

Conference Report

Deltas—sites and traps for fossil fuels

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Report of a joint British Sedimentological Research Group/Petroleum Group meeting held on 21 and 22 April 1987 at the Geological Society of London, Burlington House, Piccadilly. The meeting was organized by M. K. G. Whateley and K. T. Pickering.

This successful international meeting was convened to fill a considerable hiatus which has occurred since the flurry of conferences on deltaic sedimentation took place in the early and mid-1970s. It was felt that significant advances have been made in our understanding of deltas as sites and traps for fossil fuels and a timely forum was required to enable workers to disseminate their knowledge. The two-day meeting included 27 papers and 8 posters covering modern and ancient deltas in marine to fresh-water environments. Topics included: processes, facies models, petroleum, gas and coal related deltaic environments, together with general case studies. A Special Publication of the Geological Society of London will be published within about a year from the date of the meeting. The meeting attracted about 180 speakers and delegates from Germany, France, Norway, Canada, Italy, Denmark, USA and Britain.

Following the two days of plenary sessions, there was a two-day field trip led by Professor **Trevor Elliot** to the Westphalian of North Devon, and a two-day field trip led by Professor **John Collinson** to the Namurian of the Pennines. At the weekend following the field trips, there was a one-day core workshop in Edinburgh, organized by the British Geological Survey, looking at the Jurassic Brent cores from the northern North Sea. This very successful and popular workshop was organized by **Stuart Brown** and **Philip Richards** (BGS, Edinburgh).

The delegates were welcomed by **A. J. Smith** in his role as Vice-President of the Geological Society. The meeting commenced with a general introduction to deltaic systems and their contribution to an understanding of basin-fill successions, given by **T. Elliot**. He pointed out that there is a wide spectrum of modern deltas known and we are still only making faltering progress in recognizing this diverse spectrum in the geological record. **J. P. M. Syvitski** and **G. E. Farrow** described how they believe that fjords with their rugged topography and dynamic history of basin infilling are prone to a variety of slope failures. By moving into the realms of geomechanics, they illustrated how fjord sedimentation may be useful as an analogue for small hydrocarbon-bearing submarine fans. Time constraints meant that **G. Sestini** was only able to give us (the modern) half of a review of the sedimentary and tectonic history of the Nile Delta, a fascinating history which will add considerably to the literature on deltaic deposits when

published. **A. Pulham** gave an interesting account of the numerous and variable controls on internal structure and architecture of sandstone bodies within the upper Carboniferous, fluviially-dominated deltas of County Clare in western Ireland. **J. Collinson** ended the first morning's session with an account of the work he and his co-workers in Norway are undertaking on the styles of deformation in delta slope sequences. This returned us to causes of slope instability and the question was raised 'why is slope instability, although frequently recognized in active modern deltas, apparently absent from ancient deltaic sequences?'

The afternoon session was opened by **G. P. Allen**, **F. Mercier** and **G. Choppin de Janvry** who gave a review of the interpretation of subsurface deltaic sediments. They illustrated the diversity of delta lobe morphology (and therefore sand-body geometry) on one modern delta and emphasized the need to recognize and evaluate the relative importance of coastal depositional processes which influence the type of sand-body development. By understanding the environment of deposition, it is possible to infer the sand-body geometry. An example of subsurface facies analysis was given by **S. Brown** and **P. C. Richards**. They described the facies and development of the mid-Jurassic Brent delta near the northern limit of its progradation in the UK North Sea. Following on from this **S. Livera** discussed the facies associations and sand-body geometries in the Ness Formation of the Brent Group from the Brent Field, and described the detailed sedimentary modelling required to predict reservoir geometries. **A. C. Benfield** described the river-dominated deltaic sedimentation seen in the Huddersfield White Rock (Namurian) of the central Pennine Basin.

R. C. Selley gave an amusing presentation on deltaic reservoir production from rotational dipmeter patterns. He did point out though, that down-hole geophysics can be likened to a drunk clinging to a lamp-post, the lamp-post being used more for support than illumination. **C. S. Bristow** and **K. Myers** brought geophysics back to the surface with their description of the use of detailed gamma-ray logging, using a K, Th, U scintillometer to distinguish lithofacies associations in a Namurian deltaic sequence. A review of deltaic petroleum source rocks was given by **S. J. Cawley** and **A. Fleet**. They described the variability of organic source rock reflecting the different preservation potential of different organic matter in a wide range of depositional environments. The first day's proceedings were drawn to a close with a fascinating account by **G. G. Hahn** and **B. Schroeder** of how they used palaeomagnetic reversals to trace the evolution of the enormous Lower Keuper and Schilfersandstein delta systems across central Europe. It is a pity that events have

conspired against these authors to prevent immediate publication of their results.

The first half of the second day of the conference considered the nature of coal deposits in deltaic settings. In the second half, case histories of oil-bearing deltaic sediments were examined. The proceedings were re-opened by **S. Haszeldine** who gave a review of coal deposition in deltaic settings. He suggested that the thickness of ancient coal seams is controlled by subsidence of one form or another, whereas modern studies of deltaic coals emphasize sedimentological processes in the coal and coal-bearing sediments.

W. A. Read explained the relationship between basin subsidence and patterns of coal thickness in various fluvi-deltaic environments, and he proposed a three-fold classification of basin patterns: (1) basin, (2) inverse basin and (3) wedge. **N. Stavrakis** was unable to present his paper but **M. Whateley** delivered it for him. He showed that the delta morphology changed with time in the Permian (Gondwana) Karoo Basin from highly lobate during the early Permian to shore-parallel cusped morphology in late Permian. This, plus climatic amelioration, resulted in changes in coal type and distribution. **P. Guion** described some upper Namurian and Westphalian deltaic deposits of the East Midlands and discussed how depositional environment was an important factor in controlling oil and coal accumulations. By using statistical and sedimentological methods **B. Steingrobe** and **A. Muller** were able to show that the Namurian of the Aachen coal district can be divided into three groups which differ from the classic biostratigraphic units of Namurian A, B and C. Coal was seen to occur at the top of coarsening-upward sequences. An interesting account was given by **M. Whateley** and **Subagio** of a thick Tertiary coal deposit in Sumatra, Indonesia whose geometry appears to be strongly influenced by fan-delta lobes which built out into a lake; the coal forming in interlobe areas. The final presentation of the morning's papers related to coal was given by **A. Scott** who bravely volunteered to give a talk at the last minute on deltaic coals, giving a palaeobotanical perspective. He emphasized the need to treat coal as a 'sediment' and examine it in as much detail as we do the inter-seam sediments.

After lunch the emphasis changed back again to the oil industry. **W. Helland-Hansen** and **R. Steel** opened the session with a review of the stratigraphic relationships within the deltaic Brent Group of the North Sea using large-scale dip and strike sections through the deltaic succession. Computer simulations provided the authors with a useful basis for discussing alternative hypotheses for Brent delta behaviour. **J. Alexander** gave a more controversial talk by asking 'what is a delta' A stimulating discussion followed her talk. **H. Williams** continued the session with a talk on permeability barriers within potential fluvi-deltaic reservoir sandstone bodies in Upper Carboniferous of the Pennine Basin. A talk on the reservoir geology of the Sirikit Oilfield in Thailand was given by **S. Flint**, **D. J. Stewart** and **E. D. Van Riessen**. They described the lacustrine-deltaic sedimentation in this Tertiary intermontane basin. **R. G. Lees** and **J. E. Pollard** gave an interesting account of the trace fossil facies and their relationships in the Yordale deltaic sediments, showing that trace fossils can be successfully used in environmental interpretation. **J. Harris** discussed the sedimentology of a middle Jurassic lagoonal delta system in the Elgol Formation in the Inner Hebrides and Sea of the Hebrides Basin. **T. Teyssen** concluded the session and the formal part of the conference proceedings with a talk on the Recent and Tertiary deltaic depositional systems of north-west Borneo.

Without wishing to single out individuals for their contribution to the meeting, it is perhaps fair to say that amongst the more notable newer aspects of deltaic sedimentation presented were: (a) a better understanding of tidal deltas; (b) the geochemical aspects of deltaic sedimentation, particularly relating to the organic geochemistry of coal and petroleum; (c) geophysical techniques in exploring deltas both at outcrop and in down-hole logs, for example, palaeomagnetism and gamma-ray spectrometry, and (d) geotechnical aspects of delta front and prodelta sediment instability.

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