

Estuarine Research

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Estuarine Research

VOLUME I

**Chemistry, Biology,
and the Estuarine System**

Edited by

L. Eugene Cronin

Estuarine Research Federation



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Preface

These publications are the first of a biennial series planned by the Estuarine Research Federation to present new information and concepts relating to the estuaries of the world. Volumes I and II contain the papers presented in the Second International Estuarine Research Conference, held by the Federation at Myrtle Beach, South Carolina in October of 1973. The Conference was cosponsored by the American Society of Limnology and Oceanography and by the Estuarine and Brackish Water Sciences Association.

There has been a rapid and recent increase in research on estuaries, their components and processes, and their responses to human activities. The increase has followed recognition of the exceptional value of these coastal systems, awareness of the abuse many of them have received, and expanding scientific interest in these complex and highly dynamic bodies of water which link the fresh water and the seas. As the number of persons engaged in estuarine research, and of those who wish to use the product of such research increased, so, too, did the need for improved communications among and from investigators. A small Atlantic Estuarine Research Society was organized in 1947 to provide frequent, informal exchange. In later years, the New England Estuarine Society, the South Atlantic Estuarine Research Society, and the Gulf Estuarine Research Society have emerged to serve their respective regions. All of these have joined to form the Estuarine Research Federation, an umbrella organization for the constituent societies and their 1200 members, with potential for adding additional, interested organizations. The Federation conducts and publishes biennial symposia on "Recent Advances in Estuarine Research," implements estuarine research, and provides assistance on national and international policies and practices related to estuaries.

A valuable symposium on estuaries was held under multiple sponsorship in 1964 at Jekyll Island, Georgia, and produced the classic volume *Estuaries* edited by George Lauff and published by AAAS. That volume was comprehensive. The Federation held its First International Conference on Long Island in 1971 but publication of papers was not feasible. The Federation recognizes that total coverage is no longer feasible at any one point in time because of the expanding production of new results of research. The Executive Board has therefore de-

cided to select, for each biennial meeting, those topics in which major recent advances have indeed been achieved, design a symposium for their presentation and discussion, and arrange for publication. These are the first products. Volume I contains papers on *Chemistry*, focused on the Cycling of Elements and Estuaries; *Biology*, including sessions on the Dynamics of Food Webs, Nutrient Cycling, Zooplankton, Nekton, and Benthos; and *The Estuarine System*. Volume II provides publications on *Geology*, with collections on Estuaries with Small Tidal Ranges, Intermediate Tidal Ranges, and Large Tidal Ranges, and an additional section on Wide-Mouthed Estuaries. It also includes new materials on *Engineering*, with emphasis on Use of Vegetation in Coastal Engineering and on Estuarine Dredging Problems and Effects. The Third International Conference will be held by the Federation in October of 1975 at Galveston, Texas. The present publications are somewhat delayed in production, but rapid completion of future volumes is a foremost goal and commitment.

We wish to express exceptional appreciation to the conveners, chairman, and contributors, identified elsewhere, for the innovative and dedicated efforts they put into the creation and conduct of the Conference. Dr. Robert J. Reimold of the University of Georgia gave excellent supervision to the pre tion and arrangement of all materials for camera-ready copy.

Quite special acknowledgment is given to the Office of Coastal Zone Management of the U.S. National Oceanic and Atmospheric Administration and its Director, Dr. Robert Knecht, for considerably administered financial support which made possible participation by scientists from distant laboratories and the preparation of final materials for publication.

L. Eugene Cronin
Chairman

Austin B. Williams

Jerome Williams

For the Editorial Committee

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PART I

CHEMISTRY: CYCLING OF ELEMENTS IN ESTUARIES

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SEDIMENT-WATER EXCHANGE IN CHESAPEAKE BAY

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and

Bruce N. Troup¹

ABSTRACT

In Chesapeake Bay, diagenetic reactions in the sediment-interstitial water environment result in the enrichment of many dissolved species relative to their concentrations in the overlying water. Rapid exchange of dissolved species across the sediment-water interface in response to physical and chemical processes leads to the establishment of strong gradients in these species in the upper meter of the sediment column. In spite of the non-equilibrium nature of the overall system, the concentrations of species that participate in reactions whose time scales are rapid relative to their transport through the system, can be adequately described in terms of equilibrium models. The concentrations of chemically non-reactive dissolved materials and species that are involved in slow reactions relative to movement through the system, must be modeled on the basis of non-equilibrium diffusional transport.

INTRODUCTION

Estuaries are complex systems which receive chemical inputs from a variety of different sources (Fig. 1). River run-off contributes dissolved species derived from chemical weathering of rocks in the watershed, suspended material from mechanical weathering of terrigenous matter, and dissolved and particulate organic material of biogenic origin. The influx of sea water provides a strong

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