8. CALCAREOUS NANNOFOSSIL BIOSTRATIGRAPHY OF MESOZOIC SEDIMENTS RECOVERED FROM THE WESTERN PACIFIC, LEG 129

Elisabetta Erba and James M. Covington

ABSTRACT

Calcareous nannofossils were studied from Jurassic and Cretaceous sediments drilled in the western Pacific during Ocean Drilling Program Leg 129. Mesozoic sediments at Sites 800, 801, and 802 are dominated by volcaniclastic turbidites, claystones, porcellanites, and radiolarites. Pelagic limestones are limited to the middle Cretaceous, and a few calcareous claystones were recovered in the Upper Jurassic section at Site 801.

We documented the distribution of nannofossils, their total abundance, preservation, and relative species abundance based on semiquantitative and qualitative studies. Preservation of the calcareous nannofossils is poor to moderate, and the total abundance fluctuates from rare to very abundant. Marker species proposed for the middle and Late Cretaceous were recognized, allowing the application of standard nannofossil biozonations.

At Site 800 calcareous nannofossils are abundant and moderately preserved in the Aptian-Cenomanian, and nannofossil biostratigraphy constitutes the basic stratigraphic framework for this interval.

Radiolarians are the most abundant and persistent group throughout the sequence drilled at Site 801. Long intervals are barren of nannofossils and assemblages are usually characterized by low abundance and poor preservation. Nannofossil biostratigraphy was applied to the upper Aptian-Cenomanian interval and a few marker species were recognized for the late Tithonian.

At Site 802 Cretaceous biostratigraphy is mainly based on calcareous nannofossil biozones corroborated by radiolarian and palynomorph events in the late Aptian-Coniacian age interval. A hiatus was indicated between the Santonian and the late Campanian, and another is suspected in the interval between the Cenomanian and the Coniacian.

INTRODUCTION

The objective of Ocean Drilling Program (ODP) Leg 129 was to recover the Jurassic oceanic crust of the Pacific Plate. In the past 20 years, nine Deep Sea Drilling Project (DSDP) legs were devoted to this objective (for a synthesis see Lancelot, Larson, et al., 1990), but a thick sequence of middle Cretaceous intrusive basalts and dolerites, cherts, and thick volcaniclastic units prevented recovery of the mythical Jurassic crust. New seismic data reinforced the possibility of recovering the oldest oceanic crust of the Pacific plate and located a window where the Jurassic was drilled for the first time.

During Leg 129 three sites were drilled (Fig. 1). Site 800 is located in the northern Pigafetta Basin at 21°55.38'N, 152°19.37'E, at a water depth of 5686 m, and lies on magnetic anomaly lineation M33. Four lithostratigraphic units were identified in the Mesozoic interval below approximately 38 m of Cenozoic pelagic brown clays. The hole was terminated after penetrating a total of 498.1 m of sedimentary rocks and 46.4 m of dolerite sills with minor chert layers.

Site 801 is located in the central Pigafetta Basin at 18°38.56'N, 156°21.57'E, at a water depth of 5673.8 m. It lies on the magnetic quiet zone southeast of a M25-M37 magnetic lineation sequence. Approximately 38 m of Cenozoic pelagic brown clays, and 92.5 m of nannofossil chalk. The Mesozoic consists of 14 m of pelagic brown clays, a thick sequence of volcaniclastic turbidites (222.8 m), and 92.5 m of nannofossil chalk. The Mesozoic is represented by 110.8 m of Upper Cretaceous volcaniclastic turbidites and 49.2 m of middle Cretaceous calcareous claystones and radiolarites, overlying 50.6 m of basalts.

The Mesozoic sediments recovered were dated mainly on the basis of calcareous nannofossils and radiolarians, with minor contributions by foraminifers. Palynomorphs were identified only in the oldest sediments recovered at Sites 802, in Cores 129-802A-56R and 129-802A-57R.

In this paper we document the occurrence, preservation, and abundance of calcareous nannofossils in the Jurassic and Cretaceous.

MATERIALS AND METHODS

Semiquantitative analyses of Mesozoic nannofossil assemblages were performed on a total of 538 samples collected from different lithologic types. The nannofossil assemblages were analyzed in smear slides with a polarizing light microscope, at 1250x magnification. Preparation was kept simple and smear slides were prepared directly from the sediment samples.

The total abundance of nannofossils was estimated by comparing their occurrence with those of the other biogenic particles and inorganic components. The following letter codes were adopted:

\[ \text{V} = \text{very abundant (>50% of the fine fraction)} \]  
\[ \text{A} = \text{abundant (30% to 50% of the fine fraction)} \]  
\[ \text{C} = \text{common (12% to 30% of the fine fraction)} \]  
\[ \text{F} = \text{few (2% to 12% of the fine fraction)} \]  
\[ \text{R} = \text{rare (<2% of the fine fraction)} \]  
\[ \text{B} = \text{barren} \]

The relative abundance of the individual nannofossil species was tabulated in the range charts as follows: \( V = \text{very abundant} \) (more than 10 specimens per field of view), \( A = \text{abundant} \) (1–10 specimens per field of view), \( C = \text{common} \) (1 specimen per 2–10 fields of view), \( F = \text{few} \) (1 specimen per 11–100 fields of view), \( R = \text{rare} \) (1 specimen per 101–1000 fields of view).

Estimates of preservation were based on the degree of etching, overgrowth, and breakage, and letter codes were assigned as follows: \( G = \text{good} \) (overgrowth and/or etching are virtually absent; nannofossils retain all the diagnostic characteristics), \( M = \text{moderate} \) (overgrowth and/or etching have partially altered the ultrastructure of nannofossils, but diagnostic features are preserved), \( P = \text{poor} \) (over-
growth, etching, and/or fragmentation have highly altered nannofossil ultrastructure).

All the species considered in this report and tabulated in the range charts are listed in the Appendix ordered by the specific epithets.

**PRESERVATION OF CALCAREOUS NANNOFLORAS**

Calcareous nannofossils are important constituents of pelagic carbonates since at least Jurassic times. They also occur in Triassic sediments (e.g., Bown, 1987; Bralower et al., 1991) but are sparse and constitute only a minor portion in pelagic micrite. Nannofloras increased in abundance and diversity through the Jurassic, and in the Tithonian they experienced a super bloom to become the major contributors to pelagic carbonates. Because nannoplankton are part of the phytoplankton community, nannofossils have been used in paleoceanography to reconstruct surface-water conditions and their changes through time. Moreover, calcareous nannofossil assemblages can provide information on the type and degree of diagenetic modification experienced by pelagic carbonates. In fact, their abundance, species diversity, and composition can put constraints on the secondary alterations superimposed on the primary inputs.

The overall preservation of Mesozoic nannofossils from Sites 800, 801, and 802 is generally poor with a few intervals characterized by moderate preservation. Long intervals of the sedimentary sequences underwent severe dissolution as documented by the high number of barren samples (Table 1). The dissolution/diagenesis resistant *Watznaueria barnesae* is always the dominant taxon and even it is exclusive in a few samples. The low abundance and poor preservation of nannofloras probably reflect a deep depositional paleoenvironment in an oceanic setting with important volcaniclastic inputs. The nannofloral assemblages might also reflect primary fluctuations controlled by the position of the drilled sites with respect to the paleoequator and possible fluctuations of carbonate vs. siliceous biogenic production. Indeed, equatorial crossings occurred at the three sites at different times during the Mesozoic. The paleoequatorial communities were dominated by radiolarians, which sporadically are the only microfossils preserved (Lancelot, Larson, et al., 1990; Erba, this volume). This situation is exacerbated by drilling because the poor recovery emphasizes the harder cherty lithology rather than the interbedded soft chalks or limestones.

As regards the Jurassic section drilled at Site 801, the lithology recovered is siliceous throughout with only scanty calcareous layers. These data might confirm that nannofossils became important producers of pelagic carbonates only in the late Tithonian. However, the paleodepth and paleolatitude of Site 801 might be more important factors controlling the type of organisms preserved in the Jurassic-lowermost Cretaceous sediments.

Nannofossil preservation will be discussed from the oldest to the youngest sediments, at each site.

**Site 800**

At Site 800 the oldest sediments overlying the dolerite sills consist of Berriasian-Barremian clays and radiolarites and therefore, Cores 129-800A-56R to 129-800A-51R are barren of calcareous nannofossils. The interval recovered in Cores 129-800A-50R to 129-800A-38R consists of volcaniclastics containing sparse nannofossils dominated by *Watznaueria barnesae*, with minor contributions by other robust species such as *Cretarhabdus surirellus*. Abundance is extremely low and diversity reaches a maximum value of six species in Sample 129-800A-39R-4, 30 cm. In this interval nannofossils show evidence of strong etching and minor secondary overgrowth.

Upward, from Core 129-800A-37R to Section 129-800A-33R-2, the nannofossil total abundance fluctuates from rare to common and diversity is as high as 16 species. Also in this interval species relatively sensitive to dissolution/diagenesis were encountered. Nevertheless, preservation remains poor and a few samples are barren of calcareous nannofossils.

A second dissolution pulse is recorded in the upper lower Aptian, from Core 129-800A-32R to Section 129-800A-27R-2, where most samples are barren of nannofossils. Only Sample 129-800A-28R-3, 24-25 cm, contains common moderately preserved nannofossils. In all the other nannofossil-bearing layers from this interval, diversity is very low. Nannofloras are rare to abundant in the upper Aptian and preservation is moderate. Throughout this interval diversity is relatively high, with a maximum value of 27 species in Sample 129-800A-26R-1, 18-20 cm.

In the lower and middle Albian nannofossils are slightly less abundant and diversified, and preservation is poor. An increase in abundance is recorded in the upper Albian to Cenomanian interval, where nannofloras display moderate to good preservation. Cores 129-800A-13R to 129-800A-11R, dated as Cenomanian mainly by radiolarians, contain rare nannofossils characterized by low species diversity and poor preservation.

The Turonian to upper Campanian interval is represented by cherts and porcellanites barren of calcareous nannofossils with the exception of Sample 129-800A-6R-1, 3-4 cm, in which rare specimens of *W. barnesae* were observed.

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**Table 1. Samples investigated for Mesozoic calcareous nannofossils at Sites 800, 801, and 802.**

<table>
<thead>
<tr>
<th>Site</th>
<th>Number of studied samples</th>
<th>Number of barren samples</th>
</tr>
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<tbody>
<tr>
<td>800</td>
<td>215</td>
<td>107 (49.7%)</td>
</tr>
<tr>
<td>801</td>
<td>164</td>
<td>109 (66.5%)</td>
</tr>
<tr>
<td>802</td>
<td>159</td>
<td>45 (28.3%)</td>
</tr>
</tbody>
</table>
Site 801

Site 801 is the first drill site at which Jurassic sediments overlying oceanic crust from the Pacific plate were recovered. The Jurassic section consists of red radiolarians, clays, and brown radiolarians virtually barren of calcareous nannofossils. In fact, only eight samples in the interval represented by Cores 129-801B-43R to 129-801B-19R contain rare nannofossils, which are characterized by poor preservation and low diversity. Nannofossils are absent in the Berrinian-Valanginian brown radiolarians and in the overlying volcaniclastic turbidites of Cores 129-801B-13R to 129-801B-10R.

This barren portion is overlain by a short interval (Cores 129-801B-9R and 129-801B-8R) with rare, poorly preserved nannofossils. Only Sample 129-801B-8R-4, 111-112 cm, contains a more abundant and moderately preserved nannoflora with a relatively high diversity. The Albian to Cenomanian interval is characterized by more abundant and better preserved nannofossils recording high diversity. Assemblages also contain species sensitive to diageneisis. In particular, nannofossils are abundant in the interval recovered in Cores 129-801A-19R to 129-801A-14R, which is dated as late Albian-Cenomanian.

The upper part of the Cretaceous, assigned to the Cenomanian-Maestrichtian from radiolarians, consists of brown cherts and pelagic carbonates. The rare Jurassic nannofossils observed in sediments through Sample 129-802A-51R-1,145-146 cm, dated as Cenomanian age. Diversity is relatively high but preservation is still poor. Strong etching is recorded in the clayey layers, whereas overgrowth is dominant in the limestones.

There are calcareous nannofossils in the Cretaceous section recovered at Site 802. Total abundance fluctuates from barren to very abundant, whereas preservation is usually poor. The oldest sediments overlying the basalts consist of claystones and volcaniclastic turbidites (Cores 129-802A-56R and 129-802A-57R) and are assigned to the late Albian-early Cenomanian. The percentage of calcareous nannofossils is very low but relatively high preservation is still poor. Strong etching is recorded in the clayey layers, whereas overgrowth is dominant in the limestones.

A dissolution event characterizes Cores 129-802A-52R through Sample 129-802A-51R-1,145-146 cm, dated as Cenomanian by radiolarians.

The Upper Cretaceous is represented by volcaniclastic turbidites underling a thin pelagic clayey unit. Calcareous nannofossils are rare to very abundant and preservation fluctuates from poor to moderate. Usually the clayey layers show evidence of dissolution, whereas limestones display strong overgrowth. The highest abundances are recorded in Cores 129-802A-43R and 129-802A-38R, which were dated as Santonian and late Campanian, respectively. Here the assemblages are well diversified and delicate taxa occur commonly. Cores 129-802A-41R and 129-802A-40R are virtually barren of nannofossils, which are represented in only a few layers by common W. barnesae and other dissolution-resistant forms.

**BIOSTRATIGRAPHY**

In the last two decades calcareous nannofossils have become the premier guide fossils for age dating and correlating of Mesozoic pelagic carbonates. After the first zonal scheme published by Barnard and Hay (1974), several nannofossil zonations were proposed for the Jurassic (Thierstein, 1976; Medd, 1982; Roth et al., 1983; Perch-Nielsen, 1985) and new, much more refined schemes have been proposed recently (Bown, 1987; Bown et al., 1988). The rare Jurassic nannofossils observed in sediments recovered during Leg 129 occur in the Oxfordian-Tithonian interval, in addition to sparse specimens of Watznaueria in older layers. For the Late Jurassic we used the scheme proposed by Bralower et al. (1989), who calibrated nannofossil events with magnetic anomalies.

Cretaceous calcareous nannofossil zonation and correlation. A number of much more detailed nannofossil biostratigraphic schemes have been proposed (Thierstein, 1976; Sissingh, 1977; Roth, 1978; Perch-Nielsen, 1985). Although their resolution is relatively low, these basic zonations are reliable and reproducible worldwide and have been proven extremely useful for correlation. A number of much more detailed nannofossil biostratigraphic schemes have been proposed (Thierstein, 1976) and Monnecchi and Thierstein (1985) for the Late Cretaceous. Slight modifications of these biostratigraphic schemes were adopted as proposed by Sissingh (1977) and Roth (1978, 1983) who introduced letter codes and numbers for the biozones. Correlation of nannofossil events with magnetic anomalies is based on Bralower (1987) and Channell and Erba (in press) and on Monnecchi and Thierstein (1985) for the Lower and Upper Cretaceous, respectively.

**Site 802**

Calcareous nannofossils are the dominant group in the Cretaceous section recovered at Site 802. Total abundance fluctuates from barren to very abundant, whereas preservation is usually poor. The oldest sediments overlying the basalts consist of claystones and volcaniclastic turbidites (Cores 129-802A-56R and 129-802A-57R) and are assigned to the late Albian-early Cenomanian. The percentage of calcareous nannofossils is very low but relatively high preservation is still poor. Strong etching is recorded in the clayey layers, whereas overgrowth is dominant in the limestones.

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<table>
<thead>
<tr>
<th>AGE (M.Y.)</th>
<th>STAGE</th>
<th>CALCAREOUS NANNOFossil BIOSTRATIGRAPHY</th>
<th>LEG 129 - CORES</th>
</tr>
</thead>
<tbody>
<tr>
<td>70</td>
<td>Maestrichtian</td>
<td>Monchi &amp; Thierstein, 1985</td>
<td></td>
</tr>
<tr>
<td>80</td>
<td>Campanian</td>
<td>Roth Sissingh 1978, 1977</td>
<td></td>
</tr>
<tr>
<td>90</td>
<td>Santonian</td>
<td></td>
<td></td>
</tr>
<tr>
<td>100</td>
<td>Coniacian</td>
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<td></td>
</tr>
<tr>
<td>110</td>
<td>Turonian</td>
<td></td>
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</tr>
<tr>
<td>120</td>
<td>Cenomanian</td>
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<tr>
<td>130</td>
<td>Aptian</td>
<td></td>
<td></td>
</tr>
<tr>
<td>140</td>
<td>Barremian</td>
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<td></td>
</tr>
</tbody>
</table>

**Figure 2**: Synthesis of nannofossil biostratigraphy applied to the Cretaceous sediments recovered at Sites 800, 801, and 802. Absolute ages, chronology, and magnetic polarity sequence after Kent and Gradstein (1985).

The first appearance of *Prediscosphaera columnata*, defining the base of the *P. columnata/NC8/CC8* Zone, occurs in Sample 129-800A-24R-1, 86–87 cm, within the lower portion of lithologic Unit III. It is not possible to determine the Aptian/Albian boundary using calcareous nannofossils, but the first occurrence of *P. columnata* has always been regarded as an early Albian event. Therefore, the Aptian/Albian boundary should be placed in the upper portion of the *P. angustus/NC7/CC7* Zone and could coincide with the boundary between lithostratigraphic Units IV and III. Consequently, a hiatus could not be ruled out at this interval.

The *P. columnata/NC8/CC8* Zone extends to Sample 129-800A-21R-2, 3 cm, where *Eiffellithus turriseiffelii* was first observed. This event is used to define the base of the *E. turriseiffelii/NC10/CC9* Zone. Roth (1978) proposed the first occurrence of *Axopodorhabdus albianus* to identify the base of his NC9 Zone and Thierstein (1976) used this event as marker in the middle Albian. *A. albianus* is extremely rare at Site 800 and occurs only in the overlying zone. According to Perch-Nielsen (1985), an alternative middle Albian event is the first occurrence of *Tranolithus orionatus*, which was recorded in Sample 129-800A-23R-1, 21–22 cm. In the *P. columnata* Zone we also observed the first occurrences of small *Eiffellithus* closely resembling *E. eximius* and of *Biscutum blackii*.

The interval corresponding to Samples 129-800A-21R-2, 3 cm, through 129-800A-11R-1, 11–13 cm, is attributed to the late Albian-Cenomanian *E. turriseiffelii/NC10/CC9* Zone. *Cruciellipsis chiastia* occurs consistently in this zone, indicating an age not younger than Cenomanian. The Albian/Cenomanian boundary can not be accurately identified using nannofossil events. Thierstein (1976) proposed the first occurrence of *Lithraphidites acutus* to define this boundary.
but subsequent research (e.g., Verbeek, 1977; Perch-Nielsen, 1985) extended the range of this taxon into the Albanian. This event was used by Roth (1978) to separate his Zone NC10 from Zone NC11. *L. acutus* was never observed at Site 800 and therefore the NC10/CC9 Zone was not identified. Sissingh (1977) proposed separating Zone CC9 from Zone CC10 on the first occurrence of *Microhabdulus decoratus*. This taxon was also not observed at Site 800. *R. irregularis* ranges as high as Sample 129-800A-16R-CC. Although the last occurrence of this species is not used as a datum plane in the adopted zonal schemes, according to Perch-Nielsen (1985) and Erba (1988) this taxon has its last appearance in the latest Albanian. Consequently, the Albanian/Cenomanian boundary might be placed above Sample 129-800A-16R-CC.

Calcaneous nannofossils are virtually absent in the remaining Cretaceous interval at Site 800, dated as Turonian-late Campanian on *Parhabdolithus* sp., *nis*, *C. margerelii*, *B. Constans*, *Discorhabdus rotatorius*, *Zygodiscus Poly*-sp., Nannofossils observed in Sample 129-801B-26R-CC include the basis of radiolarians. Albian/Cenomanian boundary might be placed above Sample 129-801A-19R-CC. But subsequent research (e.g., Verbeek, 1977; Perch-Nielsen, 1985) and Erba (1988) this taxon has its last appearance in the latest Albanian. Other taxa that record their lowest appearance within the *P. columnata* Zone are *Cribrosphaerella eberneri*, *Prediscosphera cretacea*, and small *Eiffellithus*.

In Sample 129-801A-19R-CC *Eiffellithus turriselli* has its first occurrence and is used to define the base of the *E. turrisellii*/NC10/CC9 Zone. The nannofossil assemblages are abundant and moderately preserved in this interval, which extends to Sample 129-801A-14R-1, 62–63 cm. The absence of *L. acutus* and *M. decoratus* prevented the identification of the NC11 and CC10 Zones. The occurrence of *C. chiastia* throughout this zone indicates an age not younger than Cenomanian; the Albanian/Cenomanian boundary was placed between Cores 129-801A-15R and 129-801A-16R on the basis of the radiolarian distribution. The Cenomanian-Maestrichtian interval corresponding to Cores 129-801A-13R through 129-801A-7R consists of cherts, porcellanites, and pelagic brown clays barren of calcaneous nannofossils.

**Site 802**

The oldest sediments recovered at Site 802 consist of volcanic turbidites (lithostratigraphic Unit IX) and claystones (lithostratigraphic Unit VIII) containing rare, poorly preserved nannofossils (Table 4, back pocket). Assemblages consist of the dissolution/diagenesis-resistant species *W. barnesae*, *R. terebodontarius*, and *P. embergeri*, which are not age diagnostic. However, the occurrence of *P. angustus* in Sample 129-802A-57R-1, 110–111 cm, indicates an age not older than late Aptian. This assignment is consistent with pyknomorph biostratigraphy indicating a late Aptian–Albian age for Cores 129-802A-56R and 129-802A-57R.

Calcaneous nannofossils become common to very abundant in the interval between Samples 129-802A-55R-CC and 129-802A-53R-1, 66–67 cm, which is assigned to the NC10/CC9 Zone. The base of the NC10/CC9 Zone is defined on the basis of the first occurrence of *E. turriselli* in Sample 129-802A-55R-CC. *C. chiastia* is recorded up to Sample 129-802A-53R-1, 66–67 cm, indicating an age for this interval not younger than Cenomanian. Poorly preserved specimens of *Lithraphidites acutus* were observed in Samples 129-802A-55R-1, 14A-13 cm and 129-802A-53R-CC. The first occurrence of this species is used to define the base of the NC11/CC10 Zone, dated to the late Cenomanian. At Site 802 *L. acutus* is too rare to consider its first appearance a reliable event and therefore we do not separate Zone NC10 from Zone NC11. Also *M. decoratus* was not observed in this interval and therefore we did not distinguish Zone CC10.

Cores 129-802A-52R and 129-802A-51R recovered claystones and radiolarites and are barren of calcaneous nannofossils. In the zonal scheme adopted the first occurrence of this species is used to define the base of the NC11/CC10 Zone and 183
Turonian/Coniacian boundary. This Zone extends through Sample 129-802A-50R-2, 83–86 cm. In the subsequent Sample 129-802A-50R-2, 45–46 cm, the first occurrence of *Micula decussata* was observed and, therefore, we placed the base of the CC14. This zone is short because it is limited to the interval from Samples 129-802A-50R-2, 45–46 cm, to 129-802A-49R-3, 107–109 cm. The Coniacian/Santonian boundary falls within this zone.

*Lithastrinus gilli* was first observed in Sample 129-802A-49R-3, 107–109 cm. This event was used to place the boundary between Zones CC14 and CC15 as suggested by Perch-Nielsen (1985). The interval from this sample through Sample 129-802A-43R-1, 26–27 cm, was attributed to the Santonian CC15–CC16 Zones. Nannofossils are rare to very abundant, diversity relatively high, and preservation is poor to moderate. We did not find *L. cayeurii* or *L. septenarius* and therefore could not separate Zone CC15 from Zone CC16.

A hiatus was identified between Cores 129-802A-83R and 129-802A-42R. In fact, several late Campanian marker species occur in Sample 129-802A-42R-CC. They include *Ceratolithoides aculeus*, *Calcilites obscurus*, *Quadrum gahlicum*, and *Quadrum sissinghii*. We attributed the interval between Samples 129-802A-42R-CC and 129-802A-38R-2, 129–130 cm, to the late Campanian CC21 Zone. The lower part of this interval contains rare and strongly dissolved nannofossil assemblages. Nannofossils become more abundant and better preserved in the upper part of this zone. In Sample 129-802A-38R-2, 45–46 cm, we used the first appearance of *Quadrum trifidum* to place the base of the late Campanian CC22 Zone. *L. gilli* has its last occurrence within this zone, in Sample 129-802A-38R-2, 29 cm. The CC22 Zone extends to Sample 129-802A-38R-1, 1 cm, which is the highest sample containing Cretaceous nannofossils.

**SUMMARY AND CONCLUSIONS**

The Jurassic and Cretaceous sequences recovered at Sites 800, 801, and 802 were investigated for their calcareous nannofossil content. Light microscope analyses were performed on more than 500 samples from different lithologic facies. Calcareous nannofossils are usually not abundant and are poorly preserved. In fact, the Mesozoic sediments at these deep oceanic sites are dominated by chert, porcellanite, radiolarite, and claystone. Moreover, thick volcaniclastic turbidites were recovered in the middle and Upper Cretaceous interval.

We documented the occurrence, abundance, and preservation of calcareous nannofossils from the Bathonian to Campanian. Intervals barren of nannofossils or yielding only sparse solution-resistant taxa alternate with intervals containing abundant, moderately preserved assemblages with a relatively high diversity.

At Site 800 calcareous nannofossils provided the biostratigraphic framework for the Aptian-Albian interval. All the standard biozones were recognized.

Only very rare nannofossils were observed in the Jurassic sediments drilled at Site 801. Few specimens of *W. manivitae* were encountered in claystones from basement pillow lavas. A late Tithonian assemblage was identified between the Santonian and the late Campanian and another interval dated on the basis of nannofossil events.

The middle and Upper Cretaceous sequence recovered at Site 802 was dated with nannofossil biostratigraphy corroborated by radiolarian and palynomorph events in the middle Cretaceous. A hiatus was identified between the Santonian and the late Campanian and another one is suspected between the Cenomanian and the Coniacian.

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