Devonian events and correlations—a tribute to the lifetime achievements of Michael Robert House (1930–2002)

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The Devonian was a peculiar time in the Phanerozoic evolution of the Earth. Most continents, including the large Gondwana and Laurussia cratons, formed a Pangea-type assembly around the tropical Prototethys and an increasingly hot, global, greenhouse climate prevailed, with a complete lack of major ice sheets, even in polar areas. There was gradual and increasing flooding of the continents, creating huge epicontinental seas that have no modern analogues. Under these conditions the plants finally conquered the land, with the innovation of deep roots in the Emsian, the appearance of seed precursors and trees in the Givetian, and the spread of vegetation into dry uplands in the late Famennian. In the marine realm, the largest-known Phanerozoic tropical reef belts surrounded craton margins and tropical islands. It was the time of the sudden radiation of early ammonoids, of the earliest episodic blooms of calcareous-shelled, pelagic zooplankton (tentaculitoids), the rise to dominance of fishes, mostly of armoured forms and with giants reaching 10 m in length, but also including the first sharks, and the appearance of earliest tetrapods in marginal settings. However, the tropical and subtropical areas reaching up to 45° latitude were hardly a paradise. A combination of climatic, plate tectonic/magmatic and still poorly understood palaeoceanographic factors caused the recurrent sudden perturbation of stable ecological conditions by short-term global events of variable magnitude (e.g. House 1985), including two of the biggest mass extinctions that the Earth’s biosphere has experienced—the Upper Kellwasser Event at the Frasnian–Famennian boundary and the Hangenberg Events at the close of the Devonian.

The global and regional correlation of Devonian rocks relies strongly on the available fossil record, on the facies distribution of marker fossils, on the recognition of eustatic sea-level change in sequence stratigraphy, and, as a relatively new development, on the application of stable isotope geochemistry and magnetic susceptibility. The Prototethys seaway, fortunately, allowed a free exchange of pelagic faunas through all oceans and seas. In the warm-water areas, there was only moderate endemism in conodonts, ammonoids, pelagic ostracodes and tentaculitoids, which are the main biostratigraphic marker groups. Low diversity benthic assemblages of the outer shelf also include many cosmopolitan groups but they differ strongly from fossil associations of the nearshore, neritic and photic zones. In the latter areas, including reef and biostrome complexes, the evolution and ecologically controlled distribution of brachiopods, stromatoporoids, rugose and tabulate corals, and trilobites provides refined regional time frameworks but the faunas are mostly characterized by endemism that prevents simple correlation across oceans and seaways. Palynomorphs that were washed into the seas enable the correlation of marine, fluvial, limnic and terrestrial deposits.

The highly variable palaeoecology and taxonomic composition of the terrestrial, neritic and pelagic faunal assemblages are the fundamental problems of cross-facies correlations within the Devonian. Apart from overlapping facies and palaeobiogeographic ranges of some key taxa, event and physical stratigraphy are the major tools in reconstructing global changes in the Devonian world at high level of time resolution. The International Subcommission on Devonian Stratigraphy (SDS) was the first International Union of Geological Sciences (IUGS) Subcommission to complete the formal designation of all its series and stage subdivisions, but all ratified GSSPs (Global Stratotype Sections and Points), as the norm, were defined in the pelagic facies realm. Their recognition on all continents and in all other facies belts is still a major task to be resolved. As a first step to reach some progress in this wide, international and multidisciplinary scientific field, the Devonian Subcommission and the Institut Scientifique Université Mohammed V, Rabat, especially with a major organizational input by its Titular Member and Vice-Chairman, Prof. Ahmed El Hassani, organized in March 2004 an international symposium (El Hassani 2004a) on ‘Devonian neritic–pelagic correlation and events’, followed by an excursion with the same topic to the continually inaccessible Dra Valley of SW Morocco (El Hassani 2004b).
The Rabat meeting and this Volume honour the spirit and continue the major scientific interest of one of the most prominent Devonian stratigraphers of the last five decades, Prof. Michael Robert House (Figs 1–3), who passed away on 6 August 2002. Consequently, the proceedings of the Rabat meeting and this volume are dedicated to his memorial and in honour of his outstanding lifetime achievements in Devonian stratigraphy. Michael, as most Devonian workers knew him, not only promoted significantly and at an early stage the international approach of stratigraphic correlation, and recognized the complex sequence of global events and extinctions in the Emsian to Famennian, he also had a strong focus on Morocco and would have loved to take part in the Rabat meeting and the Dra Valley excursion, an area that he visited briefly during one of the excursions organized by the famous Henry Hollard.

Michael R. House was born on 27 August 1930 in Blandford Forum, Dorset, and his family soon moved to the Weymouth area where he developed an early interest in Jurassic fossils, including ammonites, that he could collect close to his home. His geography teacher at school introduced him to the Geological Survey Memoir on the area of the Dorset coast by the famous W. J. Arkell, which broadened his geological interests. This wide approach, from palaeontology to sedimentology, oil geology, cartography and tectonics, and his sense of the broad context of all observations, characterized his subsequent work and allowed him to remain innovative and inspiring to his students and colleagues. After army service in Reading, Michael went up to Cambridge in October 1951 and was soon introduced to W. J. Arkell himself who provided the best support and encouragement that an undergraduate student could get. Both W. B. R. King, then head of the department, and Arkell did not accept the logical idea that Michael should work on Jurassic ammonites, but, to the fortune of the Devonian community, suggested instead that he explore a much less-known scientific field at that time, the Devonian of SW England, whose stratigraphy and ammonoid faunas had been badly neglected since the beginning of the 20th century. Michael was offered a position as Lecturer at Durham University before finishing his final examination. Although his first two publications (House 1955, 1956b) dealt with the Mesozoic of his Dorset home area, his Devonian PhD studies soon led to discoveries that allowed him to publish on Devonian goniatites from North Cornwall (House 1956a). The love for Devonian ammonoids never left him and made him eventually one of the very few world-leading authorities on this fossil group (House 1970, 1971a, 1979, 1981a, b, 1988a, b, 1989c, 1993a, b; Becker & House 2000a). They proved to be a key for global correlations and understanding the causes of rapid and severe evolutionary change. Early significant contributions included the discovery of Wocklumeria faunas in North Cornwall (House & Selwood 1957), Upper Devonian ammonoids in the Dartmoor area (House 1959), and palaeopathological observations (House 1960a), now referred to as ‘Housean pits’, in Lower and Middle Devonian goniatites.

For two years (1958 and 1959), as a Commonwealth Fund Fellow, Michael crossed the Atlantic, at that time still by ship, to work at Harvard, Cornell and the Smithsonian Institution (Washington) on North American Devonian ammonoids. At Cornell, he was well received and supported by John W. Wells and his ‘Friends of the Devonian’. Despite the long research history in New York State and adjacent states, he soon doubled the number of regionally known genera (House 1962), introduced detailed morphometry to the taxonomy of specific groups (House 1965b), straightened the myth of alleged Frasnian clymenids (House 1960b), extended his studies to Canada (House & Pedder 1963) and Nevada (House 1965a), and based on his extensive knowledge of European faunas, was able to correlate faunas across the two continents (House 1962, 1967, 1976). The fact that he was given an international research perspective early in his scientific career influenced significantly his subsequent work. He considered the
whole global Devonian world in terms of biogeography, plate tectonics, palaeoecology and climate after his return to England (Friend & House 1964; House 1964a, 1971b, 1973a, b, 1974, 1975a, b), where he was appointed Lecturer in Palaeontology in Oxford (1963) and later offered the Chair of Geology at Hull (1967). Studies on North American goniatites, however, continued throughout his life (House 1965a, 1978, 1981c; Kirchgasser & House 1981; House & Blodgett 1982; House et al. 1986; House & Kirchgasser 1993) and, with the almost finished ‘Opus’ on the Frasnian of New York, even until his untimely death (House & Kirchgasser in press).

Fig. 2. Michael R. House during field work in NW Australia (Summer 1990), overlooking the famous marginal slope deposits of the Frasnian reef at Windjana Gorge; with W. T. Kirchgasser, P. E. Playford and G. Klapper in the middle ground (from left to right).

Fig. 3. A typical field photo of Michael R. House (from October 1997), well camouflaged by field gear, in one of his favourite areas of North Devon, showing the Upper Famennian ‘Grand Slump’ at the top of the Baggy Sandstone.
At Durham, Oxford (partly as Dean of St. Peter’s College) and Hull, Michael continued his work on the Devonian of Devon and Cornwall, which lead to a series of papers by himself or with co-authors (House & Butcher 1962, 1973; House 1963, 1964b, 1981a; House & Selwood 1964; Hendricks et al. 1971; Gauss & House 1972; House et al. 1978a, b). His enthusiasm, energy, outstanding teaching and administrative abilities earned him the highest reputation. He was active in the Yorkshire Geological Society (President from 1972–1974), the Geological Society of London (council member from 1966–1968, Chair of the stratigraphy committee 1989–1992), the Palaeontological Association (President from 1972–1974), the Systematics Association (President from 1978–1981), the Hull Geological Society, the Geologists Association (Vice-President from 1970–1973), the Association for the Advancement of Science (President of Section C in 1977), and the Palaeontographical Society (President from 1989–1994). He was a founding member of the Ussher Society in 1962 and donated many significant papers on Devonian stratigraphy to its journal, which he sometimes questioned since these papers became not as widely known as he wished. His output of papers was so high that almost nobody realized that important parts of his PhD thesis were never published. As if he unconsciously felt that something was wrong, two important manuscripts on Givetian and Frasnian goniatites from SW England were eventually finished and submitted (House 2003a, b) before he learnt of his illness. The Devonian community also may not have recognized that Michael continued to write about his Dorset home area, that he was also heavily involved in the mapping of Malta and Gozo (lacking any Palaeozoic rocks), and that he was interested in topics such as growth banding in bivalves and the post-mortal drift of Nautilus.

The Devonian remained his first interest, which led him to organize an international Devonian Symposium in England in 1978, resulting in the now-famous volume on ‘The Devonian System’ (House et al. 1979). It provided the only up-to-date and comprehensive review of Devonian biostratigraphy and facies at its time. From the beginning (1975) of activities concerning the subdivision of the Devonian into formally defined series and stages, Michael joined the SDS as a most active Corresponding and Titular Member, Secretary and, from 1992–1996, as Chairman. Over the same period he was deeply involved with the task of the International Working Group on the Devonian–Carboniferous boundary (e.g. House & Sevastopulo 1984; Price & House 1984). His research and leadership were crucial to define the Middle/Upper Devonian series boundary (House 1982; Klappler et al. 1987; House et al. 2000a), the base of the Famennian (e.g. Becker et al. 1988; Becker & House 1990; Klappler et al. 1993; House et al. 2000b), the base of the Givetian (Walliser et al. 1995), and the base of the Emsian (Yolkin et al. 1998, 2000). His major aim was to conclude the definition of all Devonian time units whilst he was chairing the SDS. He provided chronostratigraphic summaries (House 1989a; House & Gradstein, 2005) and the correlation of British successions with the newly established series and stages (House & Dineley 1985; Bluck et al. 1989; Marshall & House 2000; House 2001).

Michael’s scientific authority and international reputation were recognized by receiving a range of honorary medals from many geological societies: the William Bolitho Gold Medal of the Royal Geological Society of Cornwall (1970), the Neville George Medal of the Geological Society of Glasgow (1984), the Sorby Medal of the Yorkshire Geological Society (1985) and, outstandingly, the Murchison Medal of the Geological Society (1991). The international search for boundaries and strata types required global investigations, correlation, communication and a lot of travel—something that Michael most appreciated, especially the joint field work with friends (Fig. 2) and the international symposia that over time formed a circle of closely befriended specialists. His interests in global Devonian ammonoid faunas led him to start research projects in the Carnic Alps (House & Price 1980, with most data still unpublished), in the Montagne Noire (House & Price 1985; House et al. 1985; Becker & House 1990, 1994a), in Germany (House & Ziegler 1977), in the Tafillalt and Maider of southern Morocco (e.g. Becker et al. 1988; Becker & House 1991, 1994b; Becker et al. 2002), in the Moroccan Meseta (Becker & House 2000b), in the Timan of polar Russia (Becker et al. 2000; House et al. 2000c; Menner et al. 2000), and in the isolated Kimberleys of Western Australia (Fig. 2), where co-operation with Phil Playford (Perth) enabled the collection of huge faunas (Becker et al. 1991, 1993; Becker & House 1997, 2007 in prep.) that are still only partly published. Apart from these regions, Michael has visited most other important Devonian basins, at least those with a significant goniatite record, leaving out only politically too difficult regions, such as Central Kazakhstan, Novaya Zemlya and southern Algeria. Although being himself a perfect committee leader, his distaste for the interference of politics on science was most seriously confirmed when the Thatcher Government decided to re-organize the geological sciences of England. This resulted in the closure of his Institute at Hull, where he was Head of Department, Dean of Science (1976–1978) and Pro-Vice-Chancellor (1980–1983). The forced move to the University of Southampton in 1988 brought him closer to his Dorset home area but left some bitterness concerning the British science system.
Two scientific ideas and important developments additionally shaped Michael’s research from the 1980s on. The recognition of major extinction events, possibly or partly caused by impact events, but more usually linked with the global punctuation of sedimentary sequences; and the impact of orbital cycles on sedimentation and faunas. Together with O. H. Walliser from Göttingen, Michael was at the forefront to recognize a complex succession of Devonian extinction events (House 1983, 1985) and recognized that ammonoids, as a type of ‘bioseismometer’, were especially sensitive to global environmental change. Several studies dealt with the two mass extinctions known as the Kellwasser (Becker et al. 1989, 1991; Becker & House 1990, 1994a; House 1997) and Hangenberg Events (Price & House 1984; House 1992, 1996b) but he gave more emphasis to the complete event set (House 1987a, b, 1988b, 1989b, c, 1993a, 1996a, c, 1998, 2002; Racki & House 2002) with many shared similarities between events that require a uniform causation model and that contradicted the simple impact scenarios of other contemporaneous authors. The links between biodiversity and eustatic sea-level change were recognized to be strong and he was the first to propose a Devonian global eustatic chart (House 1983). Since this was published in the Proceedings of the Ussher Society, the subsequent Johnson et al. (1985) sea-level curve became much more well-known. The interest in global sea-level change and, therefore, in sequence stratigraphy, fuelled his field work as much as his enthusiasm for goniatites and led to a series of publications (e.g. Becker et al. 1993; House & Kirchgasser 1993; Becker & House 1997; House & Ziegler 1997; House et al. 2000c). The interest in cyclic stratigraphy arose first from his Jurassic observations (House 1986) and he realized the enormous potential for a much more refined, extremely precise future dating method. His attempts to interpret Devonian successions in terms of Milankovitch cyclicity (House 1991, 1995) have to be seen as pioneering work that left from being truly a family man, raising two children, Sue and Jim. Of course, this would have been impossible without the permanent and highest support of his wife Felicity, better known as Flick to those students and friends who had the pleasure to stay at one of the homes of the House family.

The Volume presented here includes significant contributions of the Rabat meeting as well as some papers invited by the editors because they fit the aim of the current book, which is to continue the work and ideas of M. R. House and broaden its approach. Contributions cover pelagic, neritic, and terrestrial environments (Blieck et al.; Marshall et al.) and all of the Devonian System. They are presented roughly in ascending stratigraphical order. There are case studies on rare neritic fossils found in pelagic settings, and vice versa (Ebbighausen et al.), on specific short-term global events (Marshall et al.), including the main mass extinction periods near the Frasnian-Famennian (Riquier et al.; Harkopf-Fröder et al.) and Devonian—Carboniferous boundary (Brice et al.), on geochemistry, magnetostratigraphy and on the Eovariscan tectonic influence on the correlation of regional sequences (Kaiser et al.). Since the meeting took place in Morocco, it is logical that several papers deal with Moroccan successions (Jansen et al.; Kaiser et al.; Brice et al.), but all contributions aim at global correlation or at the regional application of established global time definitions. Three papers cover the wide Lower and Middle Devonian of one of the most classical Devonian areas—eastern North America (DeSantis et al.; Bartholomew & Brett; Ver Straeten et al.)—where incredible stratigraphic progress has been enabled by an holistic approach combining lithostratigraphy, bentonite stratigraphy, biostratigraphy and sequence stratigraphy. Other investigated areas lie in Germany, France, the north of Brittany, and Algeria. Each of the papers offers important progress in its region, facies or part of the stratigraphic column and can be taken as an example of how research will have to continue. Devonian stratigraphy has progressed to such an extent in recent time that there is no further excuse to look at any basin only in terms of its regional geological context. It is the aim of the international community of Devonian stratigraphers to reconstruct the whole Devonian world, its ecosystems and sedimentary history at the finest available global timescale and, herewith, we offer several steps towards this goal.

References


INTRODUCTION—A TRIBUTE TO M. R. HOUSE


