PALAIOS
Emphasizing the impact of life on Earth's history

PALAIOS 2010
Book Review
DOI: 10.2110/palo.2010.BR54

Evolutionary Stasis and Change in the Dominican Republic Neogene, edited by Ross H. Nehm and Ann F. Budd, 2008, Springer, New York, 314 p., USD 219.00, hardcover, ISBN: 9781402082146

"The important thing in science is not so much to obtain new facts as to discover new ways of thinking about them."
Sir William Henry Bragg, Nobel Prize for Physics, 1915

From the pioneering descriptive work of lone European and North American scientists like G.B. Sowerby II and W.M. Gabb, through the groundbreaking investigations of Carlotta Joaquin Maury, to the international and multidisciplinary Dominican Republic Project, paleontological research in the Dominican Republic (DR) has taken many forms over the last 150 years. The common thread that unites this work, however, is the exquisite fossil record contained in Neogene sediments exposed along the southern flank of the Cibao Valley. Recent investigations focused on these fossils and sediments have yielded high-resolution stratigraphic controls, detailed environmental reconstructions, and significant taxonomic revisions. Furthermore, these studies provide the necessary background for evaluating evolutionary change in tropical American oceans. *Evolutionary Stasis and Change in the Dominican Republic Neogene*, edited by Ross H. Nehm and Ann F. Budd, provides an up-to-date introduction to invertebrate paleontology in the northern Dominican Republic, highlights avenues for future research, and touches on intriguing and timely issues facing geoscience educators today.

This contribution is volume 30 in Springer's Topics in Geobiology book series. It contains 13 chapters, which the editors informally organized into four sections: 1) Geology, Paleoenvironment, and Taphonomy; 2) Species-Level Patterns of Evolutionary Stasis and Change; 3) Stability and Change in Coral and Mollusc Assemblages; and 4) Education and Infrastructure. Chapter 1 (Nehm and Budd) provides a brief introduction to paleontological research in the DR. After introducing many of the important early contributions, the authors discuss the genesis, history, and accomplishments of the Dominican Republic Project (DRP), which includes 22 systematic monographs published since 1986 and numerous stratigraphic and paleoenvironmental studies. The authors also highlight research focused on evolutionary questions, including several focused explicitly on quantitative analysis of evolutionary change and stasis. The chapter continues with a brief synopsis of the remainder of the volume and concludes with the stated goal for the book (p. 14): "…to build an empirical, conceptual, and historical bridge between the accomplishments of past DR project workers and future students, scientists, and research questions."

Chapter 2, by McNeill et al., presents an overview of the geology and stratigraphy of the Cibao Valley. While this chapter is largely a review of previous work, some new interpretations are given, as well as a refined age model for several Miocene and Pliocene sections. That said, the reader should be aware that these data are preliminary and the authors promise a more complete treatment of the stratigraphic data. The stated goals of this ongoing work include refined chronostratigraphy, improved intra- and interbasin correlations, constrained rates of faunal turnover and evolutionary change.

The next chapter (Denniston et al.) focuses on reconstructing late Miocene seasonality using oxygen isotope and Sr/Ca ratios from fossil coral (*Goniopora hilli*). The 21-year-long biogeochemical record represents paleoceanographic conditions in the central Caribbean prior to the final closure of the Central American Seaway. The authors claim to have identified a decadal-scale periodicity in both $\delta^{18}O$ and Sr/Ca profiles. These data, however, are not suitable for statistical analysis, and this conclusion remains speculative. As above, ongoing work on this archive promises to shed light on late Miocene paleoenvironmental variability.

The first section of the volume concludes with an analysis of taphonomic patterns from turbinid gastropods (*Turbo dominicensis* and *T. crenulatoides*) by Nehm and Hickman. The authors test two hypotheses: (1) that shells and opercula from the same species record similar taphonomic trends; and 2) that shells and opercula from morphologically similar species also show similar paleobiological patterns. Using several paleobiological metrics (diversity, abundance, age and size), the authors reject the hypothesis that shells and opercula from the same species produce similar estimates of species richness, abundance, and stratigraphic range. Furthermore, they caution against extrapolating taphonomic patterns among morphologically similar species and suggest that biological factors may be as important as physical processes in influencing paleobiological signals in the fossil record.

Section two of the book opens with one of four papers focused on evolutionary stasis and change in coral and mollusk species. Chapter 5, by Budd and Klaus, is an examination of

evolutionary stasis within the *Montastraea "annularis"* reef-coral complex. The authors take advantage of Bookstein shape coordinates as well as traditional linear measurements and counts of morphological features to identify and characterize individual species. The authors show that this species complex exhibited morphological stasis over the last ~6 m.y., although changes in disparity and directional morphological change were observed.

Following this theme, Chapter 6 investigates patterns of evolutionary change in the reef-coral *Siderastrea*. The authors (Beck and Budd) test the hypothesis that these corals show an evolutionary pattern of punctuated equilibrium similar to that observed in bryozoans and mollusks. Using two-dimensional geometric morphometric techniques, they show that *Siderastrea* underwent evolutionary stasis during the Mio-Pliocene despite significant changes in the depositional environment.

The next chapter (Shultz and Budd) examines the diversity of the *Montastrea "cavernosa"* species complex in the DR during the Mio-Pliocene. Using an expanded and more robust sample, combined with geometric morphometric techniques, the authors document approximately twice the diversity than was previously thought to exist. In addition to highlighting the utility of geometric morphometrics for identifying new scleractinian coral species, the authors point out that, with additional specimens from the DR and around the Caribbean basin, additional species in the *Montastrea "cavernosa"* complex are likely to be identified.

Chapter 8 (Nehm) focuses on marginellid gastropods (*Prunum*) to investigate the maintenance of stasis and its relationship to the production of morphological novelty. Interestingly, in contrast to several earlier studies in this volume, morphometric methodologies did not identify additional taxa when compared with analyses based on traditional distance measurements. Despite the fact that several taxa can be confidently distinguished, the chapter unfortunately offers little in the way of resolution regarding the questions outlined in its introduction.

The third set of chapters centers around stability and change in coral and mollusk assemblages. Given that numerous species from the DR demonstrate evolutionary stasis, these papers ask if their host communities also demonstrate stasis in space and time. The first, by Klaus et al., uses interformational persistence, presence/absence data, and relative abundances to document stasis in DR coral-reef communities. Persistence and presence/absence data suggest these communities meet the minimal threshold for community stasis. In contrast, relative abundance data suggest coral community composition was changing significantly in the Mio-Pliocene. The authors suggest that these inconsistent results reflect the influence of environmental change on relative abundance trends, and to a lesser degree, issues related to taxonomic resolution discussed in previous chapters.

The next chapter examines mollusk community stability in the Río Gurabo section (Rivera et al.). The goal of this study was to document assemblage-level stasis from the same locality in which species-level stasis was previously identified. The analyses focused on species composition, relative abundance, species richness, and trophic habit. Interestingly, despite documented cases of stasis in gastropod and bryozoan species, the authors find no evidence to support assemblage-level stasis. The authors note, however, that their sample size, while large (~16,000 specimens from >300 species), needs to be expanded to adequately characterize mollusk paleocommunities.

The final chapter in this section (Johnson et al.) examines the effects of a revised age model (presented in Chapter 2) on the timing and magnitude of origination and extinction in Caribbean coral faunas. The new age model shifts regional first occurrences from 9–7 Ma to 7–5 Ma and highlights a previously unknown sampling gap in the late Miocene. The authors also highlight the importance of temporal and geographic completeness, as well as alternate taxonomic and stratigraphic interpretations, when assessing diversity trajectories using paleontological databases.

The final section of the book contains two chapters and focuses on education and infrastructure. The first chapter (Nehm et al.) examines two science education projects linked to the DRP: United States science education of Dominican American students and international outreach in the DR. These projects were developed in response to the paucity of Dominican American or Dominican national student participation in the DRP over the last 30 years. This chapter points to the importance of encouraging and recruiting minority students in United States science education and research.

The last chapter provides a brief overview of the Neogene Marine Biota of Tropical America (NMITA) relational database (http://nmita.geology.uiowa.edu) (Budd et al.). In addition to information on taxa collected as part of the DRP, NMITA hosts data from the Panamá Paleontology Project. The NMITA database is a valuable research and teaching resource, and I encourage the reader to learn more about it.

At times, I was somewhat frustrated by this volume. First, I was surprised to see that the editors authored or coauthored every chapter in the volume, which made me question the breadth of perspective in the book; however, given their respective expertise, I suspect this was either reasonable or necessary. Second, many authors concluded chapters with the caveat that their conclusions were based on preliminary or insufficient data. While I suspect few of us are ever completely satisfied with the quality of our data, I encountered these statements more often that I would have liked. Finally, I must say my jaw hit the floor when I saw the cost of the book—$219! Accordingly, I cannot recommend that my colleagues add this volume to their personal libraries. That said, I do suggest that a copy of this volume be purchased for your institutional library. Also check your local library's website, as your institution may already subscribe to book chapters electronically through SpringerLink.

Despite these criticisms, I thoroughly enjoyed reading *Evolutionary Stasis and Change in the Dominican Republic Neogene.* This volume certainly meets its stated goal and will likely serve as a bridge between past DRP accomplishments and future research. And after reviewing this book and reflecting on Bragg's quote, it is clear that there is much work that remains to be done with Neogene fossils from the Dominican Republic.

David H. Goodwin
Department of Geosciences
Denison University
Granville, Ohio 43023-0810, USA
goodwind@denison.edu