Introduction to the symposium “Advances in Chiton Research”*

Douglas J. Eernisse

Department of Biological Science, California State University, Fullerton, California 92834, U.S.A., deernisse@fullerton.edu

The present volume features contributions from participants of the symposium, “Advances in Chiton Research,” in Seattle, Washington on 31 July 2006. As the organizer for this symposium, I was impressed with the willingness of national and international authorities or students whose diverse research involves chitons to participate in these meetings. The symposium was a tremendous success and compared favorably to four previous meetings of international scope that were devoted to chitons: (1) 1987 AMS symposium on “Biology of the Polyplacophora” in Key West, Florida (see American Malacological Bulletin 6(1), 1988); (2) 1st International Chiton Symposium, 1991, Adelaide, Australia (see Journal of the Malacological Society of Australia 13, 1992); (3) the 4th International Workshop on Malacology devoted to Polyplacophora, 2001, Menfi, Sicily, Italy (see Bollettino Malacologico Supplemento 5: I-IV, [2003] 2004); and (4) 2nd International Chiton Symposium, 2003, Tsukuba, Japan (see Venus 65(1-2), 2006). The participants of the present symposium (Fig. 1) featured 14 speakers, of whom half were international, and 10 posters devoted to chitons. Including all co-authors, there were 39 total contributors to the symposium and about a third of these were students.

Research on chitons is central to many aspects not only of malacology but also of zoology, paleontology, evolutionary biology, molecular systematics, molecular evolution, physiology, and ecology (reviewed by Schwabe and Wanninger 2006, Eernisse 2007, Todt et al. 2008). The present collection of articles reflects this integrative role for contemporary chiton research. Some of the symposium speakers are not represented here because they have already published articles related to their talks in other journals, including Jean-Bernard Caron (Caron et al. 2006a, 2006b), Ryan Kelly (Kelly and Eernisse 2007, 2008, Kelly et al. 2007), and Enrico Schwabe (Schwabe 2008). Lesley Brooker (“Genes and biominalization in the radular teeth of chitons”) and Bruce Runnegar (“Paleontological evidence for the origin of valves in polyplacophoran molluscs”) gave insightful presentations and have contributed as co-authors on articles in this volume. Bernie Lieb and his coauthors have continued to elucidate the molecular evolution and systematics of molluscan hemocyanin (e.g., Bergmann et al. 2007), and his forthcoming collaborative studies on chiton hemocyanin as a promising new phylogenetic marker are eagerly anticipated. Those who have contributed articles for the present volume still represent an impressive cross-section of the diverse, ongoing research on chitons.

Pojeta and DuFoe (this volume) have extended what is known about the earlier described Ordovician spiny chiton, Echinochiton dufoei Pojeta, Eernisse, Hoare, and Henderson, 2003. This fossil has already figured prominently in the ongoing debate on the disparity of Paleozoic chitons, including whether the geologically younger multiplacophorans diverged from within chitons or from an earlier “stem chiton” ancestor, and whether certain Cambrian “problematica” with disputed affinities, such as Wiwaxia Walcott, 1911, halkierids, and Odontogriphus Conway Morris, 1976 could potentially be close relatives of chitons. The four previously known E. dufoei specimens were already remarkable for their articulated preservation but details of the anterior portion of the animal were still unknown. After additional monumental collecting effort by co-author Jimmie DuFoe, resulting in the discovery of even better fossil examples that were also displayed in a special session at the symposium, Pojeta and DuFoe are now able to provide details of the anterior portion. They show that the anterior portion has the same striking hollow girdle spines found surrounding the rest of the animal. The authors also reconsider the significance of E. dufoei in discussions of molluscan and polyplacophoran evolution.

Shaw et al. (this volume) have contributed an extremely useful description of methods they used to analyze radular tooth formation and biominalization, ensuring minimum deformation of the fragile associated tissue layers involved in biominalization processes. Based on Jeremy Shaw’s Ph.D. research, the authors have employed multiple state-of-the-art electron microscopy approaches to analyzing biominalization processes in chitons, the results of which are being published elsewhere (e.g., Shaw et al., 2008). The exquisite results achieved by these authors reflect not only the con-

---

* From the symposium “Advances in Chiton Research” presented at the joint meeting of the American Malacological Society and Western Society of Malacologists, held 29 July to 3 August 2006 in Seattle, Washington.
siderable contributions by Shaw but also the high quality of the electron microscope facility at Murdoch University, Perth, Western Australia, headed by co-author David Macey, and notably drawing on the considerable expertise of Shaw’s mentor, co-author Lesley Brooker. Besides a detailed examination of potential fixation artifacts, with implications for interpreting electron micrographs, I was especially impressed by the simple method for cleaning a radula using a high-pressure jet of water. The clever adaptation of a disposable pipet tip not only allows for avoiding artifacts associated with applying alkaline treatment but also results in the most pristine images of a chiton radula that I have ever seen.

Sigwart (this volume) has extended what has long been recognized as a phylogenetically informative set of traits, the position of the gill rows relative to the foot, the nephridiopores, and the gonopores, and also characteristics and the number of the gills within each gill row, to reveal unexpected variation in the most poorly known of all chiton taxa: the

mostly deep-water Lepidopleurida (sensu Sirenko, 2006; alternatively as Lepidopleurina). Her present contribution and her ongoing molecular and morphological investigations are welcome additions to the scant literature on lepidopleurid chitons.

Vendrasco et al. (this volume) have investigated the phylogenetic utility of the aesthetic (or esthete) canal morphology in Mopaliidae, testing between different expectations implied by either its conventional classification or the conflicting arrangement predicted by molecular results (Kelly and Eernisse 2008, Eernisse, unpubl. data). This is a significant change because it implies that Mopaliidae, as recently reformulated (e.g., Eernisse et al. 2007), had a relatively recent origin and a dramatic subsequent diversification while largely confined to the northern Pacific Ocean. Based on the pattern of innervation of esthetes, Vendrasco et al. provide independent corroboration generally agreeing with the molecular arrangement. Moreover, they have further demonstrated the phylogenetic utility of considering esthete innervation patterns across chitons.

Clark (this volume) has contributed two significant taxonomic articles here, the first clarifying the taxonomic status a north/south species pair of common, but confusing, chiton gametes and their interaction is highly informative for chiton phylogenetics.

Finally, I have contributed (Eernisse, unpubl. data) a preliminary phylogenetic analysis of worldwide chitons based on about 350 partial sequences of the mitochondrial 16S ribosomal DNA gene. While this is planned to be the first phase before an eventual multi-locus analysis including these same taxa, the 16S gene appears to be relatively effective in both separating chiton species and in providing a higher-level inference of relationships that agrees well with recent cladistic morphological analyses. The taxon sampling in this study is much more extensive than in the only previous DNA-based analysis of chiton phylogeny (Okusu et al. 2003). This has allowed a more complete inference of relationships across chitons, with important phylogenetic implications that mostly agree with, but also challenge, certain aspects of our best available classifications of living chitons (e.g., Sirenko 2006).

I thank the 2006 AMS/WSM President, Roland Anderson (Seattle Aquarium), for enlisting me as organizer for this symposium. I am grateful to AMS and WSM for helping with registration costs for the day of the symposium and travel-cost assistance.

LITERATURE CITED

Bergmann, S., J. Markl, and B. Lieb. 2007. The first complete cDNA sequence of the hemocyanin from a bivalve, the protobranch Nucula nucleus. Journal of Molecular Evolution 64: 500-510.


