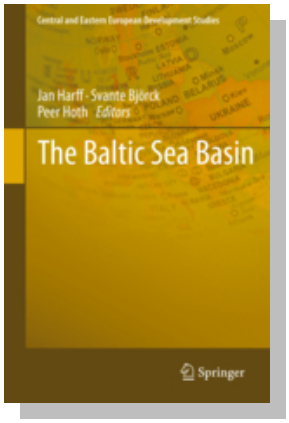

The Baltic Sea Basin, edited by Jan Harff, Svente Björck & Peer Hoth, 2011. Central and eastern European development studies. Springer-Verlag Berlin, Heidelberg, Germany. Hardcover, xiii + 449 pages. Price US$ 179.00, € 139.05. ISBN 978-3-642-17219-9. E-book price € 119.99. E-ISBN 978-3-642-17220-5.

In many ways the Baltic Sea, situated in northern Europe, is a unique area. It is a shallow (55 m average depth), semi-enclosed, marginal sea. However, like fjords, it is composed of several basins separated by shallow sills. Consequently, the water exchange between the various parts, and between the Baltic and the North Sea is limited. It makes the Baltic the world's largest brackish-water basin.

There is still a debate going on about the origin of the Baltic Sea Basin; some consider it to be mostly an erosional structure, whereas others tend to see it as a tectonic depression. Its latest history encompasses the time-span after the Last Glacial Maximum when a large ice-marginal lake developed through a number of fresh-water and brackish stages into the modern brackish sea. During this evolution, large sea (lake) level changes occurred, which were partly due to glacio-isostatic movements. Observations of their impacts may serve as a kind of laboratory for the analysis of the effects of sea-level changes on various types of coast. Additionally, Baltic Sea sediments provide high-resolution records of climate and environmental changes during the Late Quaternary at a regional scale. Around 15,000 years ago, humans settled around the Baltic Sea and used the local ecosystem resources; they were also exposed, however, to site-specific natural hazards. Nowadays, the Baltic Sea drainage area is populated by about 85 million people and the exploitation of the Baltic Sea resources cause many conflicts between socio-economic interests and the unique ecological environment. The major problems include eutrophication, chemical pollution, overfishing, immigration of alien species, and climate variations.

The Baltic Sea Basin is, as may be deduced from the short description above, of potential interest for geoscientists from several disciplines, using a wide spectrum of research approaches. The Baltic Sea drainage area has a border with 14 countries, which obviously requires exchange of research results at an international level. To meet this need, some recognized researchers - Jan Harff (Warnemünde, Germany), Svante Björck (Lund, Sweden) and Peer Hoth (Berlin, Germany) - edited a joint publication prepared by 66 scientists from 13 countries, representing various geology-related disciplines (geoscientists, climate researchers, biologists, archaeologists, and computer scientists) in order to give a comprehensive and general overview of the Baltic Sea Basin. The book partly results from a special symposium, 'The Baltic Sea Basin' held in Oslo, Norway on August 11, 2008 within the framework of the 33rd International Geological Congress.

The book contains 20 review and original research papers and is divided into 8 parts: (1) Introduction, (2) Geological and tectonic evolution, (3) The basin fill as a climate and sea level record, (4) Coastline changes, (5) Sediment dynamics, (6) Interactions between a changing environment and society, (7) Hydrogeological modeling, and (8) Monitoring. This division is, however, somewhat arbitrary and particular parts are not equally represented. As an example, three parts are composed of only one single paper, whereas the part dedicated to coastline changes comprises six contributions.

The general idea behind the book and summaries of all contributions are outlined by the editors in the Introduction chapter, which forms the first part. The second part consists of two chapters. The first, the longest one of the entire book, is authored by Šliaupa & Hoth and provides an interesting overview of the geological history of the Baltic Sea Basin since the Precambrian. It focuses mainly on the pre-Quaternary and on the central part of the basin. The authors stress that the modern Baltic Sea region used to be a sedimentary basin in the past, with the oldest evidence dating from the Late Ediacaran to the Early Cambrian. The review of the geological evolution of the area provides a background for a discussion about the geological resources, particularly of oil and

gas. The next chapter, by Amantov *et al.,* presents the results of a compilation of a large amount of seismic and sedimentological data in order to quantify glacial erosion and sedimentation in the region and its contribution to mainly glacio-isostatic postglacial uplift. They conclude that most of the erosion in the basin probably took place during the first Quaternary glaciations, and that younger glaciations mainly removed sediments left by the older glacial cycles. The authors also estimate that sediment accumulation or erosion locally may have contributed significantly to - or even exceeded - glacio-isostatic movement during the last glacial cycle

Andrén *et al*. start the third part of the book with a useful review of the development of the Baltic Sea Basin during the Eemian interglacial, the Weichselian glaciation and the Holocene. Particularly interesting is the comparison of the data on the Eemian sea versus that of the modern Baltic Sea Basin. The authors conclude that both the salinity and the surface-water temperature were significantly higher during at least parts of the Eemian interglacial, when also a pathway existed between the Baltic Basin and the Barents Sea. A valuable contribution to this review is the next chapter, by Harff *et al*., who summarize the previous data and add new results and interpretations of the Holocene history of the Baltic from the East Gotland Basin. The authors use extensive sediment echosounder data and a number of basin-wide correlated sediment cores to construct thickness maps. These are interpreted in terms of general changes in the hydrographical circulation around 8 ka cal years BP, when a coast-to-basin sediment transport in the fresh-water lake changed during the Littorina transgression into basin-to-basin transport in a brackish sea. Moreover, application of the multiproxy sediment-core analyses allowed identification of global climate-change effects in the Baltic. The third chapter in this part of the book is a more local study by Bitinas et al., focused on infrared optically stimulated luminescence (IR-OSL) dating of lacustrine inter-till sandy deposits from Klaipeda Strait (SE Baltic). The dating, in combination with the geological observations, led to the conclusion that the sediments under study were transported as blocks that are now embedded in till beds, thus proving for some parts of the Baltic Basin how complex the Quaternary stratigraphy can be.

Coastline changes are dealt with in the most extensive part of the book. They are dealt with in studies from various parts of the Baltic Sea coast and represent a wide range of scientific approaches. All of them refer, however, to general models of relative sea-level changes during the Late Pleistocene and Holocene. The opening chapter by Harff & Meyer focuses on the relative sea-level changes and their modeling for past and future scenarios based mostly on the assessment of vertical movements caused by glacio-isostasy and eustatic sea-level changes ascribed mostly to climate change. They also take into account the potential impact of extreme storms, and test their model on the SW coast of the Baltic. The next contribution, by Rosentau *et al.,* models the coastal evolution in SW Estonia based on an extensive, published dataset, and provides insight into the interpretation of archaeological data and the reconstruction of human settlements. Reconstructions of the coast line during the Baltic Ice Lake stage (~13,300 to 11,600 cal years BP) in the eastern Baltic are presented by Vassiljev *et al.* They apply a GIS approach to an existing digital elevation model and to the wealth of earlier published geological documentation. In the next chapter, Sivkov *et al*. use the submarine morphology for the reconstruction of coastline evolution in the SE part of the Baltic. They use detailed bathymetric surveys to identify submerged wave-cut cliffs and re-interpret them in the context of older, often conflicting, data. The next contribution, by Uscinowicz *et al.,* presents newly discovered *in situ* tree stumps at the bottom of the Gulf of Gdansk (16-17 m water depth), which are dated as 9,020 to 8,600 cal years BP. The additional sedimentologic, pollen and diatom data indicate that the sea level at that time was about 19-20 m lower than at present. The last chapter, by Lampe *et al*., provides an example of the evolution of sandy barriers and spits along the NE German coast. The authors point out that, along with sea-level fluctuations and isostasy, sediment supply and accommodation space are important factors.

Only two contributions are included in the part on sediment dynamics; they are authored by Soomere & Healy, and by Meyer *et al.* The authors of the former contribution apply the concept of beach-profile equilibrium to the analysis of beaches on the southern coast of the Gulf of Finland. The

theoretical concepts are positively tested using field data on beach parameters, grain-size distributions and wave climate data. The second contribution is based on an example from the SW Baltic coast, from an area where long-shore sediment transport is driven by wind and waves. The authors apply SEDSIM (sedimentary basin simulation), stratigraphic forward-modeling software, at a centennial time scale. The model appears appropriate for long-term coastal-evolution modeling for the southern Baltic coast.

Interactions between society and environment are the focus of the next part. Interesting examples of such interactions are presented in the contribution by Jöns, who combines archaeological, historical and geological data. He describes several case studies of the development of coastal settlements during the past 15,000 years and considers them in terms of adaptation to a changing sea level. It is also pointed out that well dated archaeological sites, originally located at the coastline, may serve as index points for sea-level reconstructions. The next chapter, by Spiridonov *et al.*, presents the geological hazard potential for the Baltic Sea Basin, with examples from the Russian sector of the Baltic Sea and its coastal zone. They discuss a wide range of potential hazards, including earthquakes, coastal and seabed erosion, coastal floodings, landslides and sediment pollution; they also consider various human activities which may be affected, *e.g*. the construction of buildings, harbors, oil and gas pipelines, hydro-engineering facilities, fishing and land reclamation. One of the hazards related to the Baltic Sea is eutrophication, which causes anoxic conditions in the deeper parts of the Baltic. This problem is discussed by Vallius *et al.* They point out that a significant amount of phosphorus, which is bound to oxic sea-floor sediments, is easily released during more and more frequent episodes of anoxia and thus further intensifies eutrophication. The authors consider the sea-floor desertification as a possible future scenario for the Gulf of Finland. A similar problem, but using a modeling approach, is discussed by Schernewski *et al.* They also conclude that 'internal eutrophication', *i.e.* the release of phosphorus from sediments under anoxic conditions, is important in the Szczecin lagoon, southern Baltic. They also emphasize that nitrogen, as well as phosphorus, plays a key role in the eutrophication process.

Only single contributions form the last two parts of the book. The first one, by Schafmeister & Barsow, shows that groundwater exchange is also important for the Baltic Sea Basin. The authors show through modeling of a medium-scale catchment area in northern Germany that direct submarine groundwater discharge to the sea may equal about 14% of the total precipitation over the catchment. They also discuss the possible changes due to suggested future climate changes. The last chapter focuses on monitoring of the Baltic Sea. Kratzer *et al.* discuss several remote-sensing methods and the ways of their calibration with *in situ* measurements. They also present applications of monitoring, for instance for tracing marine eutrophication.

The above overview makes clear that the book is interdisciplinary and, indeed, covers a wide range of scientific approaches. It is also clear that modeling plays an ever more important role in data analysis and improving the understanding of such a complex system. In spite of several good reviews and research reports, often based on the compilation of extensive previously published datasets, the book is, however, not a complete and comprehensive monograph of the Baltic Sea Basin. The advantage of the book is that it presents various points of view and time scales for the same problems and areas; this holds, for instance for eutrophication, which is considered from the point of view of sedimentologists, geochemists, catchment-scale modelers and remote-sensing experts in scales ranging from hours to millennia. A technical shortcoming of the book is the quality of the figures, which are frequently far too small to recognize the important details. The fact that full-color is used, does not compensate for this shortcoming.

In summary, I think that the book contains many interesting data, often compiled from local sources difficult to find for international readers. The contributions reflect some recent advances in modern studies of Baltic Sea Basin from a geological perspective. Many of the chapters in the book will be of interest not only for geologists but also for representatives of other disciplines (*e.g*. biology, ecology, oceanography) working in the Baltic Sea region and also in other areas. Particularly, much useful information may be found by those interested in the various impacts of sea-level

changes (both rise and fall) on coastal and marine systems and in eutrophication-related studies. The combination of good reviews and original studies with an interdisciplinary approach makes the book potentially useful for advanced students, especially from the Baltic Sea region, and marine geologists dealing with semi-enclosed seas elsewhere in the world will certainly find valuable information.

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