



15th Water-Rock Interaction International Symposium, WRI-15

Mike Edmunds: fifty years of water, rock and interaction

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**Abstract**

For almost 50 years Mike Edmunds pursued an accomplished and influential career in hydrogeochemistry. His research interests covered the gamut of groundwater quality issues ranging from the effects of acid rain on upland streams to the origin of deep basin brines, and spanned the globe. Almost from the start of his career he was involved with the IAGC's Water–Rock Interaction (WRI) Working Group, becoming a founding father of the triennial WRI symposia which commenced in 1974 and continue to this day. Mike was a geologist turned chemist but also, crucially, a ‘people person’. This combination of qualities created a tireless advocate for the subject of water–rock interaction in all its variety.

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**1. The early days**

Wyndham Michael Edmunds, invariably known as ‘Mike’, was born in 1941 and entered Liverpool University in the late 1950s, initially to study modern languages. Fortunately for us he soon became interested in earth sciences and converted to the geology BSc course. Following graduation, he remained at Liverpool to undertake a PhD which involved electron microprobe studies of garnet genesis in polymetamorphic rocks. Mike always acknowledged having been inspired at Liverpool particularly by Robert Shackleton, Wally Pitcher and Mike Atherton, while the Geology Department's enthusiasm for the Dalradian rocks of Donegal and Connemara led to Mike's lifelong affection for the west of Ireland.

At the end of his funding in 1966 (the PhD would not actually be awarded until 1968), Mike needed to earn a living so applied to the Institute of Geological Sciences (IGS, now British Geological Survey, BGS), which he joined in late-1966, and where like many new entrants to that organisation he was put to work on a completely unfamiliar topic, in this case the fledgling subject of groundwater geochemistry (as it was in the UK of the late

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1960s). Having cut his teeth on a study of the thermal and mineral waters of Britain, and armed with copies of Garrels & Christ and John Hem's magnum opus on the geochemistry of natural waters, he went on to make one of the pioneering studies<sup>1</sup> of the redox-related hydrogeochemical changes that occur along the flowpaths of aquifers passing into confinement (Fig. 1). This study, of the Lincolnshire Limestone in eastern England, has since provided a blueprint for many similar investigations worldwide, not least because it considered the implications for aquifer development, well corrosion and the fate of pollutants – concerns that have scarcely diminished for most aquifers over the subsequent decades.

However, even at this early point in his career, Mike had gained experience overseas in the form a study of groundwater resources in the Libyan desert. This was the start of two of the abiding interests of his working life: arid-zone recharge, and palaeo-groundwaters/climate.

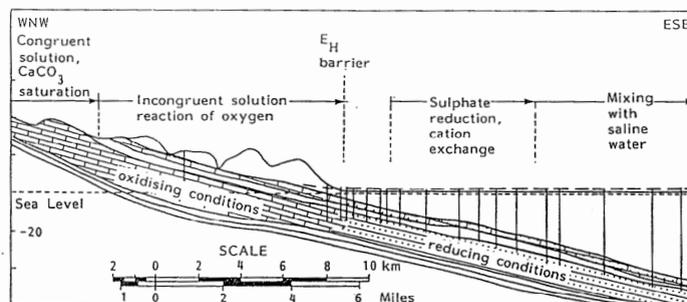


Fig. 1. Where it all began: from Mike's early work on downgradient redox changes in the Lincolnshire Limestone<sup>1</sup>.

## 2. The birth of WRI symposia

The pioneering paper referred to above<sup>1</sup> actually arose from Mike's presentation at the International Symposium on Hydrogeochemistry and Biogeochemistry held in Tokyo in September 1970. At this meeting, co-sponsored by the then International Association for Geochemistry and Cosmochemistry (IAGC), the late Prof Mikhail G Valyashko organised a small group of interested geochemists and proposed setting up various working groups, including WRI to 'study water-rock interaction under various temperature and pressure conditions, compile key programs, develop methods, and determine transportation forms of components'. During the 24th International Geological Congress in Montreal, Brian Hitchon and the late Donald E White convened an informal meeting of WRI (known as WRI-0) on 23 August 1972, where 16 interested parties met to discuss the future of WRI, including Mike. A proposal was made to hold WRI-1 in Prague, based on a suggestion by Tomas Pačes. This launched a series of triennial WRI symposia, which have become the main function of the WRI Working Group.

WRI-1 was held in 1974. Mike of course was there, and presented a paper on Chalk porewaters<sup>2</sup> which was among the first to look at this aspect of the hydrogeochemistry of southern Britain's most important aquifer. But during this time (the early 1970s) Mike realised that to get the most out of the newish field of trace elements in groundwater would require a better analytical background than could be achieved in the obsolescent laboratories at the IGS's London HQ. Fortunately this realisation coincided with the relocation of the IGS to sites outside London, and thus in 1977 he was able to establish at Wallingford (near Oxford) laboratories with the state-of-the-art facilities necessary to be at the forefront of analytical hydrogeochemistry. For example, BGS Wallingford had some of the first ICP-AES and ICP-MS instruments in the UK, together with a laboratory dedicated to isotope hydrology.

## 3. Secretary General

With these laboratory facilities behind him, Mike could devote his energies towards a broad range of groundwater-related activities. In the UK of the late 1970s into the 1980s, he found himself working simultaneously on topics at opposite extremes of the hydrogeochemist's operational envelope, on the one hand determining the geochemistry of basin brines several kilometres deep as part of the investigations into the geothermal potential of the UK, while on the other working with surface water hydrologists and ecologists from other institutes of the Natural Environment Research Council (IGS's parent body) to understand the impacts of acid rain, particularly in

upland catchments. The subject(s) of his presentations at WRI-2 (Strasbourg, 1977) and WRI-3 (Edmonton) appear to be lost in the mists of time, but at WRI-4 in Misasa (1983) he described some of the first work using hydrogeochemistry to investigate Hot Dry Rock (HDR) geothermal systems<sup>3</sup>. WRI-5 in Reykjavik saw Mike looking at lithium mobility and cycling in dilute continental waters<sup>4</sup>, work which subsequently fed into aquifer studies using trace elements. He also contributed to a study of trace element behaviour in upland catchments inspired by the recognition that UK water quality was being influenced by acid rain<sup>5</sup>. It was around this time that Mike was awarded a special merit promotion within what had now become the BGS, which would allow him to devote more time to the science he most wanted to do.

At WRI-5, the UK was selected to host the next symposium in 1989, with Mike at the helm. He duly selected an organising committee which decided the most appropriate location for a British WRI meeting was the thermal spa town of Bath, where Mike's by now close scientific associate John Andrews was based at the University and therefore well positioned to oil the wheels of organisation. However, about halfway in it was discovered that the roof of the chosen venue, the historic Assembly Rooms, was in danger of collapse and that extensive remedial work would be required. Time for a plan B, quite possibly a blessing in disguise as it had become clear that Bath would have been very crowded by tourists at the scheduled meeting time in August. Another spa town, Malvern, was chosen, which proved to be a much more suitable venue. WRI-6 was held under warm and sunny conditions, contributing to the legend that Mike was always lucky with the weather when organising events with an outdoor element. He did not himself present a paper at the meeting but contributed to a study on interstitial water-rock interaction in the unsaturated zone of a UK aquifer<sup>6</sup>. This rather neatly combined the effects of acid rain on sandstones with his growing enthusiasm for the chloride mass-balance (CMB) technique for recharge estimation.

WRI-6 was the first symposium of the series to do a deal with a publisher (Balkema) over production of the Proceedings. By contrast, it was probably the last of the symposia to be organised fully 'in house' rather than by using professional expertise. Despite that, nothing went seriously awry – though the BGS management grumbled over the amount of staff time devoted to it by some members of Mike's team.

#### **4. Working group chairman**

Next came WRI-7 at Park City in 1992, which remains the best-attended symposium of the series. By now Mike had become Chair of the WRI working group, a position he was to hold for 10 years. Although typically involved to some extent with most of the WRI symposia, as WRI Chair this was a particularly busy decade for him. He found time to give a presentation on the CMB technique applied in West Africa<sup>7</sup>.

WRI-8 held in Vladivostok in 1995 proved challenging in more ways than one. Just getting there was something of a trial, with participants numbering fewer than half those for Park City. Nevertheless the WRI spirit prevailed, aided in part by various other kinds of spirit, particularly at the banquet. Mike gave a keynote talk on geochemical indicators<sup>8</sup> but also contributed to papers on gold mobility and to two studies on springs in the Primorye region around Vladivostok which he had carried out with Oleg Chudaev, the WRI-8 Secretary General, and his colleagues.

WRI-9 at Taupo in 1998 was even further to travel for many and this was again reflected in participant numbers. Yet the unbeatable touristic potential of New Zealand rewarded those who made the effort. Mike's main contribution here was on his concept of trace elements as residence time indicators<sup>9</sup> but he also contributed to papers on thermal waters in the Kamchatka peninsula and on thallium. This last was a symptom of his growing interest in the links between groundwater geochemistry and health.

Mike's last symposium as WRI Chair was WRI-10 in Sardinia (2001). Participant numbers were up again, resulting in the highest number of presentations since Park City. Mike's was a keynote talk on the significance of geochemical signatures in long-residence sedimentary aquifers<sup>10</sup>, a topic which remained of great interest to him throughout his career.

#### **5. University professor**

Mike left the BGS at the end of July 2001 when he reached the then mandatory retirement age of 60. At this point he also relinquished the position of WRI Chair, which he had occupied for the longest period since Brian Hitchon's tenure. However it was far too early for him to give up his interests in hydrogeochemistry, so he joined Oxford University as Research Director of the Water Research Centre at the School of Geography and the Environment. Since he already lived in Oxfordshire this was a convenient transfer of work location.

Mike also continued his association with WRI as a member of the steering committee composed of previous secretaries general. This typically meets once or more between symposia to resolve any issues that may arise with regard to the next venue. Although a venue in China had been identified for the 2004 symposium, in the event it was decided to postpone this and so the USA stepped in to host WRI-11 in Saratoga Springs at fairly short notice, a feat for which Sue Brantley and colleagues must take the credit. By this time Mike was well into the geochemical baseline phase of his career, having run an EU collaborative project imaginatively named BaSeLiNe, and delivered a paper on this topic<sup>11</sup>.

By this time, Mike was well into collaboration with Jinzhu Ma and other Chinese collaborators on the origin of waters in the spectacular lake and dune country of the Badain Jaran desert of NW China. He was particularly pleased to see WRI-12 taking place in Kunming in 2007, where he could present on this topic<sup>12</sup> with the aid of John Gates, one of the excellent postgraduate students he had acquired since joining academia. The next symposium (WRI-13, Guanajuato) also proved an opportunity to meet up with previous collaborators from Mike's visits to Mexico over the years, though he chose to give a plenary talk on one of his most longstanding enthusiasms, the application of the CMB method to the African Sahel<sup>13</sup>.

Mike's final symposium was WRI-14 in Avignon in June 2013, where he presented on the subject of the pioneering Russian geochemist Vladimir Ivanovich Vernadsky<sup>14</sup>. A highlight of the Guanajuato meeting in 2010 had been the presentation to Mike of the Vernadsky Medal of the IAGC (now International Association for GeoChemistry), and his curiosity about the man had clearly been piqued. The medal is awarded in recognition of distinguished accomplishment in geochemistry over the course of a career; clearly Mike fully met the requirements.

## 6. Summary

If Mike Edmunds entered the field of hydrogeochemistry somewhat by chance, he certainly made the most of his good fortune. A gregarious man, he used his interpersonal skills to build up a global network of collaborators. He also had a wide range of geochemical enthusiasms, as shown by his WRI presentations not to mention all his other publications. He was an ideal person to promote aqueous geochemistry via the WRI platform, possessing not only organisational strengths but also a singular ability to inspire others, young and not-so-young alike. He is, alas, no longer with us; but Mike's science lives on both through his publications and the 'family' of researchers he inspired.

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