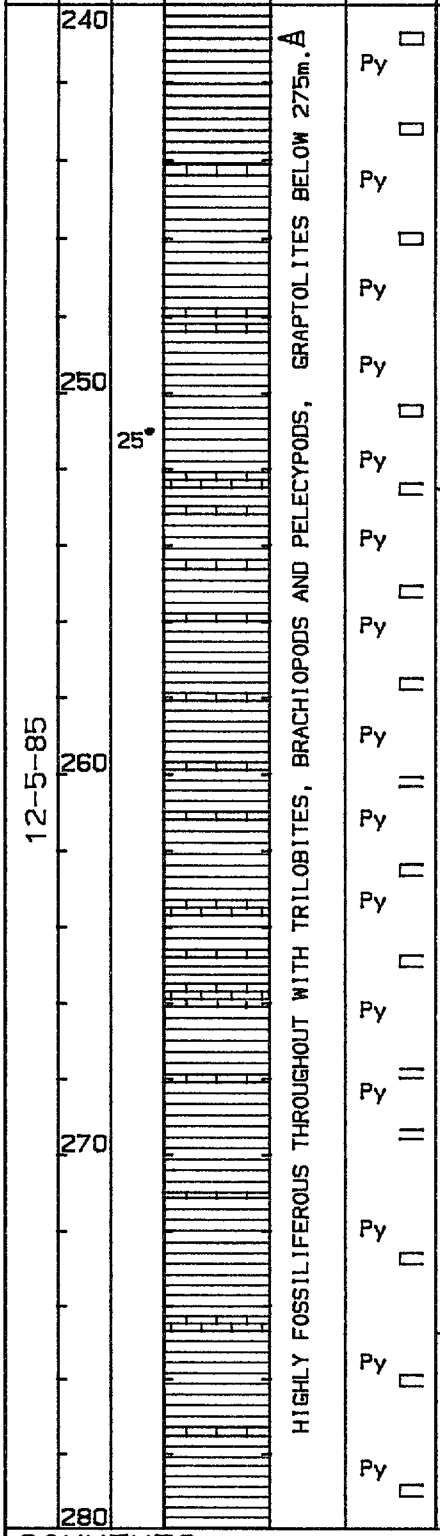
WELL NAME Mt. LIEBIG #2

SHEET 7 OF 12

BASIN AMADEUS STATE N.T. LONG. 131 50 05 LAT. 23 54 12

DRILLER B.H.F. LTD. GEOLOGIST M. OWEN GR (AMG) 886-536

DATE | DEPTH | DIP | LITHOL. LOG | FOSSILS | SEDIM. STRUCT. | LITHOLOGY | ROCK UNIT



239.55-252.30 BLACK, PYRITIC, HIGHLY FOSSILIFEROUS MDST. WITH OCCASIONAL THIN BEDS OF MUDDY GREY MICRITIC LST.
LST. USUALLY FOSSILIFEROUS, AND OFTEN HAS GRADATIONAL TOP AND BOTTOM CONTACTS WITH THE MDST.

PYRITE OCCURS BOTH AS DISSEMINATED CRYSTALS AND NODULES UP TO 1cm. ACROSS.

252.30-274.60 BLACK, PYRITIC, HIGHLY FOSSILIFEROUS MDST. WITH FAIRLY COMMON GREY MUDDY LST. BEDS. MDST. IN BEDS 5 TO 60cm. THICK, LST. GENERALLY IN BEDS 2 TO 10cm. THICK, VERY RARELY UP TO 30cm.

274.60-303.48 BLACK, PYRITIC, FOSSILIFEROUS MDST. WITH RARE THIN MICRITIC LST. BEDS.

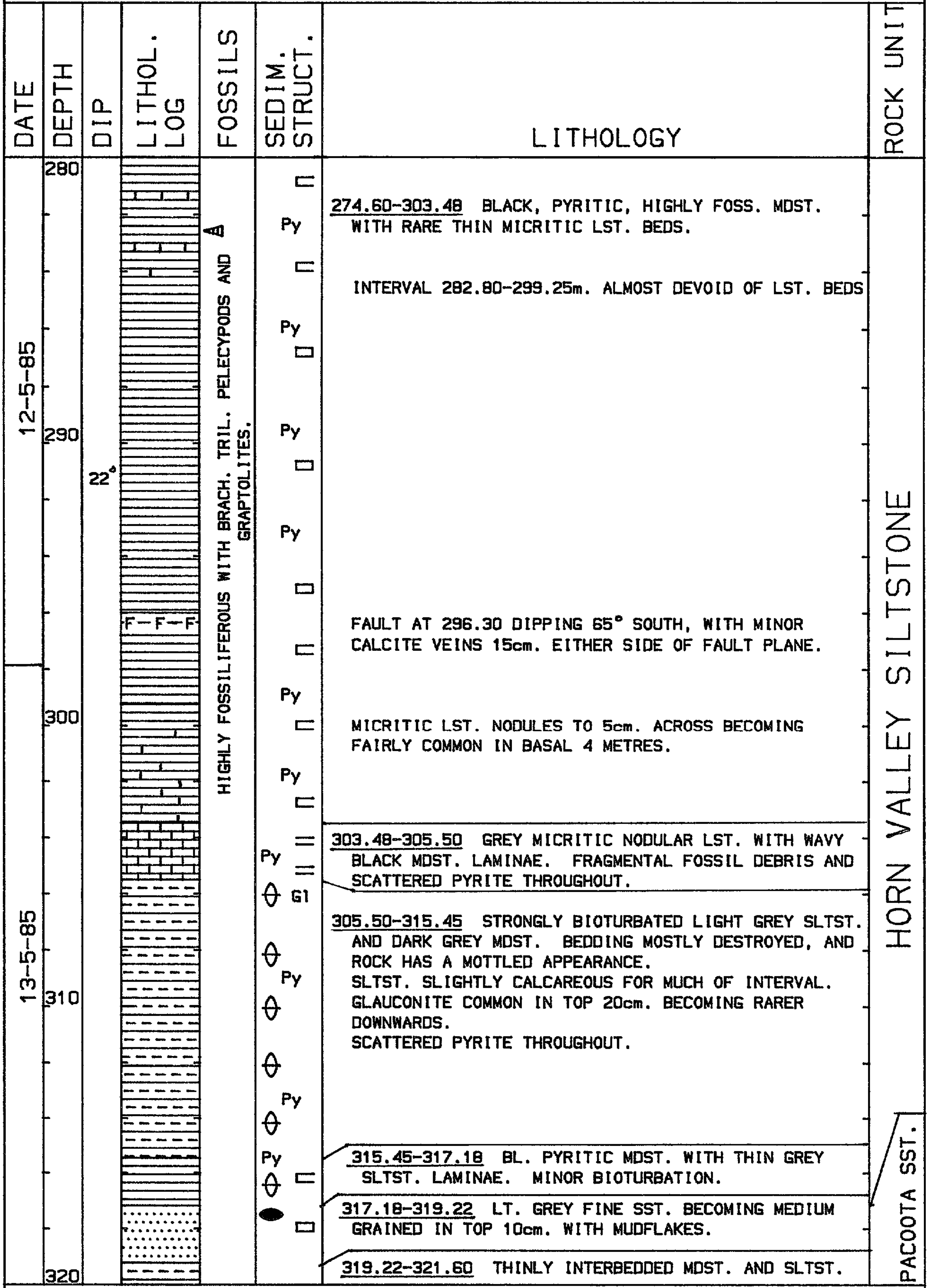
HORN VALLEY SILTSTONE

COMMENTS CORE RECOVERY 100% THROUGHOUT

WELL NAME Mt. LIEBIG #2

SHEET 8 OF 12

BASIN AMADEUS STATE N.T. LONG. 131 50 05 LAT. 23 54 12
DRILLER B.H.F. Ltd. GEOLOGIST M. OWEN GR (AMG) 886-536



274.60-303.48 BLACK, PYRITIC, HIGHLY FOSS. MDST. WITH RARE THIN MICRITIC LST. BEDS.

INTERVAL 282.80-299.25m. ALMOST DEVOID OF LST. BEDS

FAULT AT 296.30 DIPPING 65° SOUTH, WITH MINOR CALCITE VEINS 15cm. EITHER SIDE OF FAULT PLANE.

MICRITIC LST. NODULES TO 5cm. ACROSS BECOMING FAIRLY COMMON IN BASAL 4 METRES.

303.48-305.50 GREY MICRITIC NODULAR LST. WITH WAVY BLACK MDST. LAMINAE. FRAGMENTAL FOSSIL DEBRIS AND SCATTERED PYRITE THROUGHOUT.

305.50-315.45 STRONGLY BIOTURBATED LIGHT GREY SLTST. AND DARK GREY MDST. BEDDING MOSTLY DESTROYED, AND ROCK HAS A MOTTLED APPEARANCE.
SLTST. SLIGHTLY CALCAREOUS FOR MUCH OF INTERVAL.
GLAUCONITE COMMON IN TOP 20cm. BECOMING RARER DOWNWARDS.
SCATTERED PYRITE THROUGHOUT.

315.45-317.18 BL. PYRITIC MDST. WITH THIN GREY SLTST. LAMINAE. MINOR BIOTURBATION.

317.18-319.22 LT. GREY FINE SST. BECOMING MEDIUM GRAINED IN TOP 10cm. WITH MUDFLAKES.

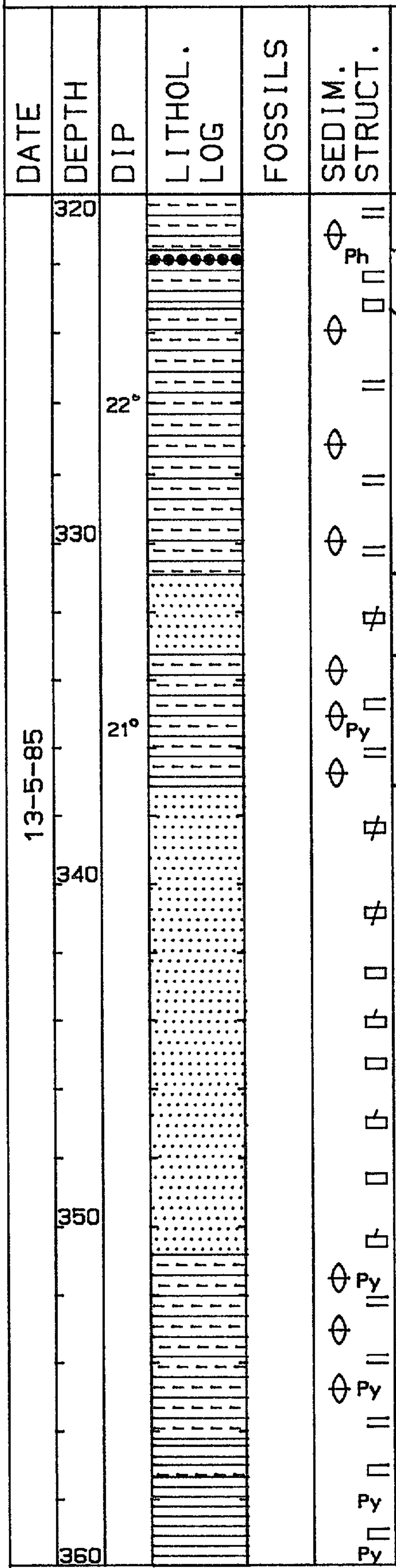
319.22-321.60 THINLY INTERBEDDED MDST. AND SLTST.

COMMENTS CORE RECOVERY 100% THROUGHOUT.

WELL NAME Mt. LIEBIG #2 SHEET 9 OF 12

BASIN AMADEUS STATE N.T. LONG. 131 50 05 LAT. 23 54 12

DRILLER B.H.F. Ltd. GEOLOGIST M. OWEN GR (AMG) 886-536



LITHOLOGY

319.22-321.60 INTERBEDDED, BIOTURBATED BL. MDST. AND LT. GREY SLTST.

321.60-323.30 BLACK MDST. WITH OCCAS. THIN SLTST. LAMINAE. 2cm. THICK BED OF PHOSPHATE NODULES TO 1cm. ACROSS AT 321.88m.

323.30-330.89 THINLY BEDDED BLACK MDST. AND LT. GREY SLTST. ZONES OF INTENSE BIOTURBATION 1 TO 30cm. THICK, SEPARATED BY INTERVALS WITHOUT BIOTURBATION FROM 10 TO 60cm. THICK

330.89-333.25 LIGHT GREY FINE TO MED. GRAINED QTZ. SST.

333.25-337.13 INTERBEDDED BLACK MDST. AND LT. GREY SLTST. EXTENSIVE BIOTURBATION AND RARE DISSEMIN. PYRITE.

337.13-350.80 LIGHT BROWN TO RED V. FINE TO MEDIUM GRAINED POROUS SST. IN SEVERAL COARSENING-UPWARDS CYCLES. RED COLOURATION RELATED TO COARSER AND MORE POROUS INTERVALS.

INDISTINCT X-BEDDING PRESENT IN LOWER HALF OF INTERVAL.

350.80-356.40 THINLY INTERBEDDED BLACK MDST. AND LIGHT GREY SLTST., IN PART BIOTURBATED, WITH COMMON PYTITE THROUGHOUT.
CONTACT WITH SST. ABOVE MARKED BY 5cm. THICK BROWN WEATHERED ZONE.

356.40-365.32 BLACK PYRITIC MDST. WITH RARE THIN GREY SLTST. LAMINAE, WHICH ARE MORE COMMON IN INTERVAL 356.94-357.30m.

ROCK UNIT: PACOOTA SANDSTONE

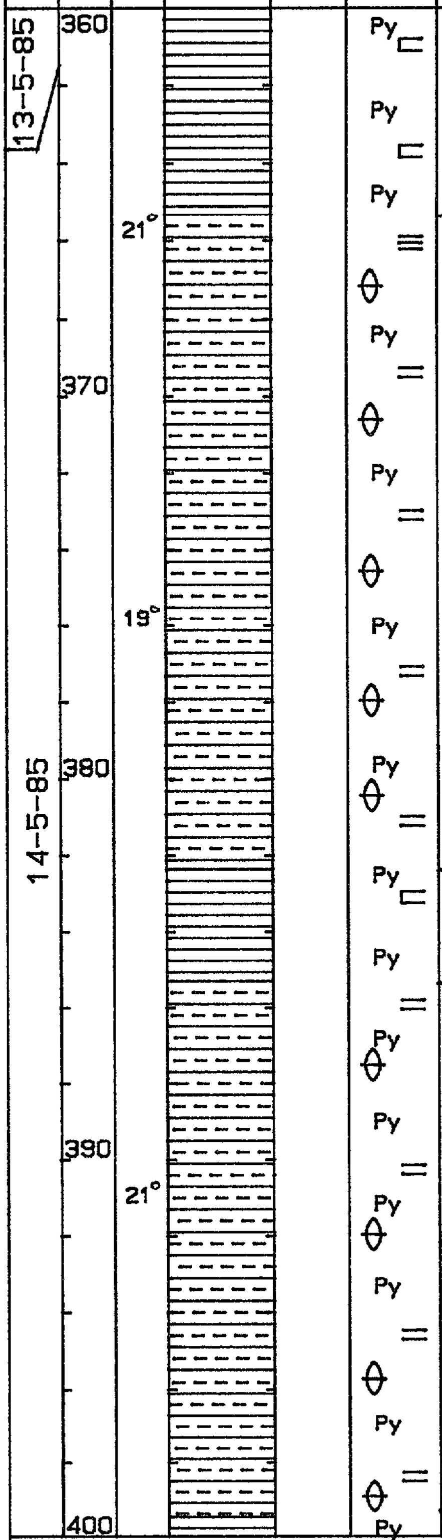
COMMENTS CORE RECOVERY 100% EXCEPT FOR
327.99-330.99 - 90%
348.82-351.82 - 90%
351.82-352.34 - 50%

WELL NAME Mt LIEBIG #2

SHEET 10 OF 12

BASIN AMADEUS STATE N.T. LONG. 131 50 05 LAT. 23 54 12
DRILLER B.H.F. Ltd. GEOLOGIST M. OWEN GR (AMG) 886-536

DATE | DEPTH | DIP | LITHOL. LOG | FOSSILS | SEDIM. STRUCT. | LITHOLOGY | ROCK UNIT



356.40-365.32 BLACK PYRITIC MDST. WITH MINOR THIN GREY SLTST. LAMINAE.

365.32-382.37 THINLY INTERBEDDED BLACK PYRITIC MDST. AND LIGHT GREY PYRITIC SLTST.
EXTENSIVE BIOTURBATION THROUGHOUT HAS MOSTLY DESTROYED BEDDING.

382.37-385.30 BLACK PYRITIC MDST. WITH MINOR GREY SLTST. LAMINAE.

385.30-399.49 THINLY INTERBEDDED BLACK MDST. AND GREY SLTST. PYRITIC THROUGHOUT.
EXTENSIVELY BIOTURBATED.

399.49-401.67 BL. PYR. MDST. WITH VERY MINOR SLTST.

PACOOTA SANDSTONE

COMMENTS CORE RECOVERY 100% THROUGHOUT

WELL NAME Mt. LIEBIG #2

SHEET 11 OF 12

BASIN AMADEUS STATE N.T. LONG. 131 50 05 LAT. 23 54 12
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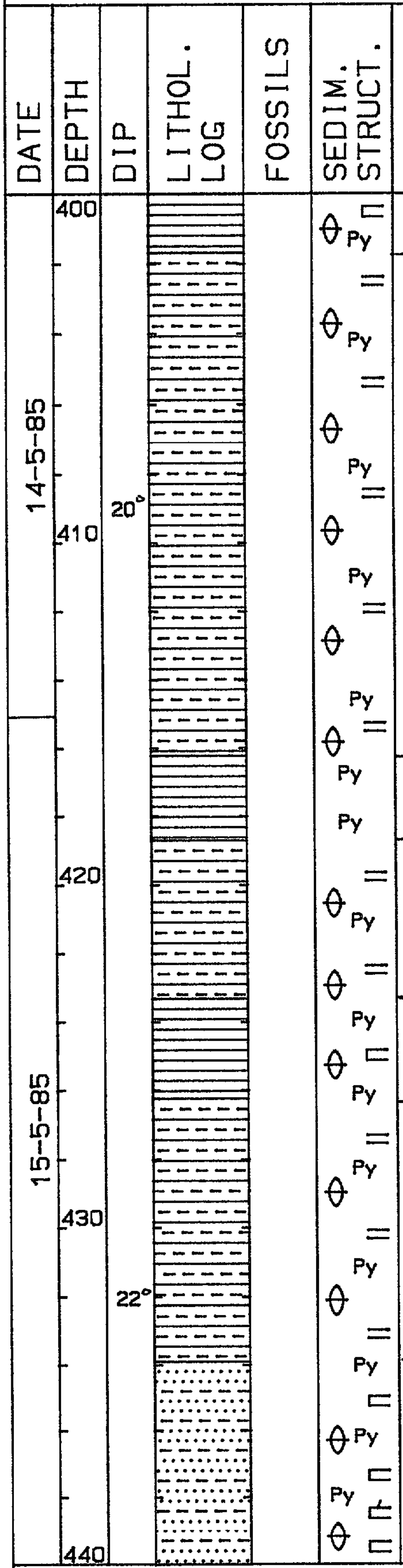

LITHOLOGY

399.49-401.67 PYRITIC MDST. WITH OCCAS. THIN GREY BIOTURBATED SLTST. LAMINAE

401.67-416.23 INTERBEDDED BLACK MDST. AND GREY SLTST. PYRITE DISSEMINATED THROUGHOUT. BEDDING MOSTLY DESTROYED BY BIOTURBATION.

416.23-418.70 BLACK, PYRITIC, UN-BEDDED MDST.

418.70-423.33 THINLY INTERBEDDED BLACK PYRITIC MDST. AND GREY SLTST. BIOTURBATION PRESENT THROUGHOUT BUT NOT STRONGLY DEVELOPED.

423.33-426.25 BLACK PYRITIC MDST. WITH RARE THIN SLTST. LAMINAE.

426.25-433.89 THINLY INTERBEDDED GREY SLTST. AND BLACK PYRITIC MDST. BIOTURBATED THROUGHOUT, AT TIMES INTENSELY. BLACK MDST. WITHOUT SLTST. INTERBEDS IN INTERVAL 432.14-432.50m.

433.89-460.42 MEDIUM TO THINLY BEDDED VERY FINE GREY SST. AND SLTST. OR MDST. PYRITE COMMON THROUGHOUT.

ROCK UNIT

PACOOTA SANDSTONE

COMMENTS CORE RECOVERY 100% EXCEPT FOR 434.76 - 436.00 85%

WELL NAME Mt. LIEBIG #2

SHEET 12 OF 12

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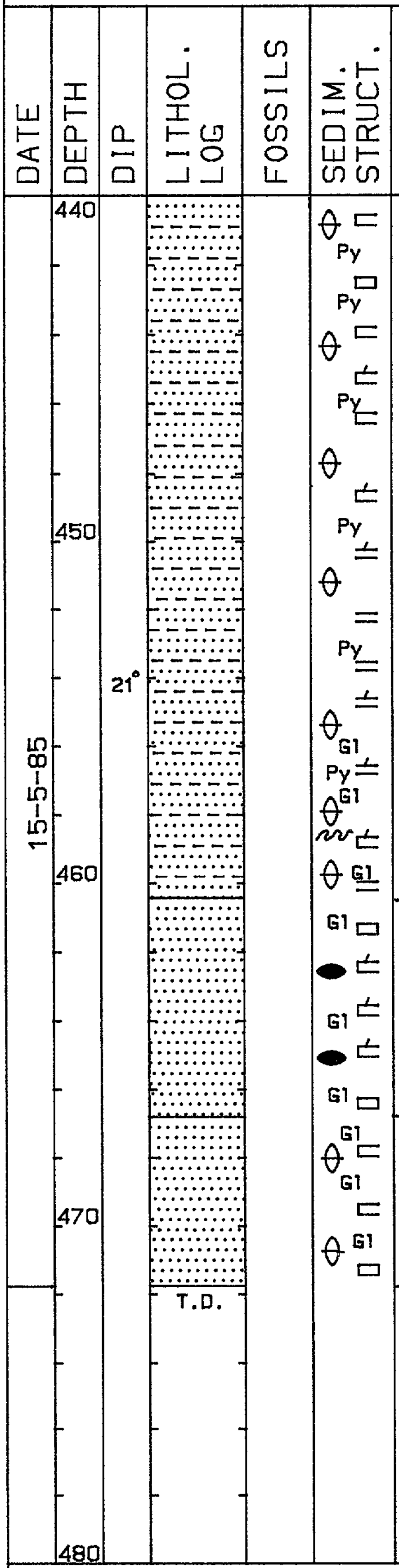

LITHOLOGY

433.89-460.42 MEDIUM TO THINLY BEDDED V. FINE SST. AND SLTST. OR MDST.
SST. IN BEDS GENERALLY 10 - 40cm. THICK, SOMETIMES X-BEDDED, PARTICULARLY TOWARDS BASE OF INTERVAL.
SLTST. OR MDST. BEDS GENERALLY <15cm. THICK.

PYRITE COMMON THROUGHOUT INTERVAL, BOTH IN SST. AND SLTST./MDST. OFTEN PRESENT ALONG SUB-VERTICAL FRACTURES IN SST. BEDS.

GLAUCONITE BECOMES INCREASINGLY COMMON TOWARDS BASE OF INTERVAL.

460.42-466.81 GREENISH-GREY GLAUCONITIC MED. TO FINE SST. THICK BEDDED AT TOP AND BOTTOM, BECOMING MED. TO THIN BEDDED IN CENTRE OF INTERVAL. X-BEDDED THROUGHOUT, WITH SCATTERED MUD-FLAKES. THIN, (<3cm) DARK GREENISH-GREY MDST. BEDS WITH MINOR X-BEDDING IN CENTRAL PART OF INTERVAL.

466.81-471.77 (T.D.) REDDISH-BROWN GLAUC. FINE TO MED. GRAINED, MED. TO THICKLY BEDDED SST. WITH MINOR GREENISH MDST. LAMINAE.

ROCK UNIT

PACOOTA SANDSTONE

COMMENTS CORE RECOVERY 100% THROUGHOUT INTERVAL