

Mike Coward (1945–2003): portrait of a structural geologist



This Special Publication celebrates the life and times of one of the late 20th century's most influential structural geologists, Mike Coward. At various times Mike was H H Read Professor of Geology at Imperial College, Chair of the UK Tectonic Studies Group and Council Member of the Geological Society of London; but these official titles belie a deeply unconventional man who loved to challenge accepted wisdom and dogma. Mike's career was an eclectic mix of pure and applied research in structural geology that straddled continents and geological time. Normal chronological narratives can hardly do justice to a man who could step from theme to theme at times, seemingly to colleagues, almost on a daily basis. This brief biography attempts to draw together some of the strands, in rather

the same way as the Special Publication itself, to offer a glimpse of a character who could be very much larger than life.

Student days

Michael Peter Coward was born in Bolton, Lancashire, on 26 June 1945 and grew up as an only child in neighbouring Farnworth. Through a great sacrifice on the part of his parents, he attended Bolton School, an institution he held in great esteem throughout his life. In 1963 he passed the scholarship examination in physics and chemistry for Imperial College. When he arrived there that autumn he changed to geology, entering what was at the time one of the greatest departments in the world. The geology course

involved a great deal of fieldwork, an activity Mike would love for the rest of his life. But it was not structural geology that attracted him at the beginning. At the end of his first year he did a mapping project in Iceland, supervised by George Walker, against the backdrop of erupting Surtsey, and thus almost became a volcanologist. It was John Ramsay, leading a field class to the Scottish Highlands, who later took Mike into the world of structural geology.

In 1966, having graduated with first class honours, Mike stayed on at Imperial College to do a PhD. A fanciful notion of doing structural geology among elephants led him towards making early efforts to set up a project in either what was then Ceylon, or in southern Africa. Janet Watson, his future supervisor, had other ideas and sent him to the Outer Hebridean island of South Uist where the only big game were sheep and deer. John Myers was already one year into his thesis on neighbouring Harris and Janet thought they would make a good team. The team soon grew. Pete Francis took on Barra, Rod Graham worked on North Uist, the islands in the Sound of Harris and much of South Harris, while John Myers mapped the rest of Harris. Later, Rick Sibson worked in detail on the Outer Isles thrust zone and Richard Lisle mapped northern Lewis. Mike's area was South Uist and Benbecula. He fell in love with the wide white strands, the moorland, the mountains and perhaps most of all, the way of life in the Western Isles. He stayed in Bornish, South Uist with an elderly spinster called Morag Macmillan, whom he looked upon as his adoptive mother. The magic of Uist was always to remain very special to Mike. These early researches are described in more detail elsewhere (Graham this volume).

The early career: South America and Australia

But Mike still felt the pull of dramatic volcanic landforms, and after finishing his PhD in 1969, he decided to abandon deep crustal structures for a while. With Pete Francis, he organized an expedition to northern Chile to study the volcanology, structure and geochemistry of the highest volcanoes in South America. John (Taff) Roobol, Pete Cobbold and George Walker joined them. Mike was quartermaster for the trip and very successfully managed to scrounge the necessary food and money, including a crate of whisky. The Royal Society paid their air fares and the Natural Environment Research Council (NERC) provided a Land Rover. They flew to Santiago in July 1969 and established base camps

for fieldwork in the mining towns of Calimo and Chuquicamata, in the High Andes. When the work was completed, they travelled by bus through Ecuador, Colombia and Central America, and returned from Mexico City to the UK in 1970.

The South American trip failed to quell Mike's wanderlust and shortly after returning to England, he emigrated to Adelaide, having accepted a job with a small mining company exploring for nickel in the Northern Territories and Western Australia. When the company ran out of funds, Mike went travelling again, this time through South Africa and Mozambique.

Structural geology in Africa

Mike's return to the UK in 1971 coincided with yet another field trip to the Hebrides. In the kitchen of the Rodel Hotel on South Harris, Robert Shackleton, then Professor of Geology and Director of the Research Institute of African Geology at the University of Leeds, offered Mike a job as his research assistant. Within a month, Mike was dispatched to collect a Land Rover from Malawi and drive it to Salisbury to begin the long-lasting project in the Limpopo Belt.

The Limpopo study marked the first of a series of significant African projects that continued throughout Mike's life. It led to innovative reinterpretations of the Archaean greenstone belts of what was then Rhodesia and gave him early experience of gold mineralization, a topic he would return to in later life. His growing attraction to Africa was encouraged by Robert Shackleton, who continued his own studies at the same time on the Pan-African belts of East Africa. A major structural and geochronological study of the Pan-African Damaran fold belt in Namibia came in the mid-1970s. Sponsored by NERC and RTZ, this was the first time Mike found himself leading a significant, multi-disciplined research project. Working with a series of students and the geochronologists from the University of Leeds (notably Chris Hawkesworth) a modern geometric, kinematic and geochemical analysis revealed new perspectives on Pan-African evolution.

The Damaran work led Mike along the postulated former plate boundary to Central Africa. In the early 1980s he worked with Mike Daly, then a field geologist with the Geological Survey of Zambia, and later a postgraduate student in Leeds. Around a camp fire, towards the end of a 10 day foot-safari in the Muchinga Mountains of northern Zambia, Mike reflected ruefully to Daly: 'I don't know why, but my students always believe that crucial exposures are only found at

the top of the highest mountain or, in your case, in the most remote part of Africa imaginable.’ That day he had walked past huge herds of elephants, crossed rivers full of watching crocodiles and settled down to a dinner of fresh impala and Scotch whisky.

Not only did Mike exude his own tireless passion for field research, he required, and inspired, it in the people he worked with. Together with Mike Daly he set up a number of structural field classes in Africa known as ‘Geotraverses’. Run by UNESCO, in co-operation with the Musée Royal de l’Afrique Centrale in Belgium, this laudable initiative brought modern field geology to the African universities. The students loved the enthusiasm and fun that came with Mike.

The Leeds and Moine thrust years

In 1975, Mike was appointed Lecturer in the University of Leeds. Together with Andrew Siddans and then Rob Knipe, the later part of the decade saw Mike build on the foundations laid by John Ramsay during his time at Leeds, to reorganize and expand the undergraduate courses in structural geology. Students either loved or hated the ‘work hard—play hard’ philosophy and the occasionally outrageous field classes, complete with Hebridean singing. The extra-curricular geology trips live longest in the memory. Mike would set up spontaneous mid-week, mid-semester trips to see structures, sometimes heading off to Pembrokeshire or even Brittany, with a minibus of undergraduates and PhD students. This did create certain antagonism among some of his colleagues. In the modern micro-managed world of ‘teaching and learning outcomes’, universities do not offer undergraduate experiences like that any more. Perhaps it is no coincidence that well over half of the graduates from those years went on to become professional geoscientists.

Mike’s main research during his time at Leeds was on the structural evolution of the Moine thrust belt, a major NERC funded project that provided the springboard for a dozen PhD projects. It was initiated at about the same time as deep seismic reflection profiles were beginning to be shot through the continents, timing that added much to the interpretation of the profiles and led to Mike playing a leading role in the steering group of the NERC-sponsored BIRPS seismic programme in the early 1980s. This period was probably one of the happiest times of his life, doing fieldwork in surroundings he loved with new ideas emerging all the time.

One of the attractions of NW Scotland was its long tradition of structural investigation,

exemplified particularly in the classic North-West Highland Memoir of 1907. Indeed, Mike Coward could be compared with Ben Peach in the rapidity with which he could map ground. Each field season in Scotland generated some new insight and a string of papers, challenging both the rules of thrust system development and the accepted wisdom for classic outcrops. Sometimes these reinterpretations were of his own papers from a couple of seasons earlier. Keeping up with this creativity could be challenging for the expanding group of PhD students, some of whom characterized each new discovery as the ‘whim of the week’. But the work has stood the test of time, with many of his papers retaining fundamental importance for understanding thrust systems and their relationship to larger orogenic processes. All this fieldwork did not do his teeth any good, for Mike was always a great chewer of pencils and crayons. On rainy days the colour would run and you could tell where Mike had been mapping by the rainbow on his face.

Like Peach and his contemporaries, Mike often stayed at the Inchnadamph Hotel, and at his request, his ashes were scattered on a hillside near the hotel, with views of the Ben More range.

The Greater Ranges

In the mid-1970s, after years of construction, the Karakoram Highway was finally opened, linking Pakistan to western Tibet and providing one of the world’s great geological transects. Like many other geologists, Mike felt compelled to go and investigate it. In 1979 he started work, initially with Brian Windley, in northern Pakistan, supported by a string of NERC grants. Fieldwork in the NW Himalayas, then as now, was always an adventure. The basic provisions were often supplemented by smuggled parmesan cheese, ham and saucisson, munched with relish on some dusty track each day. Suitably nourished, Mike was in his element, able to draw cross-sections through vast tracts of barely known geology in an astonishingly short time. Almost all of this work was carried out in collaboration with the University of Peshawar, and similar cooperation with UK geoscientists continues to this day.

It also saved his life. Disaster struck in the late summer of 1981 when, high above the northern town of Skardu, the vehicle containing Mike, Brian Windley, Carol Pudsey and Asif Khan rolled off a narrow road. Such events are commonly fatal, because in many places the roads lie hundreds of metres up steep hillsides. The only member of the group to escape without major injury was Asif Khan, at the time a PhD student

of Mike's from the University of Peshawar. Asif walked 40 km back to an army outpost to raise the alarm, but it was many hours before help arrived and, as night came, so did the snow. Mike knew that if he went to sleep he might never wake up, and kept going with endless renditions of Hebridean and Irish songs. They were rescued at four in the morning and bumped back down the road to the Skardu military hospital. Before they could operate on Mike's badly damaged leg, an earthquake struck. Days later, with the roads blocked by landslips, the team was flown out of Skardu on the floor of a small plane. Despite the dire circumstances, Mike managed to get some spectacular photographs of Nanga Parbat from the plane, snaps he showed at meetings for years afterwards. Back in Leeds, Mike enlisted the whole group of PhD students in gastronomic smuggling to ensure he was sustained during his hospitalization and kept threatening to write a paper on the balanced cross-section and structural restoration of his lower leg, which was perfectly imaged in the X-rays.

In 1985 he was asked by Robert Shackleton to join a research project, funded by the Royal Society and the Academia Sinica, which involved a traverse across Tibet. Robert organized 14 leading western geoscientists to form a team with Chinese counterparts. The cost was well over £1 million and involved reconnaissance trips to China, plus training and 'group bonding' visits to geological sites in Europe. Mike celebrated his 40th birthday on the traverse with donkey and chips, washed down with some local wine and followed by a sing-song. A year later, during a medical check prior to a follow-up trip to Beijing and Lhasa, his heart problem was diagnosed. After a triple bypass operation, he was able to go as far as Beijing but did not attempt another high-altitude Tibetan trip, though it did not affect travel elsewhere.

Imperial College, basins and the European ranges

In 1983 Mike was appointed Reader at Leeds, but soon after was offered the prestigious H. H. Read Chair of Geology at Imperial College and moved there in 1984. His Moine thrust studies continued for a while and he became interested in tracing the system offshore. As he gained access to industrial seismic data from the West Orkney basin, his attention turned from the thrust itself to the sedimentary basins on top of it. One especially damp afternoon he was discovered by some of his students with several tens of metres of paper seismic lines, completely covering the floors of the residents' lounge and corridors of

Ceilidh Place Hotel, Ullapool. This heralded a period of research on the structure of the British sedimentary basins, which would take him closer to the oil industry and further away from academic geology. The North Sea became an important focus, with an industrial incentive of course. Yet there was a significant academic component to the new ideas that were developed, such as with Simon Stewart on the salt tectonics of the southern North Sea. The culmination of all this work was a major contribution to the *Millennium Atlas* (2003). These three chapters were Mike's last major publications.

The loss of the Tibetan research led Mike to discover European geology and use his experience of inversion, gained from looking at seismic profiles from the southern North Sea and elsewhere on the UK continental shelf, to look at the external zones of the Alps, where Gidon, Lemoine, Graciansky and others had described deformed Mesozoic half-graben. His first research students at Imperial College mostly worked on one or more of these graben and, of course, were expected to do a great deal by themselves. Jean-Pierre Gratier, Professor of Geology at Grenoble, once remarked that he always knew when summer was coming because it was invariably heralded by an English student knocking on his door, explaining that he was a Mike Coward student, and asking if Professor Gratier knew where his field area was.

It is easy to be cynical about Mike's relatively brief encounter with the Alps; but anyone tempted to say it was more about good food and great wine than geology should read the major Alpine review that he wrote with Dorothee Dietrich in the Geological Society's Special Publication on *Alpine Tectonics* in 1989.

The European and offshore inversion themes continued into the 1990s. Involvement with British Gas offered the Mike the chance to move east along the Alpine chain into the Carpathians. Not only was the orogenic belt seen at this time as an area of interest for hydrocarbons, it also offered some exciting regional structural problems and led to the collaboration with Michal Nemčok and colleagues at Bratislava.

Minerals and oil

After his work on African mobile belts and greenstone belts, Mike became increasingly involved in the mid-1980s with the mining houses of South Africa, and was a frequent visitor to the copper mines of Zambia. He revelled in the 3D geometrical data available from the mines, quarries and drilling, a precursor of his passion

for good seismic data. While working on the structural setting of the gold deposits, initially with BP Mining then with its successor, Gencor and Iamgold, he met Richard Spencer, with whom he was associated for many years. The focus of attention was the Witwatersrand basin, with its sequence of four stacked basins ranging in age from Archaean to Jurassic. Undoubtedly its geographical proximity to his beloved Limpopo belt made it too much to resist. His interpretation of 2500 line km of Gencor's seismic data from the Witwatersrand basin was done at a characteristically frenetic pace and, although he often appeared to be doing something else like tying his shoe laces or staring out of the window while someone was talking to him, his conclusions would always faithfully draw on ideas and snippets of field evidence that had been presented to him. His 'gold' colleagues speak of working with Mike as a wonderful, often humbling experience where the greater significance of something that they had been working on for months frequently occurred to him in a flash.

Richard Spencer notes that Mike's ability to visualize structure in three dimensions was extraordinary. He had an amazing ability to sketch sections and maps, almost to scale, on the fly. He would ask to go back to a road-cut that had been passed at speed on the way to the outcrop of principal interest saying 'I think I saw something like this' and he would haul out his notebook and produce the cross-section from memory. From a stop at the road-cut on the return journey, Mike would casually fill in the details on his sketch, rounded off with a few structural measurements or confirmation as to what stratigraphy was involved.

At this time, Mike seemed to distrust workstations and insisted that interpretations be done on paper, possibly a throwback to the Ceilidh Place Hotel. Consequently, mining company meeting rooms were converted into vaguely controlled chaos with all working surfaces pushed together to accommodate the base maps, and the walls draped with various layers of seismic sections. Mike's consulting trips to the Witwatersrand basin were always rounded off by a presentation to management, held on Friday afternoon, and as the week progressed towards this deadline, pencil consumption would increase and his teeth would become ever more encrusted with paint chips. He made a fundamental contribution to the understanding of the tectonics and development of the Witwatersrand basin and helped to put the structural controls of gold mineralization into that context. It was a key to the development of exploration targets. Mike left his contacts in Gencor and Iamgold the gift

of being able to think differently. One wonders whether he ever realized the extent of his positive influence on the people with whom he worked.

Through the 1990s and until his death in 2003, Mike experienced ever-increasing involvement in both mining and oil industries; for by now, large numbers of his ex-students had become a powerful network through which to access ideas and data. He consulted for almost all of the active companies in the North Sea, notably (in his last years) for Statoil on North Sea fault block structure and evolution. He worked for both the oil and mining industry in many parts of the world, on major interpretation projects; with BP in Venezuela exploring the Monagas thrust belt, with Ecopetrol in Colombia, and with Placerdome in North America and Australia. The list is endless, but although working closely with industry, Mike rarely expressed appreciation for the challenge of commercializing geological insight, preferring to see conversations about commercial risk as an equivocation about a particular interpretation rather than a quantification of imperfect sight. As 3D seismic data became commonplace, Mike eventually became a proficient user of seismic work-stations; but he never lost the use of crayons and paper, or the fundamental belief that if you hadn't seen things in the field you would struggle to see them in seismic profiles.

As the 1990s progressed, Mike found academic life increasingly frustrating and life as a consultant more fulfilling. His health also deteriorated so that in 1997 he took early retirement on medical grounds from Imperial College and moved full time into his consulting company. He still maintained an aggressive pace of work, travelling widely to new areas, yet at the same time revisiting problems he had studied years before and reappraising them in the light of new experience and knowledge. He kept up this frenetic pace into the last weeks of his life.

Legacy

Mike married a fellow geologist, Alison Ries, in 1987. Their daughter Sarah was born in 1989, when they moved to Reading, and Charlie was adopted from Paraguay in 1994. Alison had been a friend since his postgraduate days and had been very much a part of his life during his years in Leeds. Now, though the creation of Ries-Coward Associates Ltd, they were able to work closely together once again.

Mike Coward leaves a huge collection of published articles, edited books, notebooks, maps, manuscripts and independent reports. Some of these are listed in this Special Publication and

many are cited by the papers that follow. Yet perhaps Mike's most significant achievement was his capacity to pass on his enthusiasm and passion for geology to his numerous colleagues and co-workers, his postgraduate and graduate students, and of course to the hundreds of geologists who have listened to his infectious talks and read his papers. Many of his doctorate students

are today professors and lecturers, exploration executives in oil and mining companies, or geoscientists in government and non-governmental institutions around the world. More than anything else, they are Mike Coward's legacy.

*With contributions from Rob Butler, Mike Daly,
Rod Graham, Alison Ries and Richard Spencer*