# 3. DATA REPORT: PALEOCENE-EARLY OLIGOCENE CALCAREOUS NANNOFOSSIL BIOSTRATIGRAPHY, ODP LEG 198 SITES 1209, 1210, AND 1211 (SHATSKY RISE, PACIFIC OCEAN)<sup>1</sup>

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## ABSTRACT

A relatively complete lower Paleocene to lower Oligocene sequence was recovered from the Southern High of Shatsky Rise at Sites 1209, 1210, and 1211. The sequence consists of nannofossil ooze and clayrich nannofossil ooze. Samples from these sites have been the target of intensive calcareous nannofossil biostratigraphic investigations. Calcareous nannofossils are moderately preserved in most of the recovered sequence, which extends from nannofossil Zones CP1 to CP16. Most traditional zonal markers are present; however, the rarity and poor preservation of key species in the uppermost Paleocene and lower Eocene inhibits zonal subdivision of part of this sequence.

### INTRODUCTION

Ocean Drilling Program Leg 198 addresses the causes and consequences of Cretaceous and Paleogene global warmth. Eight sites were drilled along a broad depth transect on Shatsky Rise, a medium-sized large igneous province in the west-central Pacific. The depth transect was designed to characterize changes in the nature of surface and deep waters during the greenhouse climate interval, as well as during abrupt climatic events such as the Paleocene/Eocene Thermal Maximum (PETM).

<sup>1</sup>Bralower, T.J., 2005. Data report: Paleocene–early Oligocene calcareous nannofossil biostratigraphy, ODP Leg 198 Sites 1209, 1210, and 1211 (Shatsky Rise, Pacific Ocean). In Bralower, T.J., Premoli Silva, I., and Malone, M.J. (Eds.), Proc. ODP, Sci. Results, 198, 1-15 [Online]. Available from World Wide Web: <http:// www-odp.tamu.edu/publications/ 198\_SR/VOLUME/CHAPTERS/ 115.PDF>. [Cited YYYY-MM-DD] <sup>2</sup>Department of Geosciences, The Pennsylvania State University, University Park PA 16802, USA. bralower@geosc.psu.edu

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A high-quality collection of sedimentary records through the Paleogene was obtained at four different sites on the Southern High of Shatsky Rise: Sites 1209, 1210, 1211, and 1212 (Fig. F1). This investigation concerns the calcareous nannofossil biostratigraphy of the first three sites. Sites 1209 and 1211 were triple cored, and Site 1210 was double cored. The biostratigraphy of Site 1212 is described in Bralower, Premoli Silva, Malone, et al. (2002) and is not discussed further in this chapter.

A precise biostratigraphic framework is a fundamental prerequisite for the interpretation of the depositional and paleoceanographic history of Shatsky Rise. Shipboard Paleogene biostratigraphic investigation was largely limited to core catcher samples except around critical boundaries. The resolution of this investigation is increased to one sample per core section or more. This higher resolution allows more precise determination of the ranges of key taxa and placement of zonal boundaries. Biostratigraphic interpretation is not without difficulty, however. Several traditionally used Paleogene zonal markers are absent or rare in sediments at the three sites. Overgrowth obscures other markers and renders their ranges difficult to determine. Similar problems have been encountered in other Paleogene sequences (e.g., Monechi, 1985; Pospichal and Wise, 1990). At Site 865 in the equatorial Pacific, Bralower and Mutterlose (1995) determined the stratigraphic ranges of >100secondary markers. This investigation seeks to determine the stratigraphic potential of some of these markers by observing their position relative to other sections, as well as their abundance and taxonomic distinctiveness near the ends of their ranges.

### METHODS AND PROCEDURES

This biostratigraphic investigation is based on observations of about one sample in each core section of the composite splice at each site. The number of samples observed is higher close to the Paleocene/Eocene boundary. Biostratigraphic investigations were conducted using the light microscope with 1000× magnification under cross-polarized light. Discoasters were observed under phase-contrast illumination. Most samples were observed on two separate occasions for a total of 30 min. A greater amount of time was devoted to samples close to the ends of species ranges and especially near zonal boundaries, where samples were sometimes observed for 1 hr.

Relative abundance of nannofossils was determined in the following fashion: a species was termed abundant if, on average, >10 specimens could be observed in a field of view at  $1000 \times$  magnification; it was termed common if 1–9 specimens could be observed in each field; it was termed few if 1–9 specimens could be observed in every 10 fields of view; and it was termed rare, if, on average, >10 fields were required to observe one specimen. All taxa observed were tabulated at Sites 1209 and 1210 (Tables T1, T2). At Site 1211 only zonal markers and other stratigraphically significant taxa were listed (Table T3). In addition, more detailed sampling was conducted near the PETM at all three sites. Ranges of key taxa were observed in these samples (Tables T4, T5, T6), although they have not been compiled in the range charts (Tables T1, T2, T3).

For most taxa, generally accepted taxonomic concepts are applied (e.g., Aubry, 1984, 1988, 1989, 1990; Perch-Nielsen, 1985; Bralower and Mutterlose, 1995). Certain groups of nannofossils, particularly the dis-

**F1.** Map of sites investigated, p. 6.



T1. Calcareous nannofossil range chart, Site 1209, p. 7.
T2. Calcareous nannofossil range chart, Site 1210, p. 8.
T3. Calcareous nannofossil range chart, Site 1211, p. 9.
T4. Zonal and other key datums, Site 1209, p. 10.
T5. Zonal and other key datums, Site 1210, p. 12.
T6. Zonal and other key datums, Site 1211, p. 14.

coasters, proved to be difficult to study, as this group is incompletely categorized and often obscured by overgrowth in the studied samples.

### RESULTS

Range charts showing the distribution of all species observed are presented in Tables T1, T2, and T3. Zonal and other key datums for the three sites are compiled in Tables T4, T5, and T6 using meters composite depth (mcd) from Bralower, Premoli Silva, Malone, et al. (2002) and revised meters composite depth (rmcd) from Westerfeld and Röhl (this volume).

#### Preservation

Calcareous nannofossil preservation is generally moderate in the Paleocene to lower Oligocene section at Sites 1209, 1210, and 1211. Most samples show signs of slight etching and moderate overgrowth. Overgrowth has masked whole specimens, making it difficult to distinguish consistently among species of *Nannotetrina*, for example, and to consistently interpret the ray form of discoasters. Etching, for example, often removes the central area of *Toweius*. A few samples distributed randomly through the sections have good preservation. In general, preservation deteriorates from the Paleocene to the Eocene and nannofossils in a number of Eocene samples are marked by moderate to high amounts of etching as a result of dissolution. There is no systematic increase in overgrowth or dissolution with depth; thus, preservation appears to be related to alteration at or near the seafloor.

### **Application of Standard Paleogene Zonations**

The standard zonation of Bukry (1973, 1975), emended by Okada and Bukry (1980), was developed in low-latitude oceanic sections. Hence, this scheme is primarily applied here. The zonation of Martini (1971), on the other hand, was established in land sequences largely from the continents. Generally, many of the zones of both schemes and the subzones of Okada and Bukry (1980) could be determined at Sites 1209, 1210, and 1211 with a fair amount of confidence (Tables T4, T5, T6). However, a number of these units could not be determined due to taxonomic difficulties or paucity of key species. For example, the base of Zone CP7 could not be determined because of the rarity of Discoaster nobilis. The base of Zone CP3 was difficult to determine with precision as a result of the rarity of Ellipsolithus macellus near the onset of its range. In addition, the base of Zone CP14 (Subzone CP14a) was difficult to determine because of the sporadic distribution of Reticulofenestra umbilicus near the base of its range. Finally, the base of Subzone CP16b, defined by the base of the acme of *Ericsonia subdisticha*, is also difficult to determine precisely, as this species is rarely abundant in samples investigated. The significance of the zonal markers and other datums that have potential as zonal markers will be discussed in detail in Bralower (unpubl. data).

Nannofossil biostratigraphy suggests extremely slow sedimentation or unconformities at all sites. At Sites 1209 and 1210, the uppermost Eocene and lowermost Oligocene interval is extremely condensed, with multiple datums concentrated within a few meters (~137–141 mcd at both sites; Tables T1, T2, T4, T5). The upper part of the middle Eocene

(Subzones CP13b–CP14a; ~98 mcd) at Site 1211 appears to be condensed (Tables T3, T6). In addition, the lowermost Eocene (Zone CP9) at Sites 1209 (~208 mcd), 1210 (~201 mcd), and 1211 (~136 mcd) appears to be highly condensed. More detailed investigation is required to determine if unconformities are present in these intervals. Reworked nannofossils have not been observed, except in the upper Eocene where markers are observed significantly above the termination of their ranges (Tables T1, T2, T3).

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**Table T1.** Calcareous nannofossil range chart for composite splice at Site 1209. (This table is available in an **oversized format**.)

**Table T2.** Calcareous nannofossil range chart for composite splice at Site 1210. (This table is available in an **oversized format**.)

**Table T3.** Calcareous nannofossil range chart for composite splice at Site 1211. (This table is available in an **oversized format**.)

| Table T4. Zonal and other key datum, Site 1209. (See table | e notes. Continued on next page.) |
|--|-----------------------------------|
|--|-----------------------------------|

| Event         Interval (cm)         (mcd)   |                           | Upper core, section. | Upper depth |         | Lower core, section. | Lower depth |         | Zone  |      | Datum mean |         |
|---|---------------------------|----------------------|-------------|---------|----------------------|-------------|---------|-------|------|------------|---------|
| LAD E, formase1290C-3H-3, 30-31130-45130-451200C-3H-4, 30-31137.95131.955CPI 6PI22130.805137.95LAD D, barbadlemin1290C-3H-4, 30-31136.4551209A-14H-4, 30-31137.95130.005CPI 5136.067137.95FAD S, predixentus1209A-14H-4, 30-31136.4551209A-14H-4, 30-31136.95120.91137.95130.005CPI 5136.067137.95FAD S, predixentus1209A-14H-5, 30-31136.95140.455120.91.14H-6, 30-31140.95147.25NP2138.45140.95FAD S, predixentus1209A-14H-5, 30-31136.95140.455120.91.14H-6, 30-31140.95147.25NP2138.45140.95FAD C, scrutur1209A-13H-1, 10-11146.55140.455120.91.14H-1, 30-31147.95147.95147.95145.95146.97FAD C, scrutur1209B-13H-1, 10-11146.55146.97147.255147.95147.95146.95146.97FAD C, scrutur1209B-13H-1, 10-11146.55153.871209H-13H-3, 10-11147.255153.87150.95153.87150.95153.87150.95153.87150.95153.87150.95153.87150.95153.87150.95153.87150.95153.87150.95153.87160.95153.97163.94153.95164.97153.95163.95163.95163.95163.95163.95163.95163.95163.95163.95163.95163.95163.95163.95 <td>Event</td> <td>interval (cm)</td> <td>(mcd)</td> <td>(rmcd)</td> <td>interval (cm)</td> <td>(mcd)</td> <td>(rmcd)</td> <td>OB80</td> <td>M71</td> <td>(mcd)</td> <td>(rmcd)</td>   | Event                     | interval (cm)        | (mcd)       | (rmcd)  | interval (cm)        | (mcd)       | (rmcd)  | OB80  | M71  | (mcd)      | (rmcd)  |
| Base acree J. subdisicha         1200C 3H+6, 30-31         136, 145         136, 145         136, 145         136, 145         136, 145         137, 195         139, 005         CP1 6b         136, 70         137, 730           LAD D. bordnothenist         1200C 3H+6, 30-31         136, 145         136, 455         130, 900         137, 195         139, 005         CP1 5b         136, 70         137, 730           LAD S. pardistentus         1200A-1H+5, 30-31         138, 655         140, 45         1209A-1H+6, 30-31         140, 155         141, 105         141, 255         NP21         139, 455         141, 085           LAD C. soltinus         1209B-15H+1, 144-145         144, 450         140, 451         1209B-15H+2, 10-111         146, 656         147, 803         1209B-15H+2, 10-111         146, 656         148, 077         148, 077         148, 077         148, 077         148, 077         148, 077         148, 077         148, 077         148, 077         148, 077         148, 077         148, 077         148, 077         148, 077         146, 051         142, 050         142, 050         142, 050         142, 050         141, 050         143, 050         146, 050         147, 050         146, 050         146, 050         146, 050         146, 050         146, 050         150, 150         140, 040  | LAD E. formosa            | 1209C-3H-2, 30–31    | 130.145     | 130.455 | 1209C-3H-3, 30–31    | 131.645     | 131.955 | CP16c | NP22 | 130.895    | 131.205 |
| LAD B. barbadiensis1200C 3He, 3.0 -31136.145136.4551200A 14H 4, 30 -31137.195139.005CP1 6a136.730FAD S. parcelistentus1200A 14H 4, 30 -31137.195130.8051200A 14H 4, 30 -31137.195137.095140.45140.455147.05137.095147.095137.095147.095137.095 <td< td=""><td>Base acme E. subdisticha</td><td>1209C-3H-6, 30–31</td><td>136.145</td><td>136.455</td><td>1209A-14H-4, 30-31</td><td>137.195</td><td>139.005</td><td>CP16b</td><td></td><td>136.670</td><td>137.730</td></td<>   | Base acme E. subdisticha  | 1209C-3H-6, 30–31    | 136.145     | 136.455 | 1209A-14H-4, 30-31   | 137.195     | 139.005 | CP16b |      | 136.670    | 137.730 |
| LAD C, grandis12005 - 3H-6, 3031136, 145136, 145136, 145136, 145137, 306137, 3  | LAD D. barbadiensis       | 1209C-3H-6, 30–31    | 136.145     | 136.455 | 1209A-14H-4, 30-31   | 137.195     | 139.005 | CP16a |      | 136.670    | 137.730 |
| FAD S. predictenturi       1209A-14H-4, 30-31       137.195       139.095       1209A-14H-5, 30-31       138.095       140.445       141.725       NP20       139.445       141.085         FAD S. preudoradions       1209A-14H-5, 30-31       138.695       140.445       1209A-14H-5, 30-31       138.695       141.725       NP20       139.445       141.085         FAD S. preudoradions       1209B-15H-5, 110-111       145.65       146.518       1209B-15H-5, 110-111       146.655       147.803       CP14b       NP17       145.955       147.605       148.077         FAD D. priecturi       1209B-15H-5, 110-111       145.65       147.803       1209B-15H-5, 110-111       146.655       148.077       148.290       153.875       150.995       153.875       150.995       153.875       1209B-16H-3, 50-51       150.995       153.575       1209A-16H-1, 45-46       151.108       153.615       CP14a       151.108       153.615       151.405       151.108       153.615       CP14a       151.108       153.615       150.995       153.575       1209A-16H-1, 45-46       153.501       150.995       153.575       1209A-17H-1, 45-46       153.501       151.108       150.615       146.255       150.995       157.375       150.995       157.375       150.995       157.375  | LAD C. grandis            | 1209C-3H-6, 30–31    | 136.145     | 136.455 | 1209A-14H-4, 30-31   | 137.195     | 139.005 | CP15  |      | 136.670    | 137.730 |
| LAD D. singthermsin       1209A-14H-5, 30-31       138.69       140445       1209A-14H-6, 30-31       140.195       141.725       NP20       139.445       141.085         LAD C. solitor       1209B-15H-1, 144-145       141.005       144.45       1209B-15H-5, 110-111       146.65       140.95       147.25       NP20       141.955       143.957       143.957       145.951       147.161         FAD D. bisectus       1209B-15H-5, 110-111       146.665       147.803       1209B-15H-5, 10-111       146.665       148.307       148.450       152.855       148.450       152.485       146.655       148.450       152.485       154.625       153.975       153.975       150.996       155.375       151.108       155.615       151.108       155.615       151.108       155.615       151.108       155.615       151.108       155.615       151.108       155.615       152.760       152.395       157.375       150.991       153.375       1209A-1741.45-46       151.209       156.355       CP14       151.108       155.615         LAD C. solitor       1209B-1614.3, 50-51       160.991       173.52       1209A-1741.45-56       151.209       157.355       CP14       151.081       156.915       157.956       157.956       157.956       157.956 <td< td=""><td>FAD S. predistentus</td><td>1209A-14H-4, 30–31</td><td>137.195</td><td>139.005</td><td>1209A-14H-5, 30–31</td><td>138.695</td><td>140.445</td><td></td><td></td><td>137.945</td><td>139.725</td></td<> | FAD S. predistentus       | 1209A-14H-4, 30–31   | 137.195     | 139.005 | 1209A-14H-5, 30–31   | 138.695     | 140.445 |       |      | 137.945    | 139.725 |
| FAD S. pseudoradians         1209A-14H-5, 30-31         138.69         140.45         1209A-14H-6, 30-31         141.025         NP20         139.445         141.055           LAD C. dulta         1209B-15H-1, 114-145         140.00         142.43         142.130         142.357         NP10         143.575         143.575         143.575         143.595         143.595         143.595         143.595         143.595         143.905         143.205         147.405         143.005         147.405         143.575         148.490         153.875         1209B-1514-5, 10-51         150.995         155.375         1209B-1614-3, 50-51         150.995         155.375         1209A-1614, 45-46         151.200         155.375         151.018         155.476         151.018         155.476         151.018         155.476         151.018         155.476         151.018         155.476         151.018         155.475         151.018         155.475         151.018         155.475         160.415         100.414         140.085         160.415         100.414         140.085         160.415         100.415         120.415         142.08         153.675         148.497         152.455         154.457         153.457         147.017         153.557         120.414         150.455         160.455         15  | LAD D. saipanensis        | 1209A-14H-5, 30–31   | 138.695     | 140.445 | 1209A-14H-6, 30–31   | 140.195     | 141.725 |       | NP21 | 139.445    | 141.085 |
| LAD C12098-15H-1144-145141.00012.44512098-15H-2107-101142.130142.137141.657143.015FAD D.2098-15H-4101-111146.665147.80312098-15H-6147.803147.805147.805147.805147.805147.805153.875148.900152.875FAD D.scriptsoa12098-16H-1, 0.5-1147.490153.87512098-16H-3, 50.51150.995155.375148.900152.875FAD S. dutsus12098-16H-3, 50.51150.995155.3751209A-16H-1, 45-46151.220155.835151.028155.415LAD N. fulgers12098-16H-3, 50.51150.995155.3751209A-16H-1, 45-46151.220155.835CP14a151.086155.415LAD C. gigos1209A-17H-1, 45-46152.0101209A-17H-1, 45-46163.935167.675163.145166.925FAD S. furcatolithoides1209A-17H-1, 45-46165.3951209A-17H-1, 45.45163.85167.675163.145166.935FAD S. furcatolithoides1209A-17H-1, 50-51170.32812098-18H-3, 50-52170.730174.335170.338174.303FAD N. fulgers12098-18H-3, 50-52170.720174.33512098-18H-3, 50-52172.200178.335174.403173.505LAD C. crossus12098-18H-4, 50-52180.93012098-19H-5, 50-22184.670189.810184.20182.579FAD N. fulgers12098-19H-4, 100-102184.10189.30512098-19H-5, 50-2184.670189.410LAD C.  | FAD S. pseudoradians      | 1209A-14H-5, 30–31   | 138.695     | 140.445 | 1209A-14H-6, 30–31   | 140.195     | 141.725 |       | NP20 | 139.445    | 141.085 |
| LAD C. solitus12098-15H-4, 110-111145, 165146, 51812098-15H-5, 110-111146, 653147, 616147, 616FAD D. iscrippsoe12098-16H-1, 0-5147, 400151, 80512098-16H-1, 20-21147, 625148, 305146, 905152, 885FAD S. otipusoe12098-16H-1, 50-51150, 995155, 37512098-16H-1, 45-46151, 220155, 835155, 835151, 108155, 615FAD R. umbilicas12098-16H-1, 30-51150, 995155, 3751209A-10H-1, 45-46151, 220155, 835CP14a151, 108155, 615FAD R. umbilicas1209A-16H-1, 45-46162, 3951209A-10H-1, 45-46153, 201158, 445CP13c152, 785FAD S. furcatolithoides1209A-17H-1, 45-46162, 3951209A-17H-1, 45-46163, 950170, 725CP13b166, 177FAD S. furcatolithoides1209A-17H-1, 45-46162, 3951209A-17H-1, 45-46153, 100176, 385174, 30FAD S. spinger1209A-17H-1, 45-46163, 3951209A-17H-1, 45-46176, 103174, 305174, 30FAD S. spinger1209A-17H-1, 45-46169, 901209A-17H-1, 45-46176, 103175, 855174, 70175, 855FAD S. spinger1209A-17H-1, 45-46169, 90180, 901209A-18H-3, 80-92174, 70175, 855174, 70175, 855FAD S. dinger1209A-18H-3, 82-43175, 901209A-18H-4, 45-46176, 103181, 755174, 70175, 855FAD S. dinger1209A-18H-4, 82-48176, 90180, 150  | LAD C. dela               | 1209B-15H-1, 144-145 | 141.000     | 142.445 | 1209B-15H-2, 107–108 | 142.130     | 143.575 |       |      | 141.565    | 143.010 |
| FAD D. bisectus       12098-15H-5, 110-111       146, 665       147, 803       12098-15H-6, 20-21       147, 805       148, 350       146, 965       146, 907         FAD D. scrippsæ       12098-16H-2, 50-51       149, 495       153, 875       12098-16H-3, 50-51       150, 995       155, 375       150, 995       155, 375       150, 995       155, 375       150, 995       155, 375       150, 995       155, 375       1209, 14H-1, 45-46       151, 220       155, 855       CP14a       151, 108       155, 615         FAD S. functolithridies       12098-16H-3, 50-51       150, 995       153, 375       1209, 14H-1, 45-46       151, 220       155, 855       CP14a       151, 108       155, 615         FAD S. functolithridies       1209A-17H-1, 45-46       165, 395       166, 170       1209A-17H-4, 50-51       169, 995       173, 325       170, 173       170, 174       170, 174       170, 174       170, 174       170, 174       170, 174       170, 174       170, 174       170, 174       170, 174       171, 470       171, 470       171, 470       175, 855       171, 470       171, 470       175, 855       181, 190       183, 174, 130       181, 170       183, 170       183, 170       181, 170       183, 174, 130       181, 170       183, 174       171, 470       175, 555   | LAD C. solitus            | 1209B-15H-4, 110-111 | 145.165     | 146.518 | 1209B-15H-5, 110-111 | 146.665     | 147.803 | CP14b | NP17 | 145.915    | 147.161 |
| FAD D. scrippsae         12098-16H-1, O-5         147.490         151.895         12098-16H-2, SO-51         149.490         153.875         150.285           FAD D. scrippsae         12098-16H-3, SO-51         150.995         155.375         1209A-16H-1, 45-46         151.220         155.855         151.108         155.615           LAD C. gigas         1209A-16H-3, SO-51         150.995         155.375         1209A-16H-1, 45-46         151.201         156.455         151.108         155.615           FAD S. turcatolithoides         1209A-16H-1, 45-46         162.095         1209A-17H-1, 45-46         153.207         1209A-17H-1, 45-46         153.207         1209A-17H-1, 45-46         153.205         170.720         174.335         1209A-17H-1, 45-46         166.925         FAD S. spiniger         1209A-17H-1, 45-46         166.925         170.720         174.335         1209B-18H-3, 50-52         170.720         174.335         1209B-18H-3, 50-52         170.720         174.335         1209B-18H-3, 50-52         172.020         175.835         CP13         171.470         175.085           LAD C. crisus         1209B-18H-1, 20-21         184.70         189.300         1208B-18H-3, 50-52         172.470         175.855         181.190           LAD C. crisus         1209B-19H-1, 120-121         178.800  | FAD D. bisectus           | 1209B-15H-5, 110-111 | 146.665     | 147.803 | 1209B-15H-6 20-21    | 147.265     | 148.350 |       |      | 146.965    | 148.077 |
| FAD S. obtuinus       12098-16H-2, S0-51       139, 495       153, 875       12098-16H-3, 50-51       150, 995       153, 375       150, 295       153, 875       150, 295       155, 875         LAD N. fulgens       12098-16H-3, 50-51       150, 995       153, 375       1209A-16H-1, 45-46       151, 200       155, 855       CP1a       151, 108       155, 615         LAD C. gigas       1209A-11H-1, 45-46       152, 201       155, 855       CP1a       152, 700       174, 355         FAD S. functontifinides       1209A-17H-1, 45-46       165, 395       166, 172       1209A-17H-2, 45-46       153, 501       186, 495       170, 725       CP13b       166, 170       169, 925         FAD S. functontifinides       1209A-17H-3, 45-46       165, 395       169, 175       1209A-17H-4, 45-46       176, 303       171, 470       174, 303       174, 403         FAD S. functontifinides       1209A-18H-2, 50-52       170, 700       174, 335       1209B-18H-4, 50-52       172, 200       178, 835       P115       171, 470       175, 605       181, 170       183, 50       181, 450       184, 420       185, 515         LAD C. crissut       1209A-18H-4, 54-46       184, 40       184, 40       184, 400       184, 420       185, 555       P13       184, 420       185, 555   | FAD D. scrippsae          | 1209B-16H-1, 0-5     | 147.490     | 151.895 | 1209B-16H-2, 50-51   | 149.490     | 153.875 |       |      | 148.490    | 152.885 |
| LAD N. hulgens12098-16H-3, 50-51150.995153.3751209A-16H-1, 45-46151.200155.855CP1a151.108155.615FAD R. umbilicus1209A-16H-1, 45-46151.201155.855CP1a151.108155.615FAD S. furcatolithoides1209A-17H-1, 45-46152.00155.855CP1a153.615153.7571209A-16H-1, 45-46153.101158.145CP1a152.705153.7571209A-17H-2, 45-46153.7571209A-17H-2, 45-46173.757 <t< td=""><td>FAD S. obtusus</td><td>1209B-16H-2, 50-51</td><td>149.495</td><td>153.875</td><td>1209B-16H-3, 50-51</td><td>150.995</td><td>155.375</td><td></td><td></td><td>150.245</td><td>154.625</td></t<>  | FAD S. obtusus            | 1209B-16H-2, 50-51   | 149.495     | 153.875 | 1209B-16H-3, 50-51   | 150.995     | 155.375 |       |      | 150.245    | 154.625 |
| FAD R. umbilineus       12098-16H-3, 50-51       150, 995       153, 375       1209A-16H-4, 45-46       151, 200       155, 855       CP14       151, 108       155, 735         FAD S. functabilihoides       1209A-17H-1, 45-46       166, 125       1209A-17H-2, 45-46       163, 195       166, 125       1209A-17H-3, 45-46       166, 125       1209A-17H-4, 45-46       166, 125       1209A-17H-4, 45-46       166, 125       1209A-17H-4, 50-51       166, 125       1209A-17H-4, 50-51       166, 125       1209A-17H-4, 50-51       166, 125       1209A-17H-4, 50-51       166, 125       1209A-17H-4, 50-52       170, 700       174, 300       170, 700       174, 300         FAD C. gigas       1209B-18H-4, 50-52       170, 700       174, 335       1209B-18H-4, 50-52       172, 200       175, 835       CP1a       NP15       171, 470       175, 085         LAD C. crasisus       1209B-18H-4, 100-102       184, 170       189, 300       1209B-18H-4, 50-52       184, 670       189, 810       CP1a       179, 100       122, 555         FAD T. carinatus       1209B-19H-4, 100-102       184, 170       189, 300       1209B-19H-5, 5-46       184, 670       189, 810       NP13       187, 903       129, 555         FAD R. inflota       1209A-19H-4, 45-46       178, 100       1209A-19H-5, 54, 454       188, 1  | LAD N. fulgens            | 1209B-16H-3, 50–51   | 150.995     | 155.375 | 1209A-16H-1, 45–46   | 151.220     | 155.855 |       |      | 151.108    | 155.615 |
| LAD C. gigas1209A.16H-2, 45-46152.010156.6451209A.17H-2, 45-46153.105158.145CP13c152.107152.700157.395FAD S. furcatolithoides1209A.17H-1, 45-46165.395166.1751209A.17H-4, 50-51166.1751209A.17H-4, 50-52170.720174.335166.945177.255CP13b166.170169.945FAD S. spiniger1209A.17H-5, 50-51169.945177.2721209B.18H-3, 50-52170.270174.335171.470175.085CP13aNP15171.470175.085LAD C. crassus1209B-18H-3, 50-52170.070176.3551209A.18H-4, 45-46176.130181.755171.470175.085LAD C. crassus1209B-19H-1, 120-121179.060185.0051209A.18H-4, 45-46176.130181.755171.470182.555LAD R. inflata1209B-19H+1, 120-121179.8001209B-19H-5, 0-2184.670189.810184.420182.555LAD T. orthostylus1209B-19H-4, 100-102184.170189.3001209B-19H-5, 0-2184.670189.810184.420185.55LAD T. orthostylus1209A-19H-5, 45-46188.60193.8551209A-19H-5, 45-46188.60193.855190.810184.920193.665FAD R. dirighta1209B-20H-4, 100-102190.500197.8001209.555191.301192.610192.610LAD L. nascens1209B-20H-4, 100-102190.500197.800208.076191.310192.610192.610LAD L. nascens1209B-20H-4, 100-102207.200<  | FAD R. umbilicus          | 1209B-16H-3, 50-51   | 150.995     | 155.375 | 1209A-16H-1, 45-46   | 151.220     | 155.855 | CP14a |      | 151.108    | 155.615 |
| FAD S. furcatolithoides       1209A-17H-1, 45-46       162, 35       166, 175       1209A-17H-4, 50-51       166, 925       170, 725       CP13b       166, 170       169, 925         FAD S. spiniger       1209A-17H-4, 50-51       166, 945       173, 725       1209A-17H-4, 50-51       166, 945       174, 335       170, 735       CP13b       NP15       171, 470       175, 935         FAD N. fulgens       1209B-18H-2, 50-52       170, 720       174, 335       1209B-18H-3, 50-52       172, 20       175, 835       CP13a       NP15       171, 470       175, 805         LAD C. crissus       1209B-18H-4, 50-51       160, 625       1209A-18H-4, 54-64       176, 420       180, 133       CP13a       171, 470       175, 805       181, 100         LAD C. crissus       1209B-19H-4, 100-102       184, 70       189, 300       1209B-19H-5, 0-2       184, 670       189, 810       N       184, 420       185, 420       185, 420       185, 430       189, 430       193, 435       193, 435       193, 435       194, 435       188, 430       193, 435       194, 454       188, 430       193, 435       194, 454       188, 430       193, 430       194, 455       189, 430       194, 455         FAD R. inflata       1209A-19H-4, 45-46       190, 80       193, 815   | LAD C. gigas              | 1209A-16H-2, 45-46   | 152.010     | 156.645 | 1209A-16H-3, 45-46   | 153.510     | 158.145 | CP13c |      | 152.760    | 157.395 |
| FAD C. gigas1209A-17H-3, 4-54169.395169.1751209A-17H-4, 50-51169.945173.7251209B-18H-3, 50-52170.300174.335170.730174.335170.336174.335170.336174.335170.336174.335170.336174.335170.336174.335170.336174.335170.336174.335175.355181.910185.3551209A-181.4, 45-64188.160183.153175.161184.420185.3551209A-191.4, 54-64189.810184.420185.355180.910184.421185.355180.910184.421185.355180.910184.421185.355180.910184.421185.355180.910184.421185.355180.910184.421185.456186.456187.450184   | FAD S. furcatolithoides   | 1209A-17H-1, 45–46   | 162.395     | 166.175 | 1209A-17H-2, 45-46   | 163.895     | 167.675 |       |      | 163.145    | 166.925 |
| FAD S. spininger1209A-17H-6 50-51169 495173 7251209B-18H-2 50-52170.730174.335170.730174.335170.730174.335170.730174.335170.730174.335170.730174.335170.730174.335170.730174.335170.730174.335170.730174.335170.730174.335170.730174.335170.730171.470175.085171.470175.085LAD C. crisbellum1209A-18H-3, 82-83175.000180.6251209A-18H-4, 45-46178.400180.155175.565181.190FAD Nannotetrina sp.1209B-19H-4, 100-102184.170189.3001209B-19H-5, 0-2184.670189.810184.420189.555FAD T. carrinatus1209A-19H-4, 45-46187.180192.3551209A-19H-5, 0-2184.670189.810184.420189.555FAD R. inflata1209A-19H-4, 45-46187.180192.3551209A-19H-5, 0-2184.670189.810184.420189.555FAD R. inflata1209A-19H-5, 45-46188.080193.8551209A-19H-5, 0-2184.670189.810184.420189.555FAD R. inflata1209A-19H-5, 45-46189.3051029A-20H-2, 100-102190.500197.8701208-20H-2, 100-102190.500197.8701208-20H-2, 100-102190.500197.8701208-20H-2, 100-102190.500199.870201.570192.810200.120FAD D. indibodensis1209B-20H-2, 100-102190.500197.8701208-20H-4, 100-102190.500193.500203.51192.  | FAD C. gigas              | 1209A-17H-3, 45–46   | 165.395     | 169.175 | 1209A-17H-4, 50–51   | 166.945     | 170.725 | CP13b |      | 166.170    | 169.950 |
| FAD N. fugens1209B-18H-2, 50-52170.720174.3351209B-18H-3, 50-52172.220175.835CP13aNP15171.470175.085LAD C. crissus1209B-18H-2, 50-52170.720174.3351209B-18H-3, 50-52172.220175.835CP13aNP15171.470175.085LAD C. crisblum1209B-19H-1, 120-121179.860180.6251209A-18H-4, 45-46176.130181.135CP13a179.140182.579FAD Nannotetrina sp.1209B-19H-4, 100-102184.170189.3001209B-19H-5, 0-2184.670189.810CP13a184.420185.555LAD T. carinatus1209A-19H-4, 45-46187.180192.3551209A-19H-5, 45-46188.680193.855NP13187.930193.105FAD R. drigdad1209A-19H-6, 45-46190.180195.3551209A-19H-5, 45-46188.680193.855NP13187.930193.105FAD R. drigdad1209A-19H-6, 45-46190.180195.3551209A-19H-6, 45-46190.800195.850197.870CP12b190.365196.613LAD L. nascens1209B-20H-2, 100-102190.500197.8701209B-20H-4, 100-102190.500197.870CP12aNP14195.680202.843FAD C. crasus1209A-20H-6, 45-46199.300202.8701209C-10H-1, 100-102203.215CP12aNP14195.680202.843FAD C. crasus1209C-10H-2, 100-102201.29201.595204.570211.965205.443209.944204.574CP11199.595205.443 <td>FAD S. spiniger</td> <td>1209A-17H-6, 50–51</td> <td>169.945</td> <td>173.725</td> <td>1209B-18H-2, 50–52</td> <td>170.730</td> <td>174.335</td> <td></td> <td></td> <td>170.338</td> <td>174.030</td>  | FAD S. spiniger           | 1209A-17H-6, 50–51   | 169.945     | 173.725 | 1209B-18H-2, 50–52   | 170.730     | 174.335 |       |      | 170.338    | 174.030 |
| LAD C. crassus       1209B-18H-2, 50-52       170.720       174.335       1209B-18H-3, 50-52       172.220       175.835       171.470       175.085         LAD C. cribellum       1209A-18H-3, 82-83       175.000       180.625       1209A-18H-4, 45-46       176.130       181.755       171.470       175.685       181.190         LAD R. inflata       1209B-19H-1, 120-121       179.800       1209B-19H-5, 0-2       184.670       189.810       184.420       189.555         FAD T. carinatus       1209A-19H-4, 45-46       187.800       1209A-19H-5, 0-2       184.670       189.810       184.420       189.555         FAD R. inflata       1209A-19H-4, 45-46       187.800       192.355       1209A-19H-5, 45-46       188.60       193.855       1209A-19H-6, 45-46       190.180       195.355       189.430       194.605         FAD R. inflata       1209A-19H-6, 45-46       190.180       195.355       1209B-20H-4, 100-102       190.560       197.870       CP12b       190.365       189.430       194.605         FAD C. grandis       1209B-20H-3, 100-102       192.660       197.870       1209B-20H-4, 100-102       193.560       200.870       192.810       200.120         FAD C. grandis       1209B-20H-3, 100-102       192.660       197.870       1209E-20H-   | FAD N. fulgens            | 1209B-18H-2, 50-52   | 170.720     | 174.335 | 1209B-18H-3, 50-52   | 172.220     | 175.835 | CP13a | NP15 | 171.470    | 175.085 |
| LAD C. cribellum1209A-18H-3, 82-83175.000180.6251209A-18H-4, 45-46176.130181.755175.565181.190LAD R. inflata1209B-19H-1, 120-121179.860185.0051209A-18H-6, 45-46178.420180.153CP13a179.140182.579FAD N. annotzirina sp.1209B-19H-4, 100-102184.170189.3001209B-19H-5, 0-2184.670189.810184.420189.555LAD T. carinatus1209A-19H-4, 45-46187.180192.3551209A-19H-5, 45-46188.680193.855NP13187.930193.015FAD R. inflata1209A-19H-5, 45-46180.680193.8551209A-19H-6, 45-46190.180195.355189.430194.605FAD R. inflata1209B-20H-2, 100-102190.560197.8701209B-20H-3, 100-102193.560200.870191.310192.681FAD C. grandis1209B-20H-3, 100-102195.600202.3701209B-20H-4, 100-102193.560208.732CP12aNP14195.680202.843FAD C. cribellum1209C-10H-4, 100-102201.20202.600196.300203.315CP12aNP14195.680202.843FAD C. cribellum1209C-10H-4, 100-102201.20202.610196.300203.315CP12aNP14195.680202.843FAD C. cribellum1209C-10H-4, 100-102201.20205.7901205C-10H-5, 100-102205.79011.282202.646207.204FAD C. cribellum1209C-10H-4, 100-102201.20205.7911209C-10H-5, 100-102205.950 <td>LAD C. crassus</td> <td>1209B-18H-2, 50–52</td> <td>170.720</td> <td>174.335</td> <td>1209B-18H-3, 50–52</td> <td>172.220</td> <td>175.835</td> <td></td> <td></td> <td>171.470</td> <td>175.085</td>  | LAD C. crassus            | 1209B-18H-2, 50–52   | 170.720     | 174.335 | 1209B-18H-3, 50–52   | 172.220     | 175.835 |       |      | 171.470    | 175.085 |
| LAD R. inflata1209B-19H-1, 120-121179.860185.0051209A-18H-6, 45-46178.420180.153CP13aT79.140182.579FAD Nannotetrina sp.1209B-19H-4, 100-102184.170189.3001209B-19H-5, 0-2184.670189.810189.420189.555LAD T. orthostylus1209A-19H-4, 45-46187.180192.3551209A-19H-5, 45-46189.810184.420189.555LAD T. orthostylus1209A-19H-4, 45-46187.180192.3551209A-19H-5, 45-46190.80193.8551209A-19H-5, 45-46190.80193.855189.430194.605FAD R. inflata1209A-19H-6, 45-46190.80195.3551209B-20H-2, 100-102190.505197.870CP12b190.350197.870FAD C. grandis1209B-20H-3, 100-102192.060199.3701209B-20H-4, 100-102193.605200.870192.810200.120FAD C. scholdoensis1209B-20H-5, 100-102192.060020.3701209A-20H-4, 45-46196.300203.315CP12aNP14195.608202.843FAD C. scholdoensis1209C-10H-4, 100-102201.291206.3751209C-10H-4, 100-102207.300210.595205.445207.204LAD D. multiradiatus1209C-10H-4, 100-102207.200211.9691209C-10H-4, 100-102207.300211.968201.595205.445FAD C. crabus1209C-10H-4, 100-102207.200211.9691209C-11H-2, 0-2208.100211.592206.550213.581FAD C. highellum1209C-10H-6, 100-102207.290 <t< td=""><td>LAD C. cribellum</td><td>1209A-18H-3, 82–83</td><td>175.000</td><td>180.625</td><td>1209A-18H-4, 45–46</td><td>176.130</td><td>181.755</td><td></td><td></td><td>175.565</td><td>181.190</td></t<>  | LAD C. cribellum          | 1209A-18H-3, 82–83   | 175.000     | 180.625 | 1209A-18H-4, 45–46   | 176.130     | 181.755 |       |      | 175.565    | 181.190 |
| FAD Nannotetrina sp.1209B-19H-4, 100-102184.170189.3001209B-19H-5, 0-2184.670189.810189.810184.420189.555FAD T. carinatus1209A-19H-4, 100-102184.170189.3001209B-19H-5, 0-2184.670189.810184.420189.555LAD T. orthostylus1209A-19H-5, 45-46187.180192.3551209B-19H-5, 45-46188.680193.855197.870CP12b189.355189.430FAD R. inflata1209A-19H-6, 45-46190.180195.3551209B-20H-2, 100-102190.500197.870CP12b190.360196.613FAD C. grandis1209B-20H-2, 100-102190.560197.8701209B-20H-4, 100-102193.650200.870191.310198.615FAD C. grandis1209B-20H-5, 100-102195.660202.3701209B-20H-4, 100-102193.650203.315CP12aNP14195.660202.843FAD C. crassus1209C-10H-4, 100-102201.291206.3751209C-10H-5, 100-102202.800280.32205.944205.944FAD C. cribellum1209C-10H-4, 100-102207.290211.9691209C-10H-5, 100-102207.204207.204207.204FAD D. lodoensis1209C-10H-6, 100-102207.290211.9691209C-11H-2, 0-2208.410215.192CP10NP12207.850213.581FAD J. carinarus1209C-10H-6, 100-102207.290211.9691209C-11H-2, 0-2208.410215.192207.850213.581FAD J. carinarus1209C-10H-6, 100-102207.290211.969<  | LAD R. inflata            | 1209B-19H-1, 120–121 | 179.860     | 185.005 | 1209A-18H-6, 45–46   | 178.420     | 180.153 | CP13a |      | 179.140    | 182.579 |
| FAD T. carinatus       1209B-19H-4, 100-102       184.170       189.300       1209B-19H-5, 0-2       184.670       189.810       189.810       184.420       189.555         LAD T. orthostylus       1209A-19H-4, 4.5-46       187.180       192.355       1209A-19H-5, 4.5-46       188.680       193.855       NP13       187.930       193.105         FAD R. dirtyoda       1209A-19H-6, 4.5-46       190.180       195.355       1209B-20H-2, 100-102       190.500       197.870       CP12b       190.360       199.360         FAD C. grandis       1209B-20H-3, 100-102       192.660       199.370       1209B-20H-4, 100-102       193.60       200.870       192.810       200.120         FAD C. grandis       1209B-20H-5, 100-102       192.660       199.370       1209B-20H-4, 100-102       193.60       203.815       CP12a       NP14       195.668       202.843         FAD C. grandis       1209B-20H-5, 100-102       201.291       206.375       1209C-10H-1, 110-111       199.890       204.574       CP11       199.568       202.484         FAD C. dribular       1209C-10H-6, 45-46       199.300       2060-10H-3, 100-102       205.300       210.595       205.456       210.595       202.046       207.204         FAD C. crassus       1209C-10H-6, 100-102   | FAD Nannotetrina sp.      | 1209B-19H-4, 100–102 | 184.170     | 189.300 | 1209B-19H-5, 0–2     | 184.670     | 189.810 |       |      | 184.420    | 189.555 |
| LAD T. orthostylus1209A-19H-4, 45-46187.180192.3551209A-19H-5, 45-46188.680193.855199.180195.355187.930193.105FAD R. dictyoda1209A-19H-5, 45-46188.680193.8551209A-19H-6, 45-46190.180195.3551209A-19H-6, 45-46190.180195.3551209A-19H-6, 45-46190.180195.3551209B-20H-2, 100-102190.500197.870CP12b190.365190.365196.613FAD C. grandis1209B-20H-3, 100-102192.060199.3701209B-20H-4, 100-102193.500200.370CP12aNP14195.680202.870FAD C. crasus1209C-10H-5, 100-102201.291206.3751209C-10H-4, 100-102205.790201.955CP12aNP14195.680202.483FAD C. cribellum1209C-10H-4, 100-102201.291206.3751209C-10H-5, 100-102205.795205.445201.955205.445201.994FAD D. cribellum1209C-10H-5, 100-102201.291206.3751209C-10H-6, 100-102207.300211.969204.574CP10NP12205.040209.948FAD D. lodoensis1209C-10H-6, 100-102207.290211.9691209C-11H-2, 0-2208.100211.962207.850213.581FAD D. barbadiensis1209C-10H-6, 100-102207.290211.9691209C-11H-2, 0-2208.10215.192CP10NP12207.850213.581FAD D. barbadiensis1209C-10H-6, 100-102207.290211.9691209C-11H-2, 0-2208.10215.192207.850213.   | FAD T. carinatus          | 1209B-19H-4, 100–102 | 184.170     | 189.300 | 1209B-19H-5, 0–2     | 184.670     | 189.810 |       |      | 184.420    | 189.555 |
| FAD R. dictyoda1209A-19H-5, 45-46188.680193.8551209A-19H-6, 45-46190.180195.355197.870CP12b189.430194.605FAD R. inflata1209B-20H-2, 100-102190.500197.8701209B-20H-3, 100-102192.600199.3701209B-20H-3, 100-102192.600199.360197.8701209B-20H-3, 100-102192.600199.360197.8701209B-20H-4, 100-102192.610193.60203.315CP12aNP14195.680202.843FAD C. grandis1209A-20H-4, 45-46199.300206.3151209C-10H-4, 100-102201.209201.41199.890204.574CP11199.595205.445FAD C. crassus1209C-10H-4, 100-102201.20206.3051209C-10H-3, 100-102201.209201.012201.209201.012202.040202.946FAD C. cribellum1209C-10H-5, 100-102201.20201.012207.200211.9691209C-10H-5, 100-102202.02205.00201.045205.00201.045205.00201.045201   | LAD T. orthostylus        | 1209A-19H-4, 45–46   | 187.180     | 192.355 | 1209A-19H-5, 45–46   | 188.680     | 193.855 |       | NP13 | 187.930    | 193.105 |
| FAD R. inflata1209A-19H-6, 45-46190.180195.3551209B-20H-2, 100-102190.500197.870CP12b190.365197.870190.3651   | FAD R. dictyoda           | 1209A-19H-5, 45–46   | 188.680     | 193.855 | 1209A-19H-6, 45–46   | 190.180     | 195.355 |       |      | 189.430    | 194.605 |
| LAD L. nascens1209B-20H-2, 100-102190.560197.8701209B-20H-3, 100-102192.600199.360199.360199.360199.360192.810200.120FAD C. grandis1209B-20H-5, 100-102192.060199.3701209B-20H-4, 150-102193.560200.870CP12aNP14195.680202.843FAD C. crassus1209A-20H-6, 45-46199.300206.3151209C-10H-1, 110-111199.890204.574CP11NP14195.680202.483LAD D. multiradiatus1209C-10H-2, 100-102201.291206.3751209C-10H-3, 100-102202.00208.032202.046207.204FAD C. cribellum1209C-10H-4, 100-102204.290209.3001209C-10H-5, 100-102207.300211.968CP11aNP12206.550211.822FAD D. lodoensis1209C-10H-6, 100-102207.209211.9591209C-11H-2, 0-2208.410215.192207.850213.581FAD S. editus1209C-10H-6, 100-102207.290211.9691209C-11H-2, 0-2208.410215.192207.850213.581FAD S. editus1209C-10H-6, 100-102207.290211.9691209C-11H-2, 0-2208.410215.192207.850213.581FAD D. barbadiensis1209C-10H-6, 100-102207.290211.9691209C-11H-2, 0-2208.410215.192207.850213.581FAD D. barbadiensis1209C-10H-6, 100-102207.290211.9691209C-11H-2, 0-2208.410215.192207.850213.581FAD D. barbadiensis1209B-21H-C, 0   | FAD R. inflata            | 1209A-19H-6, 45–46   | 190.180     | 195.355 | 1209B-20H-2, 100–102 | 190.550     | 197.870 | CP12b |      | 190.365    | 196.613 |
| FAD C. grandis1209B-20H-3, 100-102192.060199.3701209B-20H-4, 100-102193.560200.870192.810200.120FAD D. sublodoensis1209B-20H-5, 100-102195.060202.3701209A-20H-4, 45-46199.300206.3151209C-10H-1, 110-111199.890204.574CP12aNP14195.680202.843FAD C. crassus1209C-10H-2, 100-102201.291206.3151209C-10H-1, 110-111199.890204.574CP11199.595205.445FAD C. cribellum1209C-10H-5, 100-102207.290201.3551209C-10H-6, 100-102207.300211.968CP12aNP14195.680202.843FAD C. irbellum1209C-10H-5, 100-102207.290211.9691209C-10H-6, 100-102207.300211.968CP10NP12206.550211.822FAD S. radians1209C-10H-6, 100-102207.290211.9691209C-11H-2, 0-2208.410215.192CP10NP12207.850213.581FAD S. editus1209C-10H-6, 100-102207.290211.9691209C-11H-2, 0-2208.410215.192207.850213.581FAD S. editus1209C-10H-6, 100-102207.290211.9691209C-11H-2, 0-2208.410215.192207.850213.581FAD D. barbadiensis1209C-10H-6, 100-102207.290211.9691209C-11H-2, 0-2208.410215.192207.850213.581FAD D. barbadiensis1209C-10H-6, 100-102207.290211.9691209C-11H-2, 0-2208.410215.192207.850213.581  | LAD L. nascens            | 1209B-20H-2, 100-102 | 190.560     | 197.870 | 1209B-20H-3, 100-102 | 192.060     | 199.360 |       |      | 191.310    | 198.615 |
| FAD D. sublodoensis1209B-20H-5, 100-102195.060202.3701209A-20H-4, 45-46196.300203.315CP12aNP14195.680202.843FAD C. crassus1209A-20H-6, 45-46199.300206.3151209C-10H-1, 110-111199.890204.574CP11199.595205.445LAD D. multiradiatus1209C-10H-2, 100-102201.291206.3751209C-10H-3, 100-102202.800208.032CP12aNP14195.680202.046207.204FAD C. cribellum1209C-10H-5, 100-102204.290209.3001209C-10H-5, 100-102207.300211.968206.550211.822FAD D. lodoensis1209C-10H-6, 100-102207.290211.9691209C-11H-2, 0-2208.410215.192CP10NP12207.850213.581FAD J. orthostylus1209C-10H-6, 100-102207.290211.9691209C-11H-2, 0-2208.410215.192CP10NP12207.850213.581FAD S. editus1209C-10H-6, 100-102207.290211.9691209C-11H-2, 0-2208.410215.192CP10NP12207.850213.581FAD D. barbadiensis1209C-10H-6, 100-102207.290211.9691209C-11H-2, 0-2208.410215.192CP10NP12207.850213.581FAD D. barbadiensis1209C-10H-6, 100-102207.290211.9691209C-11H-2, 0-2208.410215.192CP10NP12207.850213.581FAD D. barbadiensis1209E-10H-6, 100-102207.290211.9691209E-2H-1, 122210.300216.683 <td>FAD C. grandis</td> <td>1209B-20H-3, 100-102</td> <td>192.060</td> <td>199.370</td> <td>1209B-20H-4, 100–102</td> <td>193.560</td> <td>200.870</td> <td></td> <td></td> <td>192.810</td> <td>200.120</td>   | FAD C. grandis            | 1209B-20H-3, 100-102 | 192.060     | 199.370 | 1209B-20H-4, 100–102 | 193.560     | 200.870 |       |      | 192.810    | 200.120 |
| FAD C. crassus1209A-20H-6, 45-46199.300206.3151209C-10H-1, 110-111199.890204.574CP1199.595205.445LAD D. multiradiatus1209C-10H-2, 100-102201.291206.3751209C-10H-3, 100-102202.800208.032202.057202.046207.204FAD C. cribellum1209C-10H-4, 100-102204.290209.3001209C-10H-5, 100-102205.790210.595205.040209.948FAD Chiphragmalithus spp.1209C-10H-6, 100-102207.290211.9691209C-10H-6, 100-102207.300211.968207.800210.555210.555210.555213.581FAD D. lodoensis1209C-10H-6, 100-102207.290211.9691209C-11H-2, 0-2208.410215.192CP10NP12207.850213.581FAD 5. cridians1209C-10H-6, 100-102207.290211.9691209C-11H-2, 0-2208.410215.192207.850213.581FAD 5. editus1209C-10H-6, 100-102207.290211.9691209C-11H-2, 0-2208.410215.192207.850213.581FAD D. barbadiensis1209C-10H-6, 100-102207.290211.9691209C-11H-2, 0-2208.410215.192207.850213.581FAD D. barbadiensis1209C-10H-6, 100-102207.290211.9691209C-11H-2, 0-2208.410215.192207.850213.581FAD D. diastypus1209B-21H-CC, 0208.560215.5801209B-22H-1, 122208.410215.192207.850213.581FAD C. eograndis1209B-22H-1, 64215.5902  | FAD D. sublodoensis       | 1209B-20H-5, 100-102 | 195.060     | 202.370 | 1209A-20H-4, 45-46   | 196.300     | 203.315 | CP12a | NP14 | 195.680    | 202.843 |
| LAD D. multiradiatus1209C-10H-2, 100-102201.291206.3751209C-10H-3, 100-102202.800208.032202.046207.204FAD C. cribellum1209C-10H-4, 100-102204.290209.3001209C-10H-5, 100-102205.790210.595210.595205.040209.948FAD C. hodnensis1209C-10H-5, 100-102207.290211.9691209C-10H-6, 100-102207.300211.968CP10NP12207.850213.581FAD S. radians1209C-10H-6, 100-102207.290211.9691209C-11H-2, 0-2208.410215.192CP10NP12207.850213.581FAD S. radians1209C-10H-6, 100-102207.290211.9691209C-11H-2, 0-2208.410215.192207.850213.581FAD S. ceditus1209C-10H-6, 100-102207.290211.9691209C-11H-2, 0-2208.410215.192207.850213.581FAD D. barbadiensis1209C-10H-6, 100-102207.290211.9691209C-11H-2, 0-2208.410215.192207.850213.581FAD D. barbadiensis1209C-10H-6, 100-102207.290211.9691209C-11H-2, 0-2208.410215.192207.850213.581FAD D. diastypus1209B-21H-CC, 0208.560215.5801209B-22H-1, 12210.030216.683209.295216.132FAD D. diastypus1209B-22H-1, 164210.550217.2541209B-22H-1, 127210.030216.683209.295216.132FAD Z. bijugatus1209B-22H-1, 127211.80217.973211.205217.973211   | FAD C. crassus            | 1209A-20H-6, 45-46   | 199.300     | 206.315 | 1209C-10H-1, 110-111 | 199.890     | 204.574 | CP11  |      | 199.595    | 205.445 |
| FAD C. cribellum1209C-10H-4, 100-102204.290209.3001209C-10H-5, 100-102205.790210.595210.595205.040209.948FAD Chiphragmalithus spp.1209C-10H-5, 100-102205.800210.5951209C-10H-6, 100-102207.290211.9691209C-11H-2, 0-2208.410215.192CP10NP12207.850213.581FAD S. radians1209C-10H-6, 100-102207.290211.9691209C-11H-2, 0-2208.410215.192CP10NP12207.850213.581FAD T. orthostylus1209C-10H-6, 100-102207.290211.9691209C-11H-2, 0-2208.410215.192207.850213.581FAD S. editus1209C-10H-6, 100-102207.290211.9691209C-11H-2, 0-2208.410215.192207.850213.581FAD D. barbadiensis1209C-10H-6, 100-102207.290211.9691209C-11H-2, 0-2208.410215.192207.850213.581FAD C. eograndis1209S-21H-CC, 0208.560215.5801209B-21H-1, 12210.030216.683209.295216.132FAD D. diastypus1209B-22H-1, 64210.550217.2541209B-22H-1, 122210.300216.683209.295216.132FAD C. eodela1209B-22H-1, 127211.180217.9451209B-22H-1, 132211.230218.000211.205217.973FAD D. diastypus1209B-22H-1, 127211.180217.9451209B-22H-1, 132211.230218.000211.205217.973FAD C. eodela1209A-22H-3, 46-47215.860223.0   | LAD D. multiradiatus      | 1209C-10H-2, 100–102 | 201.291     | 206.375 | 1209C-10H-3, 100-102 | 202.800     | 208.032 |       |      | 202.046    | 207.204 |
| FAD Chiphragmalithus spp.1209C-10H-5, 100-102205.800210.5951209C-10H-6, 100-102207.300211.968206.550211.282FAD D. lodoensis1209C-10H-6, 100-102207.290211.9691209C-11H-2, 0-2208.410215.192CP10NP12207.850213.581FAD T. orthostylus1209C-10H-6, 100-102207.290211.9691209C-11H-2, 0-2208.410215.192CP10NP12207.850213.581FAD S. editus1209C-10H-6, 100-102207.290211.9691209C-11H-2, 0-2208.410215.192207.850213.581FAD D. barbadiensis1209C-10H-6, 100-102207.290211.9691209C-11H-2, 0-2208.410215.192207.850213.581FAD D. barbadiensis1209C-10H-6, 100-102207.290211.9691209C-11H-2, 0-2208.410215.192207.850213.581FAD D. barbadiensis1209B-21H-CC, 0208.560215.5801209B-21H-1, 12210.030216.683209.295216.132FAD C. eograndis1209B-22H-1, 64210.550217.2541209B-22H-1, 12210.030216.683209.295216.132FAD Z. bijugatus1209B-22H-1, 127211.180217.9451209B-22H-1, 132211.230218.000211.205217.973LAD C. tenuis1209B-22H-1, 127211.180217.9451209B-22H-1, 132211.230218.000211.205217.973LAD C. tenuis1209B-22H-3, 46-47215.860223.1051209B-22H-1, 132211.230218.00021   | FAD C. cribellum          | 1209C-10H-4, 100–102 | 204.290     | 209.300 | 1209C-10H-5, 100-102 | 205.790     | 210.595 |       |      | 205.040    | 209.948 |
| FAD D. lodoensis1209C-10H-6, 100–102207.290211.9691209C-11H-2, 0–2208.410215.192CP10NP12207.850213.581FAD S. radians1209C-10H-6, 100–102207.290211.9691209C-11H-2, 0–2208.410215.192207.850213.581FAD T. orthostylus1209C-10H-6, 100–102207.290211.9691209C-11H-2, 0–2208.410215.192207.850213.581FAD S. editus1209C-10H-6, 100–102207.290211.9691209C-11H-2, 0–2208.410215.192207.850213.581FAD D. barbadiensis1209C-10H-6, 100–102207.290211.9691209C-11H-2, 0–2208.410215.192207.850213.581FAD D. barbadiensis1209E-21H-CC, 0208.500215.5801209B-22H-1, 12210.030216.683209.295216.132FAD C. eograndis1209B-22H-1, 64210.550217.2541209B-22H-1, 12210.030216.683209.295216.132FAD D. diastypus1209B-22H-1, 64210.550217.2541209B-22H-1, 12210.030216.683209.295216.132FAD Z. bijugatus1209B-22H-1, 127211.180217.9451209B-22H-1, 132211.230218.000211.205217.973FAD C. eodela1209A-22H-3, 46-47215.860223.1051209A-22H-4, 46-47217.360224.605CP8b216.610223.855FAD D. multiradiatus1209C-12H-2, 50-52220.070227.3001209C-12H-3, 50-52221.570228.800CP8aNP92  | FAD Chiphragmalithus spp. | 1209C-10H-5, 100–102 | 205.800     | 210.595 | 1209C-10H-6, 100-102 | 207.300     | 211.968 |       |      | 206.550    | 211.282 |
| FAD S. radians1209C-10H-6, 100-102207.290211.9691209C-11H-2, 0-2208.410215.192207.850213.581FAD T. orthostylus1209C-10H-6, 100-102207.290211.9691209C-11H-2, 0-2208.410215.192207.850213.581FAD S. editus1209C-10H-6, 100-102207.290211.9691209C-11H-2, 0-2208.410215.192207.850213.581FAD D. barbadiensis1209C-10H-6, 100-102207.290211.9691209C-11H-2, 0-2208.410215.192207.850213.581LAD F. tympaniformis1209B-21H-CC, 0208.500215.5801209B-22H-1, 12210.030216.683209.295216.132FAD D. diastypus1209B-22H-1, 64210.550217.2541209B-22H-1, 12210.030216.683209.295216.132FAD Z. bijugatus1209B-22H-1, 127211.180217.9451209B-22H-1, 122211.230218.000211.205217.973FAD C. eodela1209B-22H-1, 127211.180217.9451209B-22H-1, 132211.230218.000211.205217.973FAD C. eodela1209A-22H-3, 46-47215.860223.1051209A-22H-4, 46-47217.360224.605CP8b216.610223.855FAD D. multiradiatus1209C-12H-2, 50-52220.070227.3001209C-12H-3, 50-52221.570228.800CP8aNP9220.820228.805   | FAD D. lodoensis          | 1209C-10H-6, 100–102 | 207.290     | 211.969 | 1209C-11H-2, 0-2     | 208.410     | 215.192 | CP10  | NP12 | 207.850    | 213.581 |
| FAD T. orthostylus1209C-10H-6, 100-102207.290211.9691209C-11H-2, 0-2208.410215.192207.850213.581FAD S. editus1209C-10H-6, 100-102207.290211.9691209C-11H-2, 0-2208.410215.192207.850213.581FAD D. barbadiensis1209C-10H-6, 100-102207.290211.9691209C-11H-2, 0-2208.410215.192207.850213.581LAD F. tympaniformis1209B-21H-CC, 0208.560215.5801209B-22H-1, 12210.030216.683209.295216.132FAD C. eograndis1209B-22H-1, 64210.550217.2541209B-22H-1, 12210.030216.683209.295216.132FAD D. diastypus1209B-22H-1, 127211.180217.9541209B-22H-1, 122211.230218.000211.205217.973FAD C. eordela1209B-22H-1, 127211.180217.9451209B-22H-1, 132211.230218.000211.205217.973FAD C. eordela1209A-22H-3, 46-47215.860223.1051209A-22H-4, 46-47217.360224.605CP8b216.610223.855FAD D. multiradiatus1209C-12H-2, 50-52220.070227.3001209C-12H-3, 50-52221.570228.800CP8aNP9220.820228.800   | FAD S. radians            | 1209C-10H-6, 100–102 | 207.290     | 211.969 | 1209C-11H-2, 0–2     | 208.410     | 215.192 |       |      | 207.850    | 213.581 |
| FAD S. editus1209C-10H-6, 100-102207.290211.9691209C-11H-2, 0-2208.410215.192207.850213.581FAD D. barbadiensis1209C-10H-6, 100-102207.290211.9691209C-11H-2, 0-2208.410215.192207.850213.581LAD F. tympaniformis1209B-21H-CC, 0208.560215.5801209B-22H-1, 12210.030216.683209.295216.132FAD C. eograndis1209B-22H-1, 64210.550217.2541209B-22H-1, 70210.610217.319CP9210.580217.287FAD Z. bijugatus1209B-22H-1, 127211.180217.9451209B-22H-1, 132211.230218.000211.205217.973FAD C. eodela1209A-22H-3, 46-47215.860223.1051209A-22H-4, 46-47217.360224.605CP8b216.610223.855FAD D. multiradiatus1209C-12H-2, 50-52220.070227.3001209C-12H-3, 50-52221.570228.800CP8aNP9220.820228.800   | FAD T. orthostylus        | 1209C-10H-6, 100–102 | 207.290     | 211.969 | 1209C-11H-2, 0-2     | 208.410     | 215.192 |       |      | 207.850    | 213.581 |
| FAD D. barbadiensis1209C-10H-6, 100-102207.290211.9691209C-11H-2, 0-2208.410215.192207.850213.581LAD F. tympaniformis1209B-21H-CC, 0208.560215.5801209B-22H-1, 12210.030216.683209.295216.132FAD C. eograndis1209B-22H-1, 64210.550217.2541209B-22H-1, 12210.030216.683209.295216.132FAD D. diastypus1209B-22H-1, 64210.550217.2541209B-22H-1, 70210.610217.319CP9210.580217.287FAD Z. bijugatus1209B-22H-1, 127211.180217.9451209B-22H-1, 132211.230218.000211.205217.973LAD C. tenuis1209B-22H-3, 46-47215.860223.1051209A-22H-4, 46-47217.360224.605CP8b216.610223.855FAD D. multiradiatus1209C-12H-2, 50-52220.070227.3001209C-12H-3, 50-52221.570228.800CP8aNP9220.820228.800  | FAD S. editus             | 1209C-10H-6, 100–102 | 207.290     | 211.969 | 1209C-11H-2, 0-2     | 208.410     | 215.192 |       |      | 207.850    | 213.581 |
| LAD F. tympaniformis1209B-21H-CC, 0208.560215.5801209B-22H-1, 12210.030216.683209.295216.132FAD C. eograndis1209B-22H-1, 64210.550217.2541209B-22H-1, 12210.030216.683CP9210.580217.287FAD D. diastypus1209B-22H-1, 64210.550217.2541209B-22H-1, 70210.610217.319CP9210.580217.287FAD Z. bijugatus1209B-22H-1, 127211.180217.9451209B-22H-1, 132211.230218.000211.205217.973LAD C. tenuis1209B-22H-3, 46-47215.860223.1051209A-22H-4, 46-47217.360224.605CP8b216.610223.855FAD D. multiradiatus1209C-12H-2, 50-52220.070227.3001209C-12H-3, 50-52221.570228.800CP8aNP9220.820228.800  | FAD D. barbadiensis       | 1209C-10H-6, 100–102 | 207.290     | 211.969 | 1209C-11H-2, 0-2     | 208.410     | 215.192 |       |      | 207.850    | 213.581 |
| FAD C. eograndis1209B-21H-CC, 0208.560215.5801209B-22H-1, 12210.030216.683209.295216.132FAD D. diastypus1209B-22H-1, 64210.550217.2541209B-22H-1, 70210.610217.319CP9210.580217.287FAD Z. bijugatus1209B-22H-1, 127211.180217.9451209B-22H-1, 132211.230218.000211.205211.205217.973LAD C. tenuis1209B-22H-1, 127211.180217.9451209B-22H-1, 132211.230218.000211.205211.205217.973FAD C. eodela1209A-22H-3, 46-47215.860223.1051209A-22H-4, 46-47217.360224.605CP8b216.610223.855FAD D. multiradiatus1209C-12H-2, 50-52220.070227.3001209C-12H-3, 50-52221.570228.800CP8aNP9220.820228.050  | LAD F. tympaniformis      | 1209B-21H-CC, 0      | 208.560     | 215.580 | 1209B-22H-1, 12      | 210.030     | 216.683 |       |      | 209.295    | 216.132 |
| FAD D. diastypus1209B-22H-1, 64210.550217.2541209B-22H-1, 70210.610217.319CP9210.580217.287FAD Z. bijugatus1209B-22H-1, 127211.180217.9451209B-22H-1, 132211.230218.000211.205211.205217.973LAD C. tenuis1209B-22H-1, 127211.180217.9451209B-22H-1, 132211.230218.000211.205211.205217.973FAD C. eodela1209A-22H-3, 46-47215.860223.1051209A-22H-4, 46-47217.360224.605CP8b216.610223.855FAD D. multiradiatus1209C-12H-2, 50-52220.070227.3001209C-12H-3, 50-52221.570228.800CP8aNP9220.820228.050  | FAD C. eograndis          | 1209B-21H-CC, 0      | 208.560     | 215.580 | 1209B-22H-1, 12      | 210.030     | 216.683 |       |      | 209.295    | 216.132 |
| FAD Z. bijugatus1209B-22H-1, 127211.180217.9451209B-22H-1, 132211.230218.000211.205217.973LAD C. tenuis1209B-22H-1, 127211.180217.9451209B-22H-1, 132211.230218.000211.205217.973FAD C. eodela1209A-22H-3, 46-47215.860223.1051209A-22H-4, 46-47217.360224.605CP8b216.610223.855FAD D. multiradiatus1209C-12H-2, 50-52220.070227.3001209C-12H-3, 50-52221.570228.800CP8aNP9220.820228.050   | FAD D. diastypus          | 1209B-22H-1, 64      | 210.550     | 217.254 | 1209B-22H-1, 70      | 210.610     | 217.319 | CP9   |      | 210.580    | 217.287 |
| LAD C. tenuis1209B-22H-1, 127211.180217.9451209B-22H-1, 132211.230218.000211.205217.973FAD C. eodela1209A-22H-3, 46-47215.860223.1051209A-22H-4, 46-47217.360224.605CP8b216.610223.855FAD D. multiradiatus1209C-12H-2, 50-52220.070227.3001209C-12H-3, 50-52221.570228.800CP8aNP9220.820228.050   | FAD Z. bijugatus          | 1209B-22H-1, 127     | 211.180     | 217.945 | 1209B-22H-1, 132     | 211.230     | 218.000 |       |      | 211.205    | 217.973 |
| FAD C. eodela1209A-22H-3, 46-47215.860223.1051209A-22H-4, 46-47217.360224.605CP8b216.610223.855FAD D. multiradiatus1209C-12H-2, 50-52220.070227.3001209C-12H-3, 50-52221.570228.800CP8aNP9220.820228.050  | LAD C. tenuis             | 1209B-22H-1, 127     | 211.180     | 217.945 | 1209B-22H-1, 132     | 211.230     | 218.000 |       |      | 211.205    | 217.973 |
| FAD D. multiradiatus         1209C-12H-2, 50-52         220.070         227.300         1209C-12H-3, 50-52         221.570         228.800         CP8a         NP9         220.820         228.050   | FAD C. eodela             | 1209A-22H-3, 46–47   | 215.860     | 223.105 | 1209A-22H-4, 46–47   | 217.360     | 224.605 | CP8b  |      | 216.610    | 223.855 |
|   | FAD D. multiradiatus      | 1209C-12H-2, 50-52   | 220.070     | 227.300 | 1209C-12H-3, 50-52   | 221.570     | 228.800 | CP8a  | NP9  | 220.820    | 228.050 |
| LAD H. kleinpellii 1209C-12H-5, 50–52 224.580 231.800 1209C-12H-6, 50–52 226.080 233.225 225.330 232.513  | LAD H. kleinpellii        | 1209C-12H-5, 50–52   | 224.580     | 231.800 | 1209C-12H-6, 50–52   | 226.080     | 233.225 |       |      | 225.330    | 232.513 |
| FAD D. mohleri         1209C-12H-6, 50–52         226.070         233.225         1209A-23H-3, 45–46         226.800         234.213         CP6         226.435         233.719  | FAD D. mohleri            | 1209C-12H-6, 50-52   | 226.070     | 233.225 | 1209A-23H-3, 45-46   | 226.800     | 234.213 | CP6   |      | 226.435    | 233.719 |
| FAD H. kleinpellii         1209A-23H-4, 45–46         228.305         235.713         1209A-23H-5, 45–46         229.805         237.256         CP5         NP6         229.055         236.485  | FAD H. kleinpellii        | 1209A-23H-4, 45–46   | 228.305     | 235.713 | 1209A-23H-5, 45–46   | 229.805     | 237.256 | CP5   | NP6  | 229.055    | 236.485 |

### Table T4 (continued).

|                        | Upper core, section. | Upper   | depth   | epth Lower core section |         | Lower depth |      | Zone |         | mean    |
|------------------------|----------------------|---------|---------|-------------------------|---------|-------------|------|------|---------|---------|
| Event                  | Event interval (cm)  | (mcd)   | (rmcd)  | interval (cm)           | (mcd)   | (rmcd)      | OB80 | M71  | (mcd)   | (rmcd)  |
| FAD S. anarrhopus      | 1209A-23H-4, 45–46   | 228.300 | 235.713 | 1209A-23H-5, 45–46      | 229.800 | 237.256     |      |      | 229.050 | 236.485 |
| FAD F. tympaniformis   | 1209C-13H-5, 100–102 | 235.840 | 243.260 | 1209C-13H-6, 100–102    | 237.340 | 244.760     | CP4  | NP5  | 236.590 | 244.010 |
| FAD Fasciculithus spp. | 1209C-13H-6, 100–102 | 237.340 | 244.760 | 1209C-13H-7, 0-2        | 237.840 | 245.270     |      |      | 237.590 | 245.015 |
| FAD C. bidens          | 1209C-13H-7, 0–2     | 237.850 | 245.270 | 1209A-24H-5, 45–46      | 238.685 | 248.435     |      |      | 238.268 | 246.853 |
| FAD S. primus          | 1209A-24H-6, 45–46   | 240.185 | 249.935 | 1209A-24H-7, 45–46      | 241.685 | 251.256     |      |      | 240.935 | 250.596 |
| FAD T. pertusus        | 1209A-24H-7, 45–46   | 241.680 | 251.256 | 1209C-14H-3, 115–116    | 241.810 | 251.550     |      |      | 241.745 | 251.403 |
| FAD E. macellus        | 1209C-14H-4, 100–102 | 243.180 | 252.822 | 1209C-14H-5, 100–101    | 244.680 | 254.294     | CP3  | NP4  | 243.930 | 253.558 |
| FAD C. danicus         | 1209C-14H-7, 0–2     | 246.660 | 256.395 | 1209A-25H-3, 110–111    | 247.090 | 257.042     | CP2  | NP3  | 246.875 | 256.719 |
| FAD C. tenuis          | 1209A-25H-5, 110–111 | 250.080 | 260.085 | 1209A-25H-6, 100–101    | 251.480 | 261.485     | CP1b | NP2  | 250.780 | 260.785 |
| K/T boundary           | 1209C-15H-3, 96      | 251.590 | 261.580 |                         |         |             | CP1a | NP1  | 251.590 | 261.580 |

Notes: LAD = last appearance datum, FAD = first appearance datum. Bold = zonal markers or primary events. OB80 = Okada and Bukry, 1980, M71 = Martini, 1971.

| Table T5. Zonal and other key datum, Site 1210. (See table notes. Continued on next page | e.) |
|--|-----|
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|                           | Upper core, section, | Upper depth |         | Lower core, section, | Lower depth |         | Zone  |      | Datum mean |         |
|---------------------------|----------------------|-------------|---------|----------------------|-------------|---------|-------|------|------------|---------|
| Event                     | interval (cm)        | (mcd)       | (rmcd)  | interval (cm)        | (mcd)       | (rmcd)  | OB80  | M71  | (mcd)      | (rmcd)  |
| LAD E. formosa            | 1210B-13H-2, 70-71   | 130.015     | 130.015 | 1210B-13H-3, 70-71   | 131.515     | 131.515 | CP16c | NP22 | 130.765    | 130.765 |
| Base acme E. subdisticha  | 1210B-13H-7, 21-22   | 137.025     | 137.025 | 1210A-14H-2, 144-145 | 136.335     | 136.335 | CP16b |      | 136.680    | 136.680 |
| LAD D. barbadiensis       | 1210B-13H-7, 21-22   | 137.025     | 137.025 | 1210A-14H-2, 144-145 | 136.335     | 136.335 | CP16a |      | 136.680    | 136.680 |
| LAD C. grandis            | 1210A-14H-2, 144-145 | 137.335     | 137.335 | 1210A-14H-3, 45-46   | 137.835     | 137.835 | CP15  |      | 137.585    | 137.585 |
| FAD S. predistentus       | 1210A-14H-3, 45-46   | 137.835     | 137.835 | 1210A-14H-4, 45-46   | 139.335     | 139.335 |       |      | 138.585    | 138.585 |
| LAD D. saipanensis        | 1210A-14H-3, 45-46   | 137.835     | 137.835 | 1210A-14H-4, 45-46   | 139.335     | 139.335 |       | NP21 | 138.585    | 138.585 |
| FAD S. pseudoradians      | 1210A-14H-4, 45-46   | 139.335     | 139.335 | 1210A-14H-5, 45-46   | 140.835     | 140.835 |       | NP20 | 140.085    | 140.085 |
| LAD C. dela               | 1210A-14H-4, 45-46   | 139.335     | 139.335 | 1210A-14H-5, 45-46   | 140.835     | 140.835 |       |      | 140.085    | 140.085 |
| LAD C. solitus            | 1210A-15H-1, 45-46   | 146.565     | 146.825 | 1210A-15H-2, 45-46   | 148.065     | 148.325 | CP14b | NP17 | 147.315    | 147.575 |
| FAD D. bisectus           | 1210A-15H-2, 45-46   | 148.065     | 148.325 | 1210A-15H-3, 45-46   | 149.565     | 149.825 |       |      | 148.815    | 149.075 |
| FAD D. scrippsae          | 1210A-15H-5, 1-2     | 152.125     | 152.385 | 1210B-15H-2, 100-102 | 152.700     | 152.960 |       |      | 152.413    | 152.673 |
| LAD N. fulgens            | 1210A-15H-5, 1-2     | 152.112     | 152.385 | 1210B-15H-2, 100-102 | 152.700     | 152.960 |       |      | 152.406    | 152.673 |
| FAD S. obtusus            | 1210B-15H-2, 100-102 | 152.700     | 152.960 | 1210B-15H-3, 50-51   | 153.695     | 153.955 |       |      | 153.198    | 153.458 |
| FAD R. umbilicus          | 1210B-15H-3, 50-51   | 153.695     | 153.955 | 1210B-15H-4, 0-1     | 154.695     | 154.955 | CP14a |      | 154.195    | 154.455 |
| LAD C. gigas              | 1210B-15H-4, 0-1     | 154.695     | 154.955 | 1210B-15H-5, 50-51   | 156.695     | 156.955 | CP13c |      | 155.695    | 155.955 |
| FAD. S. furcatolithoides  | 1210A-16H-3, 45-46   | 160.215     | 160.475 | 1210A-16H-4, 45-46   | 161.715     | 161.975 |       |      | 160.965    | 161.225 |
| FAD C. gigas              | 1210B-16H-3, 50-51   | 164.075     | 164.335 | 1210B-16H-4, 100-101 | 166.075     | 166.335 | CP13b |      | 165.075    | 165.335 |
| LAD C. crassus            | 1210B-16H-5, 50-51   | 167.075     | 167.335 | 1210B-16H-6, 50-51   | 168.575     | 168.835 |       |      | 167.825    | 168.085 |
| FAD S. spiniger           | 1210B-16H-5, 50-51   | 167.075     | 167.335 | 1210B-16H-6, 50-51   | 168.575     | 168.835 |       |      | 167.825    | 168.085 |
| FAD N. fulgens            | 1210A-17H-2, 45-46   | 169.005     | 169.492 | 1210A-17H-3, 45-46   | 170.505     | 170.992 | CP13a | NP15 | 169.755    | 170.242 |
| LAD C. cribellum          | 1210A-17H-4, 45-46   | 172.005     | 172.626 | 1210A-17H-5, 45-46   | 173.505     | 174.125 |       |      | 172.755    | 173.376 |
| LAD R. inflata            | 1210A-17H-4, 45-46   | 172.005     | 172.626 | 1210A-17H-5, 45-46   | 173.505     | 174.125 | CP13a |      | 172.755    | 173.376 |
| FAD T. carinatus          | 1210A-18H-2, 45-46   | 179.385     | 179.875 | 1210A-18H-3, 45-46   | 180.885     | 181.505 |       |      | 180.135    | 180.690 |
| LAD T. orthostylus        | 1210A-18H-4, 45-46   | 182.385     | 183.005 | 1210A-18H-5, 45-46   | 183.885     | 184.505 |       | NP13 | 183.135    | 183.755 |
| FAD Nannotetrina sp.      | 1210A-18H-5, 45-46   | 183.885     | 184.505 | 1210B-18H-2, 140-141 | 184.445     | 185.065 |       |      | 184.165    | 184.785 |
| FAD R. inflata            | 1210B-18H-2, 140-141 | 184.445     | 185.065 | 1210B-18H-3, 100-101 | 185.545     | 186.165 | CP12b |      | 184.995    | 185.615 |
| FAD R. dictyoda           | 1210B-18H-2, 140-141 | 184.445     | 185.065 | 1210B-18H-3, 100-101 | 185.545     | 186.165 |       |      | 184.995    | 185.615 |
| FAD C. grandis            | 1210B-18H-4, 100-101 | 187.045     | 187.665 | 1210B-18H-5, 100-101 | 188.545     | 189.165 |       |      | 187.795    | 188.415 |
| LAD L. nascens            | 1210B-18H-4, 100-101 | 187.045     | 187.665 | 1210B-18H-5, 100-101 | 188.545     | 189.165 |       |      | 187.795    | 188.415 |
| FAD D. sublodoensis       | 1210A-19H-2, 48-49   | 190.275     | 191.095 | 1210A-19H-3, 47-48   | 191.765     | 192.585 | CP12a | NP14 | 191.020    | 191.840 |
| FAD C. crassus            | 1210A-19H-3, 47-48   | 191.765     | 192.585 | 1210A-19H-4, 47-48   | 193.265     | 194.085 | CP11  |      | 192.515    | 193.335 |
| FAD Chiphragmalithus spp. | 1210B-19H-3, 50-51   | 195.845     | 196.665 | 1210B-19H-4, 50-51   | 197.345     | 198.165 |       |      | 196.595    | 197.415 |
| LAD D. multiradiatus      | 1210B-19H-3, 50-51   | 195.845     | 196.665 | 1210B-19H-4, 50-51   | 197.345     | 198.165 |       |      | 196.595    | 197.415 |
| FAD C. cribellum          | 1210B-19H-4, 50-51   | 197.345     | 198.165 | 1210B-19H-5, 50-51   | 198.845     | 199.665 |       |      | 198.095    | 198.915 |
| FAD S. radians            | 1210B-19H-5, 50-51   | 198.845     | 199.665 | 1210B-19H-6, 50-51   | 200.345     | 201.165 |       |      | 199.595    | 200.415 |
| FAD D. lodoensis          | 1210B-19H-6, 50-51   | 200.345     | 201.165 | 1210A-20H-3, 45-46   | 201.195     | 203.305 | CP10  | NP12 | 200.770    | 202.235 |
| FAD T. orthostylus        | 1210B-19H-6, 50-51   | 200.345     | 201.165 | 1210A-20H-3, 45-46   | 201.195     | 203.305 |       |      | 200.770    | 202.235 |
| FAD S. editus             | 1210B-19H-6, 50-51   | 200.345     | 201.165 | 1210A-20H-3, 45-46   | 201.195     | 203.305 |       |      | 200.770    | 202.235 |
| FAD D. barbadiensis       | 1210B-19H-6, 50-51   | 200.345     | 201.165 | 1210A-20H-3, 45-46   | 201.195     | 203.305 |       |      | 200.770    | 202.235 |
| FAD D. diastypus          | 1210B-20H-1, 50-52   | 201.790     | 203.904 | 1210B-20H-2, 50-52   | 203.290     | 205.380 | CP9   |      | 202.540    | 204.642 |
| LAD F. tympaniformis      | 1210B-20H-2, 10      | 202.910     | 204.990 | 1210B-20H-2, 90      | 203.710     | 205.790 |       |      | 203.310    | 205.390 |
| FAD Z. bijugatus          | 1210B-20H-3, 100     | 205.280     | 207.390 | 1210B-20H-3, 110     | 205.380     | 207.490 |       |      | 205.330    | 207.440 |
| FAD C. eodela             | 1210B-20H-6, 0-1     | 208.785     | 209.995 | 1210A-21H-2, 48-49   | 209.325     | 211.432 | CP8b  |      | 209.055    | 210.714 |
| FAD D. multiradiatus      | 1210B-21H-3, 100-102 | 214.950     | 217.060 | 1210B-21H-4, 100-102 | 216.450     | 218.560 | CP8a  | NP9  | 215.700    | 217.810 |
| LAD H. kleinpellii        | 1210B-21H-5, 100-102 | 217.950     | 220.060 | 1210B-21H-6, 50-51   | 218.945     | 221.055 |       |      | 218.448    | 220.558 |
| FAD D. mohleri            | 1210A-22H-2, 45-46   | 220.035     | 222.145 | 1210A-22H-2, 118     | 220.760     | 222.870 | CP6   |      | 220.398    | 222.508 |
| FAD S. anarrhopus         | 1210A-22H-3, 42-43   | 221.505     | 223.615 | 1210A-22H-4, 45-46   | 223.035     | 225.145 |       |      | 222.270    | 224.380 |
| FAD H. kleinpellii        | 1210A-22H-3, 60      | 221.680     | 223.790 | 1210A-22H-3, 70      | 221.780     | 223.890 | CP5   | NP6  | 221.730    | 223.840 |
| FAD F. tympaniformis      | 1210B-22H-5, 100-102 | 229.080     | 231.190 | 1210B-22H-6, 0-2     | 229.580     | 231.690 | CP4   | NP5  | 229.330    | 231.440 |

### Table T5 (continued).

|                        | Upper core, section, | Upper depth |         | Lower core, section. | Lower depth |         | Zone |     | Datum mean |         |
|------------------------|----------------------|-------------|---------|----------------------|-------------|---------|------|-----|------------|---------|
| Event                  | interval (cm)        | (mcd)       | (rmcd)  | interval (cm)        | (mcd)       | (rmcd)  | OB80 | M71 | (mcd)      | (rmcd)  |
| FAD Fasciculithus spp. | 1210A-23H-2, 47-48   | 230.855     | 232.965 | 1210A-23H-3, 93-94   | 232.815     | 234.925 |      |     | 231.835    | 233.945 |
| FAD E. macellus        | 1210A-23H-2, 47-48   | 230.855     | 232.965 | 1210A-23H-3, 93-94   | 232.815     | 234.925 | CP3  | NP4 | 231.835    | 233.945 |
| FAD C. bidens          | 1210A-23H-2, 47-48   | 230.855     | 232.965 | 1210A-23H-3, 93-94   | 232.815     | 234.925 |      |     | 231.835    | 233.945 |
| FAD S. primus          | 1210A-23H-3, 93-94   | 232.815     | 234.925 | 1210A-23H-4, 27-28   | 233.655     | 235.765 |      |     | 233.235    | 235.345 |
| FAD T. pertusus        | 1210A-23H-3, 93-94   | 232.815     | 234.925 | 1210A-23H-4, 27-28   | 233.655     | 235.765 |      |     | 233.235    | 235.345 |
| FAD C. danicus         | 1210B-23H-4, 100-102 | 238.590     | 240.700 | 1210B-23H-5, 100-102 | 240.090     | 242.200 | CP2  | NP3 | 239.340    | 241.450 |
| FAD C. tenuis          | 1210A-24H-2, 45-46   | 241.305     | 243.325 | 1210A-24H-3, 45-46   | 242.805     | 244.825 | CP1b | NP2 | 242.055    | 244.075 |
| K/T Boundary           | 1210A-24H-4, 51      | 244.360     | 246.380 |                      |             |         | CP1a | NP1 | 244.36     | 246.380 |

Notes: LAD = last appearance datum, FAD = first appearance datum. Bold = zonal markers or primary events. OB80 = Okada and Bukry, 1980, M71 = Martini, 1971.

| Table T6. Zonal and other key datum, Site 1211. (See table notes. Continued on next page.) |
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|                           | Upper core, section, | Upper depth |         | Lower core, section, | Lower depth |         | Zone  |      | Datum mean |         |
|---------------------------|----------------------|-------------|---------|----------------------|-------------|---------|-------|------|------------|---------|
| Event                     | interval (cm)        | (mcd)       | (rmcd)  | interval (cm)        | (mcd)       | (rmcd)  | OB80  | M71  | (mcd)      | (rmcd)  |
| LAD E. formosa            | 1211C-8H-7, 30–31    | 79.955      | 79.955  | 1211-9H-3, 100–101   | 80.435      | 80.435  | CP16c |      | 80.195     | 80.195  |
| Base acme E. subdisticha  | 1211C-9H-4, 52–53    | 85.895      | 85.895  | 1211C-9H-5, 102–103  | 87.895      | 87.895  | CP16b |      | 86.895     | 86.895  |
| LAD D. barbadiensis       | 1211C-9H-4, 52–53    | 85.895      | 85.895  | 1211C-9H-5, 102–103  | 87.895      | 87.895  | CP16a |      | 86.895     | 86.895  |
| FAD S. predistentus       | 1211C-9H-5, 102–103  | 87.895      | 87.895  | 1211C-9H-6, 22–23    | 88.595      | 88.595  |       |      | 88.245     | 88.245  |
| LAD D. saipanensis        | 1211C-9H-5, 102–103  | 87.895      | 87.895  | 1211C-9H-6, 22–23    | 88.595      | 88.595  |       | NP21 | 88.245     | 88.245  |
| LAD C. grandis            | 1211A-10H-1, 105–106 | 89.005      | 87.924  | 1211-10H-2, 133–134  | 90.835      | 89.665  | CP15  |      | 89.920     | 88.795  |
| FAD S. pseudoradians      | 1211A-10H-3, 107–108 | 92.025      | 90.945  | 1211-10H-4, 108–109  | 93.535      | 92.005  |       | NP20 | 92.780     | 91.475  |
| LAD C. dela               | 1211A-10H-6, 45–46   | 95.905      | 93.928  | 1211-10H-7, 45–46    | 96.905      | 94.878  |       |      | 96.405     | 94.403  |
| FAD D. bisectus           | 1211C-10H-4, 120–121 | 97.195      | 96.045  | 1211C-10H-5, 0–1     | 97.495      | 96.365  |       |      | 97.345     | 96.205  |
| FAD S. obtusus            | 1211C-10H-5, 0–1     | 97.495      | 96.365  | 1211C-10H-5, 100–101 | 98.495      | 97.345  |       |      | 97.995     | 96.855  |
| LAD C. solitus            | 1211C-10H-5, 100–101 | 98.495      | 97.345  | 1211C-10H-6, 0–1     | 98.995      | 97.845  | CP14b | NP17 | 98.745     | 97.595  |
| LAD N. fulgens            | 1211C-10H-5, 100–101 | 98.495      | 97.345  | 1211C-10H-6, 0–1     | 98.995      | 97.845  |       |      | 98.745     | 97.595  |
| FAD R. umbilicus          | 1211C-10H-5, 100–101 | 98.495      | 97.345  | 1211C-10H-6, 0–1     | 98.995      | 97.845  | CP14a |      | 98.745     | 97.595  |
| FAD D. scrippsae          | 1211C-10H-5, 100–101 | 98.495      | 97.345  | 1211C-10H-6, 0–1     | 98.995      | 97.845  |       |      | 98.745     | 97.595  |
| LAD C. gigas              | 1211C-10H-5, 100–101 | 98.495      | 97.345  | 1211C-10H-6, 0–1     | 98.995      | 97.845  | CP13c |      | 98.745     | 97.595  |
| FAD. S. furcatolithoides  | 1211C-10H-6, 50–51   | 99.495      | 98.345  | 1211-11H-2, 45–46    | 99.745      | 98.852  |       |      | 99.620     | 98.599  |
| FAD C. gigas              | 1211A-11H-2, 45–46   | 99.745      | 98.852  | 1211-11H-3, 45–46    | 101.245     | 100.345 | CP13b |      | 100.495    | 99.599  |
| LAD R. inflata            | 1211A-11H-2, 45–46   | 99.745      | 98.852  | 1211-11H-3, 45–46    | 101.245     | 100.345 | CP13a |      | 100.495    | 99.599  |
| FAD S. spiniger           | 1211A-11H-3, 45–46   | 101.245     | 100.345 | 1211-11H-4, 45–46    | 102.745     | 101.834 |       |      | 101.995    | 101.090 |
| FAD N. fulgens            | 1211A-11H-3, 45–46   | 101.245     | 100.345 | 1211-11H-4, 45–46    | 102.745     | 101.834 | CP13a | NP15 | 101.995    | 101.090 |
| LAD C. crassus            | 1211A-11H-3, 45–46   | 101.245     | 100.345 | 1211-11H-4, 45–46    | 102.745     | 101.835 |       |      | 101.995    | 101.09  |
| LAD C. cribellum          | 1211A-11H-4, 45–46   | 102.745     | 101.834 | 1211-11H-5, 45–46    | 104.245     | 103.155 |       |      | 103.495    | 102.495 |
| FAD T. carinatus          | 1211B-11H-5, 45–46   | 106.795     | 105.740 | 1211B-11H-6, 45–46   | 108.295     | 107.141 |       |      | 107.545    | 106.441 |
| LAD T. orthostylus        | 1211B-11H-7, 20–21   | 108.845     | 107.610 | 1211C-11H-5, 100–101 | 109.235     | 108.555 |       | NP13 | 109.040    | 108.083 |
| FAD R. inflata            | 1211C-11H-6, 50–51   | 110.235     | 109.555 | 1211-12H-3, 45–46    | 111.175     | 111.085 | CP12b |      | 110.705    | 110.32  |
| FAD Nannotetrina sp.      | 1211C-11H-6, 50–51   | 110.235     | 109.555 | 1211-12H-3, 45–46    | 111.175     | 111.085 |       |      | 110.705    | 110.32  |
| FAD R. dictyoda           | 1211A-12H-3, 45–46   | 111.175     | 111.085 | 1211-12H-4, 45–46    | 112.675     | 112.585 |       |      | 111.925    | 111.835 |
| LAD L. nascens            | 1211A-12H-5, 45–46   | 114.175     | 113.893 | 1211-12H-6, 45–46    | 115.675     | 115.272 |       |      | 114.925    | 114.583 |
| FAD D. sublodoensis       | 1211A-12H-6, 45–46   | 115.675     | 115.272 | 1211B-12H-5, 45–46   | 116.935     | 116.845 | CP12a | NP14 | 116.305    | 116.059 |
| FAD C. grandis            | 1211A-12H-6, 45–46   | 115.675     | 115.272 | 1211B-12H-5, 45–46   | 116.935     | 116.845 |       |      | 116.305    | 116.059 |
| FAD C. crassus            | 1211B-12H-5, 45–46   | 116.935     | 116.845 | 1211B-12H-6, 45–46   | 118.435     | 118.288 | CP11  |      | 117.685    | 117.567 |
| FAD Chiphragmalithus spp. | 1211C-12H-5, 100–101 | 120.065     | 120.365 | 1211C-12H-6, 97–98   | 121.535     | 121.869 |       |      | 120.800    | 121.117 |
| LAD D. multiradiatus      | 1211C-12H-5, 100–101 | 120.065     | 120.365 | 1211C-12H-6, 97–98   | 121.535     | 121.869 |       |      | 120.800    | 121.117 |
| FAD C. cribellum          | 1211C-12H-6, 97–98   | 121.535     | 121.869 | 1211C-12H-7, 0–1     | 121.565     | 121.903 |       |      | 121.550    | 121.886 |
| FAD S. editus             | 1211A-13H-4, 40–42   | 123.700     | 123.870 | 1211-13H-5, 102–104  | 125.820     | 125.990 |       |      | 124.760    | 124.93  |
| FAD D. lodoensis          | 1211A-13H-5, 102–104 | 125.820     | 125.990 | 1211-13H-6, 101–103  | 127.160     | 127.276 | CP10  | NP12 | 126.490    | 126.633 |
| FAD D. barbadiensis       | 1211A-13H-5, 102–104 | 125.820     | 125.990 | 1211-13H-6, 101–103  | 127.160     | 127.276 |       |      | 126.490    | 126.633 |
| FAD S. radians            | 1211A-13H-5, 102–104 | 125.820     | 125.990 | 1211-13H-6, 101–103  | 127.160     | 127.276 |       |      | 126.490    | 126.633 |
| FAD T. orthostylus        | 1211A-13H-5, 102–104 | 125.820     | 125.990 | 1211-13H-6, 101–103  | 127.160     | 127.276 |       |      | 126.490    | 126.633 |
| LAD F. tympaniformis      | 1211A-13H-6, 1       | 126.150     | 126.320 | 1211-13H-6, 5        | 126.190     | 126.360 |       |      | 126.170    | 126.34  |
| FAD <b>D. diastypus</b>   | 1211A-13H-6, 1       | 126.150     | 126.320 | 1211-13H-6, 5        | 126.190     | 126.360 | CP9   |      | 126.170    | 126.34  |
| FAD Z. bijugatus          | 1211A-13H-6, 10      | 126.240     | 126.410 | 1211-13H-6, 13       | 126.270     | 126.440 |       |      | 126.255    | 126.425 |
| FAD C. eodela             | 1211C-13H-6, 0–1     | 131.185     | 130.933 | 1211-14H-2, 45–46    | 131.755     | 131.795 | CP8b  |      | 131.470    | 131.364 |
| FAD D. multiradiatus      | 1211A-14H-2, 45–46   | 131.755     | 131.795 | 1211-14H-3, 45–46    | 133.255     | 133.295 | CP8a  | NP9  | 132.505    | 132.545 |
| LAD H. kleinpellii        | 1211A-14H-4, 45–46   | 134.755     | 134.795 | 1211-14H-5, 45–46    | 136.255     | 136.295 |       |      | 135.505    | 135.545 |
| FAD D. mohleri            | 1211A-14H-5, 45–46   | 136.255     | 136.295 | 1211-14H-6, 45–46    | 137.755     | 137.769 | CP6   |      | 137.005    | 137.032 |
| FAD H. kleinpellii        | 1211B-14H-4, 55–56   | 137.495     | 137.595 | 1211B-14H-4, 57–58   | 137.515     | 137.615 | CP5   | NP6  | 137.505    | 137.605 |
| FAD S. anarrhopus         | 1211B-14H-4, 60–61   | 137.545     | 137.645 | 1211B-14H-5, 60–61   | 139.045     | 139.145 |       |      | 138.295    | 138.395 |
| FAD F. tympaniformis      | 1211B-14H-6, 60–61   | 140.545     | 140.645 | 1211B-14H-7, 10–11   | 141.545     | 141.645 | CP4   | NP5  | 141.045    | 141.145 |

### Table T6 (continued).

|                        | Upper core, section, | Upper depth |         | Lower core, section, | Lower depth |         | Zone |     | Datum mean |         |
|------------------------|----------------------|-------------|---------|----------------------|-------------|---------|------|-----|------------|---------|
| Event                  | interval (cm)        | (mcd)       | (rmcd)  | interval (cm)        | (mcd)       | (rmcd)  | OB80 | M71 | (mcd)      | (rmcd)  |
| FAD Fasciculithus spp. | 1211A-15H-1, 45–46   | 142.015     | 141.571 | 1211-15H-2, 45-46    | 143.515     | 143.085 |      |     | 142.765    | 142.328 |
| FAD S. primus          | 1211A-15H-1, 45–46   | 142.015     | 141.571 | 1211-15H-2, 45–46    | 143.515     | 143.085 |      |     | 142.765    | 142.328 |
| FAD C. bidens          | 1211A-15H-1, 45–46   | 142.015     | 141.571 | 1211-15H-2, 45–46    | 143.515     | 143.085 |      |     | 142.765    | 142.328 |
| FAD E. macellus        | Indeterminable       |             |         | Indeterminble        |             |         | CP3  | NP4 |            |         |
| FAD C. danicus         | 1211A-15H-2, 45–46   | 143.515     | 143.085 | 1211-15H-3, 45–46    | 145.015     | 144.585 | CP2  | NP3 | 144.265    | 143.835 |
| FAD T. pertusus        | 1211A-15H-2, 45–46   | 143.515     | 143.085 | 1211-15H-3, 45–46    | 145.015     | 144.585 |      |     | 144.265    | 143.835 |
| FAD C. tenuis          | 1211A-15H-3, 45-46   | 145.015     | 144.585 | 1211-15H-4, 45-46    | 146.515     | 146.085 | CP1b | NP2 | 145.765    | 145.335 |
| K/T Boundary           | 1211A-15H-4, 146     | 147.52      | 147.09  |                      |             |         | CP1a | NP1 | 147.52     | 147.09  |

Notes: LAD = last appearance datum, FAD = first appearance datum. Bold = zonal markers or primary events. OB80 = Okada and Bukry, 1980, M71 = Martini, 1971.