

7th Cambridge Diagenesis Conference 2011: an introduction

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The Cambridge Diagenesis Conferences (1981–1998) were set up to act as a conduit for the interchange of clay mineral expertise between universities and research institutes on one hand, and the hydrocarbon industry on the other. At the time, oil companies were dealing with the development of the North Sea Oil Province which was turning out to be a natural laboratory for the fundamental study of authigenic clay minerals and their relationship to lithofacies, burial, overpressure, reservoir quality and hydrocarbon emplacement. This symbiosis between industry and academia flourished for nearly two decades. Each conference was followed by a special issue of *Clay Minerals* dealing with topics relevant to, or discussed at the particular meeting. By the late 1990s the North Sea had become a mature province and the major oil companies were looking to other parts of the world to replenish their reserves. The 6th Cambridge Conference (1998), *Mineral diagenesis and reservoir quality – the way forward*, and the special issue of *Clay Minerals* (2000) was the culmination of the first phase of this conference series.

Subsequent years were a period of consolidation with three bench mark publications: Clay minerals in onshore and offshore strata of the British Isles; origins and clay mineral stratigraphy (Jeans & Merriman, 2006), Earth's energy “Golden Zone”: a synthesis from mineralogical research (Nadeau, 2011), and the Clay Minerals volume of Deer, Howie and Zussman *Rock-forming Minerals* (Wilson, 2013), publications that should be on the

shelves of all scientists who have a serious interest in clay minerals and their role in sediments and diagenesis.

Around 2009 the Clay Minerals Group (Mineralogical Society of Great Britain) became aware that clay-rich rocks and clay mineral problems were once again coming to the renewed attention of oil and gas companies as well as other industries that deal with fine-grained rocks as reservoirs. The conference series started its second phase of life with the 7th meeting in Cambridge in September 2011. The title “*Clay and carbonate facies and their diagenetic pathways in reservoir rocks*” was particularly challenging and is a topic that has been very largely avoided because of its complexity. The contents of this special issue of *Clay Minerals* contain papers related to this special topic but also to others of no less importance in understanding the distribution of clay minerals in sediments and rocks and the effects they may have in modifying porosity and permeability.

The ten papers in this special issue divide into four groups. The first two deal with matters of direct and practical importance in drilling wells and hydrocarbon production. **Wilson and Wilson** provide a new conceptual analysis of the relationship between clay minerals and shale instability. The contribution of clay minerals to formation damage in sandstone reservoirs is critically reviewed by **Wilson et al.** The second group is concerned with experimental, present-day and ancient analogues of geological targets that are now being actively explored or developed by oil companies. **Tosca and Masterson** describe the results of experimental work on the controls of the low-temperature formation of Mg silicates that

are important components in the lacustrine and perimarine sediments such as in the Cretaceous reservoirs of off-shore Brazil. **Kuznetsova and Motenko** describe the different pathways in alteration taken by various types of volcanic ash in the permafrost soils of Kamchatka in eastern Russia; such weathering products may have played a role in the glaciogenic sediments of late Ordovician age that are important hydrocarbon reservoirs in north Africa. **Taylor and Macquaker** describe the three dimensional architecture of the sedimentological and diagenetic facies in the Upper Cretaceous Mancos Shale of Utah, providing an indication of the type of facies analysis necessary before fracturing techniques can be successfully applied.

K-Ar dating of illite is the topic of the third group of papers. **Wilkinson et al.** review critically and discuss the significance of the K-Ar ages of the fibrous illite cement that is so widespread in the North Sea reservoirs, they suggest that there has been appreciable modification after their initial development. The mid-Miocene bentonites of eastern Europe are the setting in which **Clauer et al.** demonstrate how the study of the K-Ar dates and stable isotopes ratios in nanometre-sized illite-type particles can be used to determine the timing, duration, and physicochemical conditions of their development, providing an insight into the complexities of the development of neoformed illite in shales in contrast to sandstone reservoirs.

The fourth and final group of papers deal with the Upper Cretaceous Chalk, the main reservoir for water, oil and gas in northern Europe. The Chalk's exceptional fine grain and apparent homogeneity has restricted the understanding of its diagenesis. A recent breakthrough in recording the geochemistry of complete sequences of its cements has led to the suggestion by **Hu et al.** that the diagenetic history of its smectite clay assemblage can be deduced by examining the relationship between the trace

element chemistry of different types of cemented chalk and their associated clay minerals. **Jeans et al.** report on their initial investigation of this relationship in examples of Cenomanian and Campanian chalks in England. **Wray and Jeans** extend this investigation by using the bulk geochemical composition of the acid-insoluble residues in Campanian chalks to differentiate between volcanogenic clays exhibiting a negative europium anomaly and clays that do not – these are assumed to be of non-volcanogenic origin.

Similar to the previous special issues devoted to the Cambridge Diagenesis Conferences, the submitted manuscripts were handled by guest editors. This time it was Harry Shaw and Tony Fallick who undertook the editorial effort and handled the submitted manuscripts. They have made an excellent job and the outcome is of high quality and comparable to the previous successful issues. Last but not least, it should be underlined that this effort would not have been completed without the contribution of the oil industry, the backbone of the Cambridge Diagenesis Conferences. The financial support by **Shell, British Gas** and **Exxon Mobil** is highly appreciated and contributed to the successful outcome of this issue.

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