

BIOSTRATIGRAPHIC SUMMARY

WELL: Murphy #01 ST00BP00 OCS-G-25850, Block 178, Desoto Canyon Area

API #: 608234002700

SAMPLE INTERVAL EXAMINED: 10390' – 24519'

DATE: September 2, 2014

AGE HORIZONS AND COMMENTS

NOTE: Nannofossils in bold italics.

Ages noted here are based on the Gradstein et al., 2012 calibrations and may not be in exact agreement with the ages on the PDI strat charts, which incorporate Gradstein, 2004 calibrations

10390 First Sample Examined – In Ecologic Zone 5

10390 First Sample Examined – At or below the Discoaster B horizon

LATE MIOCENE

10740 Discoaster C – very rare – (6.33 Ma) – Late Miocene (Messinian) - Nannozone NN11

10830 Discoaster calcaris with Discoaster neohamatus with a significant increase in Discoaster C – (7.37 Ma) - Late Miocene (Tortonian) - Nannozone NN11

10950 Discoaster loeblichii – (7.53 Ma) – Late Miocene (Tortonian) – Nannozone NN11

11040 Catinaster mexicanus – single specimen – (7.83 Ma) – Late Miocene (Tortonian) - Nannozone NN11

11310 Nonion barleeanus – very rare, persistent - (8.19 Ma) - Late Miocene (Tortonian)
- Foramzone N17

11340 Discoaster prepentaradiatus –rare - with Secondary Marker (Minylithus convalis) – (8.04 Ma) - Late Miocene (Tortonian) - Nannozone NN11

11430 Globorotalia linguaensis – rare, persists to 11490' - (8.97 Ma) - Late Miocene (Tortonian) - Foramzone N16

- 11430** *Discoaster prepentaradiatus persistent* – rare - with *Secondary Marker (Reticulofenestra pseudumbilica Acme)* – (8.97 Ma) - Late Miocene (Tortonian) - Nannozone NN10
- 11640** *Discoaster bollii* – rare, persistent - (9.22 Ma) - Late Miocene (Tortonian) - Nannozone NN10
- 11790** *Discoaster hamatus* – very rare, persistent - (9.53 Ma) - Late Miocene (Tortonian) - Nannozone NN9
- 11880** *Bolivina L* – very rare, does not persist - (9.56 Ma) - Late Miocene (Tortonian) - Foramzone N16
- 11910** *Catinaster calyculus* – single specimen, not persistent - (9.67 Ma) - Late Miocene (Tortonian) - Nannozone NN9
- 11940** *Catinaster coalitus* – very rare, not persistent - (9.69 Ma) - Late Miocene (Tortonian) - Nannozone NN9
- 12090** *Mixed Middle Miocene / Oligocene / trace Eocene flora includes Cyclicargolithus floridanus, Discoaster sanmiguelensis, Sphenolithus heteromorphus, Discoaster kugleri, D. deflandrei, Dictyococcites bisecta, D. barbadiensis as sporadic downhole occurrences not considered age diagnostic to 12600'*
- 12120** *Coccolithus miopelagicus* - single specimen, single reoccurrence at 12180', persistent below: Questionable age due to presence within the interval of reworked flora – (10.97 Ma) - Late Miocene (Tortonian) - Nannozone Top NN7
- 12240** *Uvigerina 3* – single specimen, persistent - with highest observed *Globorotalia mayeri* and *Cibicides carstensi* - (10.97 Ma) - Late Miocene - (Tortonian) – Foramzone N14
- 12270** Probable zone of Late-Middle Miocene reworking; includes *Globorotalia fohsi robusta*, *Globorotalia fohsi lobata*, *Globorotalia fohsi fohsi*, and *Globorotalia fohsi peripheroacuta* - Persists to 12420'
- 12570** Secondary marker (*Globorotalia fohsi lobata*) - with highest observed *Globorotalia fohsi robusta* - very rare - (11.59 Ma) - Late Miocene (Tortonian) - Foramzone N14
- 12870** *Discoaster kugleri* – very rare, persistent – single occurrences at 12240', 12540' and 12570' are within the interval of reworked flora and are probably not age diagnostic – (11.58 Ma) - Late Miocene (Tortonian) – Nannozone NN7

MIDDLE MIOCENE

- 13290** *Discoaster sanmiguelensis* – single specimen, reoccurrence at 13320', 13470' associated with a significant condensed section – (11.79 Ma) - Middle Miocene (Serravalian) – Nannozone NN7

14250 *Secondary Marker (Catinaster sp. A) – single specimen - (12.18 Ma) - Middle Miocene (Serravalian) – Nannozone NN6*

14820 *Globorotalia fohsi peripheroronda* – with highest observed *Globorotalia fohsi peripheroacuta* and *Globorotalia fohsi fohsi* - (13.8 Ma) - Middle Miocene (Serravalian) - Foramzone N11

14820 *Sphenolithus heteromorphus* - single specimen, with highest observed *Cyclicargolithus floridanus* persistent – (13.53 Ma) - Middle Miocene (Serravalian) – Nannozone NN5

15030 *Praeorbulina glomerosa* – very rare, persistent - with highest observed *Praeorbulina sicana* - (14.78 Ma) - Middle Miocene (Langhian) - Foramzone N9

15060 *Globigerinatella insueta* – very rare, does not persist - (14.91 Ma) - Middle Miocene (Langhian) - Foramzone N9

15150 *Discoaster deflandrei* Acme – numerous - (15.80 Ma) - Middle Miocene (Langhian) - Nannozone NN4

LATE EOCENE

15570 *Discoaster barbadiensis* – rare, persistent, with highest observed *Discoaster saipanensis*, *Ericsonia formosa*, *Reticulofenestra hillae*, and *Dictyococcites bisecta* - (34.77 Ma) - Late Eocene (Priabonian) - Nannozone NP19/20

15600 *Globigerinatheka barri* – very rare, persistent - with highest observed *Globigerinatheka mexicana*, *Globigerinatheka semiinvoluta*, and *Turborotalia pomeroli* - (36.74 Ma) - Late Eocene (Priabonian) - Foramzone P15

15630 *Cribocentrum reticulata* – several, persistent - (35.35 Ma or older) - Late Eocene (Priabonian) - Nannozone NP19/20

MIDDLE EOCENE

15660 *Acarinina spinuloinflata* – rare, persistent - (38.54 Ma) - Middle Eocene (Bartonian) - Foramzone P15

15690 *Chiasmolithus grandis* – very rare, not persistent - (37.98 Ma or older) - Middle Eocene (Bartonian) - Nannozone NP17

15720 *Acarinina bullbrooki* – very rare, with highest observed *Truncorotaloides rohri* - (40.49 Ma) - Middle Eocene (Bartonian) - Foramzone P13

15750 *Igorina broedermanni* – single specimen, does not persist - (42.09 Ma) - Middle Eocene (Lutetian) - Foramzone P12

15810 *Sphenolithus furcatolithoides* – several, not persistent - (40.21 Ma or older) - Middle Eocene (Bartonian) - Nannozone NP17

EARLY EOCENE

- 15840 *Acarinina soldadoensis angulosa* – very rare, persistent, with highest observed *Acarinina pseudotopilensis* and *Morozovella aragonensis* - (48.22 Ma) - Early Eocene (Ypresian) - Foramzone P9
- 15900 *Morozovella subbotinae* – rare, persistent - (50.67 Ma or older) - Early Eocene (Lutetian) - Foramzone P7
- 15900 *Prinsius martinii* – very rare, persistent - (55.47 Ma) - Early Eocene (Ypresian) - Nannozone NP10**

LATE PALEOCENE

- 15930 *Acarinina mckannai*– single specimen, persistent, with highest occurring *Planorotalites pseudomenardii*, *Morozovella occlusa*, and *Morozovella velascoensis* - (57.66 Ma) - Late Paleocene (Thanetian) - Foramzone P4

EARLY EOCENE

- 15930 *Toweius tovae* – rare, not persistent - with highest observed *Fasciculithus tympaniformis* and *Cruciplacolithus frequens* - (55.64 Ma or older) - Early Eocene (Ypresian) - Nannozone NP10**

LATE PALEOCENE

- 15960 Secondary marker (*Morozovella conicotruncata*) – very rare, does not persist, with highest observed Secondary Marker (*Morozovella angulata*) – (58.57 Ma or older) - Late Paleocene (Thanetian) - Foramzone P4
- 15960 *Heliolithus kleinpellii* – several, not persistent, with highest observed *Heliolithus cantabriae* – (58.80 Ma) - Late Paleocene (Thanetian) - Nannozone NP7**

MIDDLE PALEOCENE

- 15990 *Cruciplacolithus tenuis* – numeous, not persistent - (60.74 Ma) - Middle Paleocene (Selandian) - Nannozone NP5**

EARLY PALEOCENE

- 16050 Secondary marker (*Praemurica trinidadensis*) – very rare, persistent, with highest observed *Praemurica inconstans*, *Praemurica uncinata*, and *Parasubbotina pseudobulloides* - (62.88 Ma) - Early Paleocene (Danian) - Foramzone P1

LATE CRETACEOUS

- 16200 *Favusella washitensis* - with *Praeglobotruncana delrioensis* - (96.76 Ma) - with highest observed *Rotalipora greenhornensis*, *Rotalipora appenninica*, *Rotalipora*

cushmani, Globotruncana ventricosa, Rosita fornicata, and Globotruncana lapparenti – (96.76 Ma) - Late Cretaceous (Cenomanian) – Washita – at or below the 96.76 Ma unconformity – Ecologic zone 4
Note: The entire Upper Cretaceous is absent to 30 ft sample resolution.

16200 *Rhagodiscus asper* – rare, persistent - with highest observed *Retacapsa crenulata*, *Eprolithus floralis*, and *Watznaueria barnesiae* – (93.68 Ma or older) - Late Cretaceous (Cenomanian) - Nannozone CC10

16260 *Rhagodiscus plebius* – very rare, not persistent - (99.77 Ma) - Late Cretaceous (Cenomanian) - Nannozone CC9

16320 *Watznaueria britannica* – very rare, not persistent - (100.03 Ma) - Late Cretaceous (Cenomanian) - Nannozone CC9

EARLY CRETACEOUS

16590 *Ticinella primula* LAD – single specimen with highest occurrence of *Planomalina buxtorfi* LAD (101.18 Ma) – persistent – (101.51 Ma) – Early Cretaceous (Albian)

16740 Ecologic Zone 3

16860 *Biticinella breggiensis* – single specimen with reoccurrence at 16950', 17130' – (101.59 Ma) – Early Cretaceous (Albian)

16860 *Nannoconus bucheri* – rare, persistent - (101.53 Ma or older) – Early Cretaceous (Albian) - Nannozone CC9

17010 Local Marker (*Coskinolinoides texanus*) – single specimen with reoccurrence at 17310', 17370', persistent below 17490' - (101.59 Ma) - Early Cretaceous (Albian)

17070 FAD *Rotalipora appenninica* - (101.92 Ma) – Early Cretaceous (Albian)

17130 FAD *Planomalina buxtorfi* – (101.92 Ma) – Early Cretaceous (Albian) – Ecologic zone 2

17280 Ecologic zone 3

17340 *Hedbergella gorbachikae* – single specimen, reoccurrence at 17370', 17400', 17550', 17670' - (105.29 Ma) - Early Cretaceous (Albian)

17490 *Schuleridea punctatula* (Ostracode) – single specimen - (107.55 Ma) - Early Cretaceous (Albian)

17520 Local Marker (*Barkerina barkerensis*) – very rare, reoccurrence at 17550', 17640', 17670' - (107.55 Ma) - Early Cretaceous (Albian)

17700 Ecologic zone 2

17938 Ecologic zone 3

18150 FAD *Ticinella primula* – very rare, persistent above – (111.84 Ma) – Early Cretaceous (Albian)

18390 *Hedbergella trocoidea* – single specimen, reoccurrence at 18630', 18660' – (122.10 Ma) – Early Cretaceous (Aptian)

18480 Ecologic zone 2

18510 FAD *Braarudosphaera africana* – single specimen - (124.98 Ma) - Early Cretaceous (Aptian) - Nannozone CC7

18780 *Retecapsa angustiforata* – single specimen, persistent - (125.71 Ma) - Early Cretaceous (Aptian) - Nannozone CC7

18840 *Hedbergella sigali* – persistent development - with *Globuligerina hoterivica* (126.13 Ma) – Early Cretaceous (Aptian) – Ecologic zone 3

19140 Local Marker (*Gavelinella barremiana*) – very rare, reoccurrence at 19230' – Early Cretaceous (Barremian)

19350 *Subtilisphaera terrula* – several, persistent - with *Avellodinium falcificum* – Early Cretaceous (Barremian)

19470 Local Marker (?*Afropollis* sp.) – single-specimen – Early Cretaceous (Barremian)

19590 *Calcicalithina oblongata* – very rare, persistent - (130.09 Ma) - Early Cretaceous (Barremian) - Nannozone CC5

19620 Ecologic zone 2

20370 *Rhagodiscus dekaenelii* – very rare, not persistent - (132.09 Ma) - Early Cretaceous (Hauterivian) - Nannozone CC4

20790 Local Marker (Significant benthic foram increase) - includes *Choffatella decipiens*, *Lenticulina nodosa*, *Epistomina ornata*, *Epistomina hechti*, *Epistomina caracolla*, and *Trocholina infragranulata* – considered below Last Appearance Datum's but within overlapping range zones – Early Cretaceous (Hauterivian) – Ecologic zone 3

20820 *Cruciellipsis cuvillieri* – very rare, persistent - (132.90 Ma) - Early Cretaceous (Hauterivian) - Nannozone CC4

21090 FAD *Calcicalithina oblongata* – very rare - (139.45 Ma) - Early Cretaceous (Berriasian) - Nannozone CC2

21120 Ecologic zone 2

LATE JURASSIC

21400 Reinholdella A - several, persistent to 21670' with Guarantella ornata variety – (152.05 Ma possibly younger) - Late Jurassic (Early Tithonian/Latest Kimmeridgian)

Note: A single pyritized fragment of Reinholdella A at 21310' may be reworked

EARLY CRETACEOUS

21460 FAD Diadorhombus rectus – single specimen - (143.14 Ma) - Early Cretaceous (Berriasian) - Nannozone CC1

LATE JURASSIC

21520 FAD Micrantholithus obtusus – rare - (145.01 Ma) - Late Jurassic (Tithonian) - Nannozone NJT17b

21640 FAD Nannoconus steinmannii –very rare, persistent above - (145.44 Ma) - Late Jurassic (Tithonian) - Nannozone NJT17b

21670 Epistomina uhligi – single specimen, reoccurrence at 21700', 21850', 21880', 22000' – probably below true stratigraphic top – Late Jurassic (Tithonian)

21670 Polycostella beckmannii – rare - (145.74 Ma) - Late Jurassic (Tithonian) - Nannozone NJT17a

21760 Lithologic change – Bossier Shale (Early Tithonian)

21790 FAD Conusphaera mexicana- very rare, persistent above - (150.27 Ma) - Late Jurassic (Tithonian) - Nannozone NJT15a

21940 FAD Polycostella beckmannii - with FAD Zeugrhabdotus embergerii – (152.06 Ma) - Late Jurassic (Tithonian) - Nannozone NJT14

22880 Globuligerina oxfordiana – persistent – (157.3 Ma) - Late Jurassic (Oxfordian) – Approximate Smackover Fm. Equivalent – Ecologic zone 3

22940 Ecologic zone 2

23760 Lithologic change – Norphlet Formation – Late Jurassic [Oxfordian] – Ecologic zone 1

24519 Sample total depth