Salt tectonics, sediments and prospectivity, edited by G.I. Alsop, S.G. Archer, A.J. Hartley, N.T. Grant & R. Hodgkinson, 2012. Geological Society, London, Special Publication 363. Geological Society, London (www.geolsoc.org.uk/bookshop). Hardback, 632 pages. Price US$ 240.00, GBP 120.00 (fellows US$ 120.00, GBP 60.00 ; members affiliated societies US$ 144.00, GBP 72.00). ISBN 978-1-86239-341-7.

The mechanical properties of salt rock under the various physical conditions that characterize sedimentary basins have received increasing attention during the past few decades. The threshold pressure and temperature under which salt flows, are much below that for other sedimentary rocks; this makes salt the most mobile constituent and the most effective detachment agent in the upper crust. Salt rock is a common constituent of petroleum systems and plays an important role in controlling the structural evolution of hydrocarbon traps and in shaping migration pathways. In addition, its high thermal conductivity influences the maturity of the source rocks and its negligible permeability makes salt a most effective seal. These and numerous other peculiar features of salt rock make it an attractive and important research subject for the oil industry; this is reflected in the volume under review by numerous new data collected from oil plays.

An international conference, held in January 2010 in London under the umbrella of the Petroleum Group of the Geological Society and the Society for Sedimentary Geology (SEPM), formed the basis for this voluminous (624-page) book. It is the first book of its kind since, 16 years ago, the significant monograph by Alsop et al. (1996) was published. The new long-awaited monograph contains 29 contributions, grouped into five main parts: (1) Halokinetic sequence stratigraphy (5 chapters), (2) Salt in passive margin settings (10 chapters), (3) Central European salt basins (4 chapters), (4) Deformation within and adjacent to salt (6 chapters) and (5) Salt in contractional settings and salt glaciers (4 chapters).

Not truly surprisingly, most of the studies of salt structures and related basin architecture come from both Americas, with new data from the La Popa Basin in Mexico (Jurassic salts; 4 contributions), from Brazil (Neoproterozoic, Permo-Carboniferous, Cretaceous and Paleogene-Neogene salts in the Santos, Campos, Kwanza and other basins; 5 contributions), from the Gulf of Mexico (Mesozoic salts; 2 contributions) and from Europe (Permian and Triassic evaporates; 8 contributions). Single examples come from Australia, Canada, Iran, Oman, Tunisia and from the central part of the Dnieper-Donets Basin in Ukraine. This last basin is incorporated in the central European salt-basins system, the extent of which is defined in the book in a very broad sense, encompassing all Permian evaporate subbasins of Pangea. In spite of the wealth of regions from all continents that are represented, there are also some areas lacking, such as the giant evaporate basins located in Russia (e.g. the Uralian basins), in Middle Asia (e.g. Kazakhstan), in China, in fore-Himalayan India and in the central United States. It may be that the editors have decided not to include all possible areas because the volume is already so voluminous.

The introduction to the monograph is concise; the content of the various contributions is presented one by one, and therefore we confine this review to some more general impressions. The contributions address salt-controlled phenomena in different geotectonic settings, from continental passive margins to intracontinental to orogenic contexts. The first setting by far plays the most important role in the book, without doubt because this is the hottest target for the oil industry. The overview covers the wide spectrum of investigation methods, from analyses of seismic profiles, balancing cross-sections to interdisciplinary basin modeling, structural geology, sedimentological analyses within a sequence-stratigraphic framework to remote sensing. Numerical and analogue simulations are included as well.

The main subject of the book is the interplay between sediment accumulation and salt movement in sedimentary basins. Investigations in a perfectly exposed region of the La Popa Basin yielded details of a sequence boundary in a halokinetic context, which could be used for the reconstruction of the evolution of a completely welded vertical diapir, based on the outcrop data. An equally fine reconstruction of changes of the depositional environment in a halokinetic context is presented for the Patawarta diapir in Australia. Sedimentological phenomena are present in almost all chapters, but rather high-level analyses based on seismic lines form the ‘body’ of most contributions.

Examples of perfect-quality seismic profiles from a salt basin at the Brazilian continental margin give an impressive overview of extensional and compressive features created by gravity-driven flows down the continental

slope, which is compensated by the viscous salt complex. Among them are a system of rhythmic block rotation associated with salt doming, turtle structures and spectacular prograding sedimentary patterns created by a horizontal salt withdrawal over a distance of several tens of kilometers. The last phenomenon is the subject of numerical simulations exploring the feedback between salt flow and the rate of sediment accumulation. Quantitative exploration of several factors allows the reader to understand the mechanisms of coupling between salt movement, the configuration of sedimentary patterns and the internal complexity of salt structures. Numerical models examine the mechanical evolution of the salt complex as a result of the transition from a more stable, laminated autochthonous salt complex to a weaker, inhomogeneous pile of salt that became deformed in the course of halokinesis in the Bay of Biscay and the Oman Salt Basin.

The Zagros Mountains represent an outstanding example of a regular fold pattern controlled by the underlying Cambrian salt complex over 250 km long; this has been simulated at a sandbox scale. It reveals how important the salt layer is in controlling the geometry of divergent compressional features. An impressive map of a seabed relief from the Mediterranean Levant Basin illustrates the interactions between recent strike-slip faults, halokinetics and sedimentary features. Seismic lines show that four detachment salt layers produced an outstanding multi-layered fold pattern with different characteristic wavelengths. In the Tunisian passive margin of North Africa, halokinetics in Triassic salt led to salt extrusion at the bottom of a sedimentary basin during Cretaceous rifting; a recently buried salt glacier was created.

Specific information can easily be found through a 16-page index, including geographical and geological names and also the most important geological terms. The book, with its abundant illustrations and high-quality seismic cross-sections from almost all over the world, is unavoidable reading for any geologist dealing with salt, sedimentary basins, modeling, tectonics or petroleum systems. A significant number of the spectacular seismic profiles show sedimentary patterns and deformation structures of which the evolution is hard to understand for those who are not trained in modern salt tectonics. Such a condensed overview of the complex interactions between rheologically controlled halokinetic and sedimentary processes makes the book a perfect brain teaser.

Reference

Alsop, G.I., Blundell, D. & Davison, J. (eds), 1996. Salt tectonics. Geological Society, London, Special Publication 100, 302 pp.

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