



Fjord systems and archives, edited by John A. Howe, William E.N. Austin, Matthias Forwick & Matthias Paetzel, 2011. Special Publication 344. The Geological Society of London (www.geolsoc.org.uk/bookshop). Hardcover, 380 pages. Price £ 85.50; fellows £ 42.75; corporate affiliates £ 68.40; members other societies £ 51.30. ISBN 978-1-86239-312-7.

Fjords are, depending on their geographical region, known also as inlets, sounds, canals or sea-lochs. They are glacially over-deepened semi-enclosed marine basins, often separated by entrance sills from adjacent coastal waters. The fjord coastlines form a large part of the coastal zones, since they span wide areas above 56° latitude in the northern hemisphere and 42° latitude in the southern hemisphere. In many respects, they are relatively simple systems, and consequently they are used by oceanographers, biologists and sedimentologists as mini-ocean models for studies of large-scale processes. From a sedimentological point of view, however, the most interesting feature of fjords probably is that they commonly serve as sediment traps and thus may preserve high-resolution records of their environment and of climate fluctuations.

Fjords have received scientific interest for several decades. The fundamental works on fjords by Freeland et al. (1979) and Syvitski et al. (1987) were already published more than 20 years ago, so this new book is a long awaited update. It is not a concise and comprehensive overview of fjords, however, but rather brings together a selection of contributions most of which were presented during fjord-dedicated workshops or special conference sessions in Oban (UK), Oslo (Norway) and Bergen (Norway) in 2006, 2008 and 2009, respectively. The book is consequently, as usual for post-conference volumes, composed of variable works including short contributions but also data-rich interesting original research papers, as well as valuable reviews.

The scientific contents of the book are composed of 23 contributions; an online supplementary glossary of fjord-related terms is also available. The editors divided the book into five main themes, viz. (1) physics and physical oceanography, (2) biology and biological processes, (3) sediment dynamics and processes, (4) sediments and depositional architecture, and (5) depositional archives and paleoenvironments. This division is somewhat arbitrary and the various parts are not equally represented. For instance the 'biology' part contains only three short chapters on dinoflagellate cysts and foraminifers, and 'modern sedimentary processes' contains only two contributions, but these topics also form important parts of several other chapters.

The five review papers are the most valuable. The first is an introductory review on fjord systems and archives by Howe c.s., which is followed by two 'non-mathematical reviews' written by physical oceanographers for geologists. They regard mid-latitude fjords (by Inall & Gillibrand) and Arctic fjords (by Cottier et al.) and they will undoubtedly be of considerable support for those working on sedimentation and the sedimentary record in fjords. The two remaining valuable, comprehensive reviews are focused on particular regions. The first (by Dallimore & Jmieff) is about fjords and inlets along the west coast of Canada, and the second (by McIntyre & Howe) deals with fjords on the Scottish west coast. Although not a true review,

it is also worth mentioning here the contribution by Overeem & Syvitski, which presents interesting modelling results of fjord stratigraphy for some northern-hemisphere fjords. It shows how the timing and rate of deglaciation of particular fjords, in combination with relative sea-level changes (due to eustatic sea-level rise and local glacio-isostatic uplift), shape the resultant sedimentary infill of several fjords.

There is a lack of balance in the geographical coverage of the fjords under study. Most of them deal with fjords of Svalbard, Scotland and Scandinavia, with only one - but valuable - study (by Hass et al.) from the southern hemisphere. This uneven distribution may, on one hand, be considered as a weakness of the book, but on the other hand it results in a comprehensive view of Arctic fjords, for example of Svalbard and mid-latitude fjords as those of Scotland.

The reader may thus learn from both the review paper by Cottier et al. and the case study by Skardhamar & Svendsen about the factors controlling the circulation in the fjords of Svalbard (Spitsbergen). Sediment traps were applied by Trusel et al. to study the sedimentation rate, and by Howe et al. to test dinoflagellate cysts as potential paleoceanographic proxies. Several works (Baeten et al., Forwick et al., MacLachlan et al.) applied multibeam echosounder data to reveal details of the fjord-bottom relief, which in association with geophysical data and analyses of sediment cores allowed them to reconstruct the post-glacial history of the fjords' sedimentary environment. Among these contributions, the most detailed (and also the longest) is the one by Forwick et al., who used a wealth of hydrographic, geochemical, foraminiferal, lithologic and geophysical data to interpret the impact of local glaciers and rivers on the Late Pleistocene and Holocene sedimentation. The last contribution about the Svalbard region, by Skirbekk et al., presents a reconstruction of regional variations of the Holocene climate on the basis of a paleoceanographical analysis.

Scottish fjords or sea-lochs are presented in some studies applying similar research methods as those dealing with Svalbard. Physical fluid processes in the mid-latitude fjords, based mostly on examples from Scotland, are reviewed by Inall & Gillibrand. Modern sedimentation and carbon budgets are presented by Loh et al., whereas Austin & Cage report on foraminifers in marls. The post-glacial sedimentation histories and mass failures, based on multibeam mapping, geophysical surveys and core analyses, are presented by Stoker et al. for a single loch, and by McIntyre & Howe in a regional review. The next three papers (Cundill & Austin; Mokeddem et al.; Baltzer et al.) employ multiproxy analyses, with emphasis on pollen, foraminifers and seismic facies, for Late Pleistocene and Holocene paleoenvironmental reconstructions.

The rest of the contributions focus on high-resolution multiproxy studies reflecting local (catchment scale) to regional and global environmental and climate changes. Two chapters about the Swedish coast use dinoflagellate cysts (Harland et al.) and carbon stable isotopes in foraminifers (Filipsson & Nordberg), respectively, as the main methods. The work on the Sognefjorden (Norway) by Paetzel & Dale shows a record of regional climate variations in anoxic and oxic fjord environments. Then, Hass et al. focus on the history of the last 2000 years; they used high-resolution grain-size analysis of a sediment core from Antarctica, which shows trends similar to global climate changes.

In summary, I think that the book contains a wealth of interesting data and information. The various contributions reflect the recent advances and trends in modern fjord research,

including the development and widespread application of new techniques for sea-floor mapping, as well as various proxies for the reconstruction of environmental and climate change. The results often show that fjords, frequently referred to as simple systems, are actually fairly complex. Despite several reviews, the book is not a complete and comprehensive fjord monograph, however, and several important fields - for instance biology and ecology - could have been represented in some more detail.

Several contributions will be of interest for geologists and researchers in other disciplines (e.g. biology, ecology, climatology) working in modern fjord and estuarine environments. The book is also a valuable source of information for all the scientists engaged in climate and environmental paleorecords. The combination of good review articles and high-quality multi-approach original studies makes the book useful, for active scientists and advanced students alike.

References

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