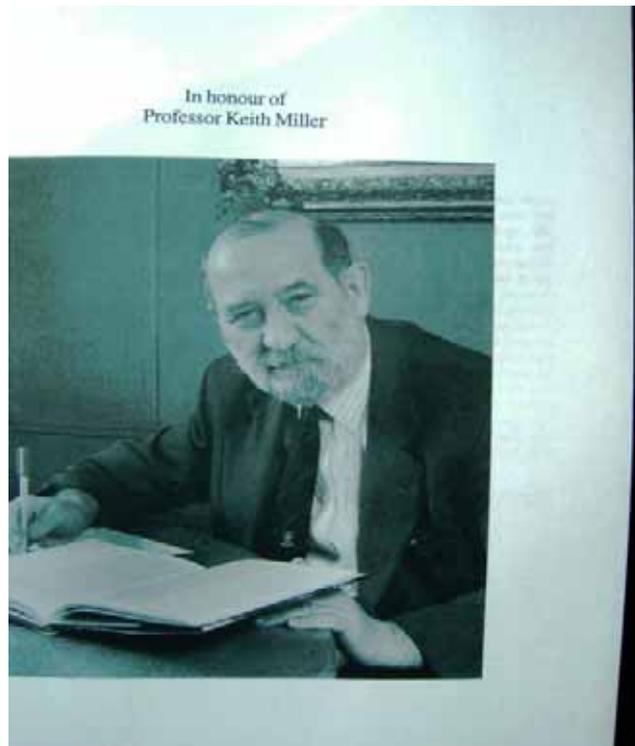


ALEXANDROUPOLIS - GREECE
ECF16 OPENING SESSION – Monday 3 July 2006 8:00
Commemoration Speech for Keith Miller by Alex Kfourri.

KEITH JOHN MILLER 1932 - 2006



We mourn the loss of a very dear friend. Keith Miller died peacefully in the afternoon of Friday 26 May from pneumonia after suffering for a number of years from a rare form of skin cancer.

Our thoughts and heart-felt sympathy go to his devoted wife Catherine who cared for him and tended to his every need selflessly during this very trying period. Our condolences go also to the other members of Keith's family.

I don't feel that I am here to bury Keith or to praise him. I just wish to pay homage and deliver a personal tribute to a truly exceptional man who will always be very much alive in my mind. But praise is inevitable for one who has led such a full and remarkable life as Keith did.

Keith Miller was born in Blackburn, Lancashire on 12 January 1932. He came from solid Northern English stock. He went to Queen Elizabeth's Grammar School in Blackburn. I have known him for 38 years but this does not take me back to his childhood. I tried to imagine what he may have been like as a schoolboy but on verification my conjectures were off the mark in some respects. For instance he discovered the beauty and glory of

the Derbyshire Peak district and of the lake district of Cumbria which were to give him so much joy during the rest of his life, only as a sixteen year old adolescent. It is there that he acquired his rock climbing skills and his insatiable appetite for exploration, of which more, later.

Keith entered the higher echelons of academic life through industry and that only adds to his merit. On leaving school he took an apprenticeship with Leyland Motors and attended evening courses for the HNC, also winning an award to a scholarship to read mechanical engineering at that venerable institution of the University of London, The Imperial College of Science and Technology. There was now no turning back. He enjoyed his university life to the full. He participated in sporting activities, soccer and tennis. His qualities of judicious leadership came into evidence with his Presidency of the Students' Union. After emerging with a FIRST he taught at various places, also in Africa, at Ahmadu Bello University in Zaria, Nigeria which, I seem to remember had opened about that time and later he lectured at Queen Mary College, London.

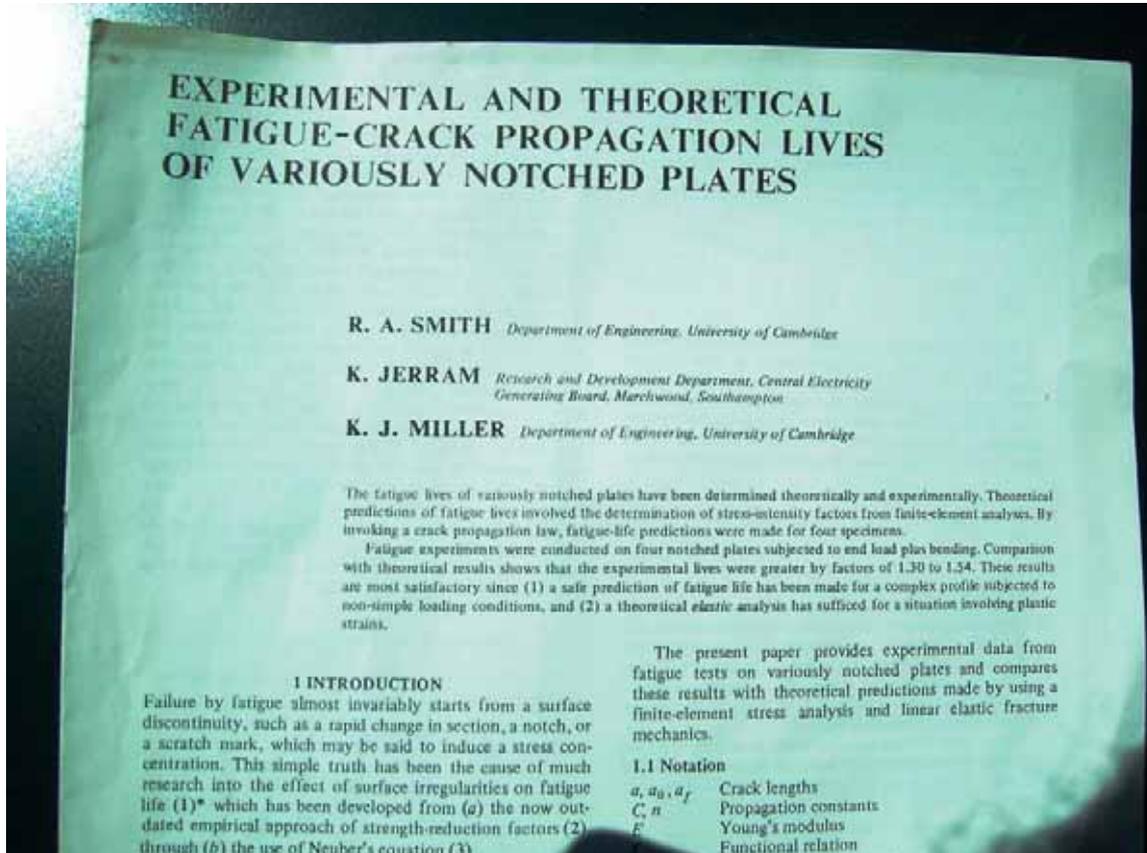
I met him in Cambridge about 1968. He was completing his Ph. D. from London University while I was struggling with my Ph. D. in Cambridge. But it was already obvious to me, by the very exalted nature (as seen by me at the time) of his appointment as Lecturer and Staff Member in the Department of Engineering of the University of Cambridge, combined sometime later with a Fellowship of Trinity College, Isaac Newton's College, that he was held in high regard. We often met in the Department and in spite of the difference in status we became friends and indulged in some games of tennis.

A year or so later we found that work wise we covered some common ground and we wrote our first paper together. However it was not until October 1973 that I joined his team (so to speak) and this started an association which has endured to the end.

Keith was an amiable extrovert with abounding energy. In Cambridge it took him a couple of months to find his feet but he soon made his imprint felt in the Engineering Department, extending appreciably the Fatigue Laboratory. He was not the sort of scholar who would cloister himself in isolation for weeks or months on ends in the pursuit of some abstruse theory. He enjoyed contact with people and being active all the time.

He had a very refreshing down to earth vision of fatigue phenomena and a great flair for what seemed to him to be the essential physical mechanisms and factors influencing fatigue. I remember for instance that in very early days the popular view on metal fatigue was that it was some kind of obscure malaise of the metal, a debilitating disease that caused it to ultimately give up the ghost. To Keith metal fatigue was simply the birth and growth of cracks and from this initial standpoint he set out chasing cracks in all their shapes and forms as a bloodhound pursues his quarry. He wanted to find out everything about cracks, their modes and their paths.

Keith's first two brilliant research students in Cambridge are very well known to you but, unfortunately, they are not attending our conference, Rod Smith and Mike Brown. I think I remember that with Rod Smith they were studying notches



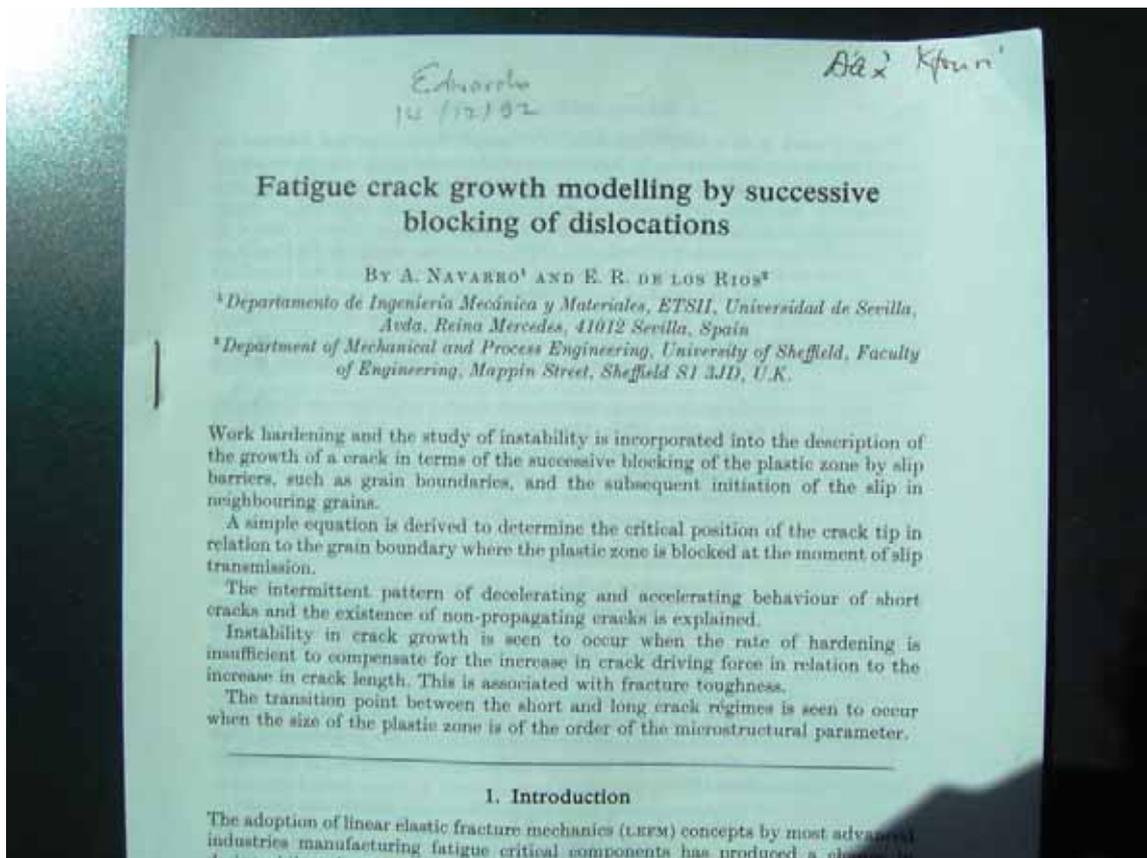
They found that the notch effect had quite a short range (A useful simple formula was derived for estimating the range of influence of a notch). But they observed that since short micro-cracks existed ab initio or were created at a very early stage of fatigue cycling, notches had a marked effect on the fatigue life of the specimen since most of the life was taken up under the short crack regime.

Keith Miller recognised at an early stage the effect of load biaxiality on the size of the crack-tip plastic zone and its relevance to fracture. With Mike Brown a vast programme on the effect of multiaxial loading and the examinations of activated planes was initiated. A multitude of sins have followed since, such as mixed mode fatigue, the interaction between modes, low cycle fatigue, thermal shock etc.

I mention these two cases as examples of Keith's early (perhaps shared) vision of what he thought could be significant factors in the comportment of metal fatigue although they might have seemed trivial to some at the time.

We have since had a large number of conferences on short cracks. At one time short cracks seem to have become an obsession with Keith. Whenever he saw a blackboard and

a piece of chalk or a flat surface to sit on with a pen and paper he would draw a dipping curve representing the deceleration of a short crack almost to a standstill, as it approached a grain boundary barrier, only to pick up again when the barrier was crossed. The pattern was repeatable at successive grain boundaries. (A dislocation model of this phenomenon was made by Navarro and Eduardo de Los Rios)



Now some of the short cracks grew large enough to come under the influence of the stress intensity K and their progression linked up with the stage II Paris law propagation line for long cracks, while others just stopped growing. The dividing line between the non-propagating and the propagating cracks in the grey middle region of the Kitagawa-Takahashi diagram is related to the fatigue limit or the threshold and Keith wrote interesting papers on this question.

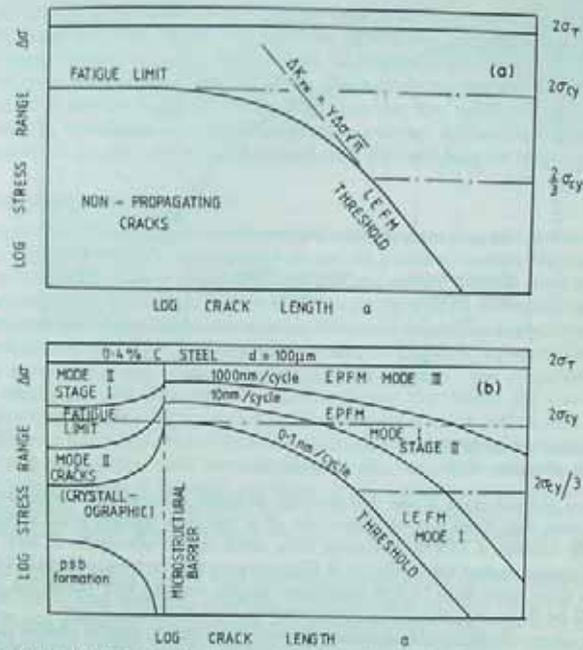


Fig. 2. Failure boundary maps. (a) The Kitagawa-Takahashi diagram [2]. (b) The Brown fatigue fracture mode map with crack speed contours [30].

To assist readers of this review Fig. 3 is presented to illustrate the three main regimes of short cracks. Additional lines such as a equal to d_1 , d_2 and d_3 represent the size of microstructural units such as inclusions, dislocation spacing, grains or distances between phases or strong/hard microstructural units, and these too will be expected to affect crack growth behaviour. Hence this region is also designated as the microstructural short crack (MSC) regime. As crack lengths

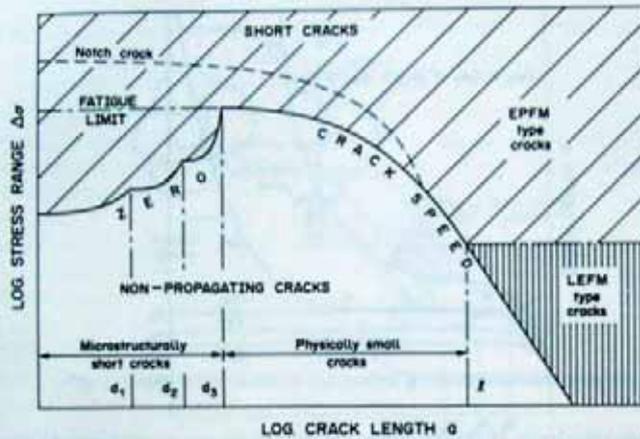


Fig. 3. Three regimes of short crack behaviour.

to define. These and other problems frequently give rise to not a little confusion in the current literature. Sometimes the boundary of LEFM behaviour is increased by authors up to and beyond the cyclic yield stress level despite the obvious loss of small scale yielding (SSY) assumptions above about $2\sigma_{cy}/3$ in a reversed stress test. In some cases LEFM analyses are even employed to describe MSC growth. It is clear that more experiments need to be performed on suitably shaped specimens that permit wide ranging studies over all the regimes listed above since experiments that only study boundary conditions are seldom of sufficient sensitivity to be able to delineate a boundary. For example it is not possible to use CT type specimens to study the full range of the PSC regime. Similarly it is difficult to perform wide-ranging EPFM type experiments on macro-notched specimens.

Some of these issues will be discussed in detail below since this brief review will be based on

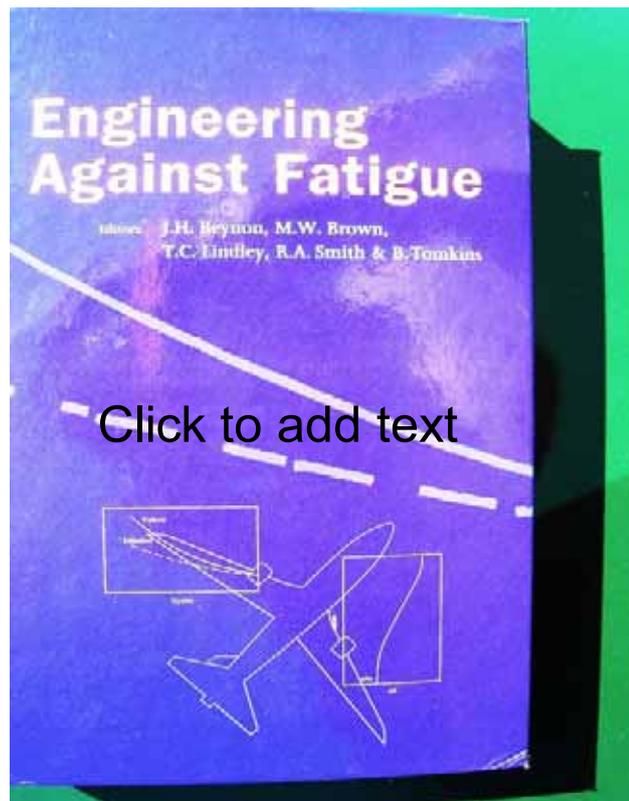
There were no conditions influencing fatigue which were not subjected to his scrutiny: the effect of temperature and of the environment, crack corrosion fatigue, thermal shock, low cycle fatigue, fretting, micro-structure, local plasticity, ratcheting and shakedown, you name it. I need say no more since you are more conversant with his work or interest in these fields than I am.

In 1977 Keith Miller took on a professorship in the Department of Mechanical Engineering of the University of Sheffield and soon became the departmental head. He set up his Structural Integrity Research Institute University of Sheffield (S.I.R.I.U.S) supported by industry and governmental institutions. With his friend and colleague Brian Tomkins a number of courses on metal fatigue for Industry were organised, as well as other subjects of interest to engineers. During his headship the international status of the department rose appreciably. Later he was appointed Dean of the Faculty of Engineering of the University of Sheffield.

Keith Miller had an affable personality and a truly international outlook combined with a natural gift for making close friends from all parts of the globe. He had a large number of research students, assistants and visiting colleagues. He authored or co-authored hundreds of technical papers and edited many conference proceedings and scientific reports. He also took on some consultancy assignments. Keith Miller was a tireless organiser and presided over a large number of International Conferences. The first ones that came to my notice were the ones on The Mechanical Behaviour of Materials (I.C.M).

He was a Founder Member and Past President of E.S.I.S. and it is true to say that had it not been for Keith Miller we would probably not be here to-day. The journal he founded, The International Journal of the Fatigue and Fracture of Engineering Materials and Structures (F.F.E.M.S.) is still going very strong at the present time. There was one conference however over which he did not preside but it was in his honour

... AND TO REFLECT ON THE CONTRIBUTION OF K.J. MILLER



It ended with a vivacious evening dinner at Cutlers Hall, best known to the international community for its promotion of stainless steel with which we come into contact at every meal.

KEITH MILLER'S EXPLORATIONS

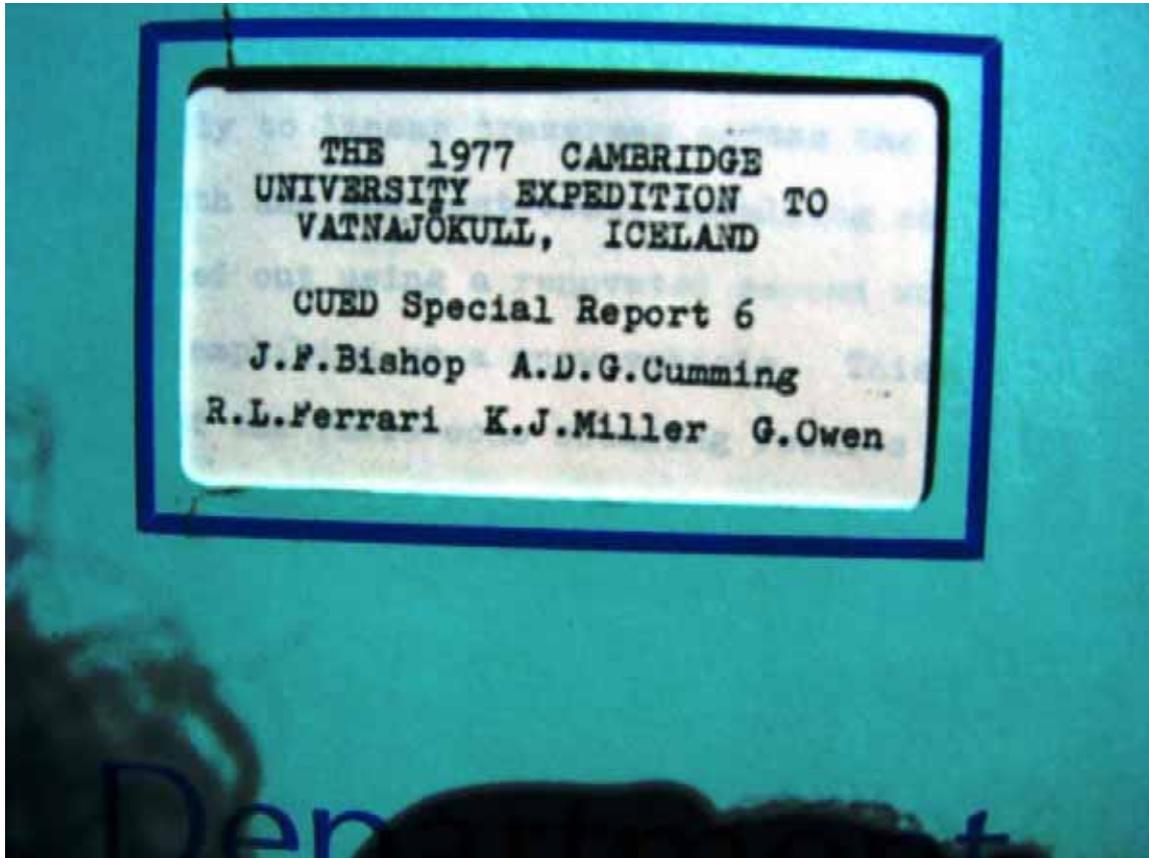
Keith Miller has participated in thirteen or more expeditions to Africa, Iceland, Greenland and the Karakoram, some mountaineering orientated, others with largely scientific aims but all also involving exploration.

Keith Miller is Professor of Mechanical Engineering at the University of Sheffield and was formerly a lecturer in the Department of Engineering at Cambridge University and a Fellow of Trinity College. He has participated in thirteen expeditions to Africa, Iceland, Greenland and the Karakoram, some mountaineering orientated, others with largely scientific aims, but all also involving exploration. He has recently been awarded the Royal Geographical Society's Founder's Medal and the Mungo Park Medal of the Royal Scottish Geographical Society for his contribution to the Earth Sciences.



But Keith had another equally remarkable side to his life: exploration. He took part in at least thirteen expeditions to Africa, Iceland, Greenland and the Karakoram, some mountaineering orientated, others with largely scientific aims but all involving

exploration. He participated in the 1977 Cambridge University Expedition to VATNAJOKULL in Iceland of which I have a record



FIELD WORK

CAMBRIDGE UNIVERSITY VATNAJÖKULL EXPEDITION, 1977

By J. F. BISHOP*, A. D. G. CUMMING**, R. L. FERRARI†, AND K. J. MILLER†

This expedition to Iceland was concerned with ice depth soundings of the largest ice cap in Europe and involved both the development of impulse radar systems and the use of satellite survey equipment for locating experimental stations and ice depth traverses (Fig. 1). Vatnajökull, which translated means 'water-ice', is a temperate ice sheet and measures approximately 140 km east to west and 100 km north to south, thereby occupying more space than all other glaciers in Europe combined. Ice depth studies had previously been limited to seismic experiments conducted during the French-Icelandic expedition of 1951 when some 33 individual soundings were recorded. A few gravitational studies have also been made. It was not until 1976, however, that a



FIG. 1. Map illustrating the routes taken by the expedition over Vatnajökull.

first glacier base profile was obtained by a joint Cambridge-Icelandic expedition using electronic equipment developed at the University of Cambridge (see *Polar Record*, Vol 18, No 115, p 375-77). From that expedition some understanding of the electrical properties of ice was deduced and it became possible to design equipment that, theoretically, could measure the deepest parts of the ice cap. It was agreed in Reykjavik, in July 1976, to carry out a joint expedition in 1977 using a Mark II British instrument to survey Vatnajökull, at least in part, time and weather permitting. Owing to unforeseen difficulties it was only possible for Cambridge University members to carry out this work.

* St John's College, and British Antarctic Survey, Cambridge.

** Emmanuel College, and Engineering Department, University of Cambridge.

† Trinity College, and Engineering Department, University of Cambridge.

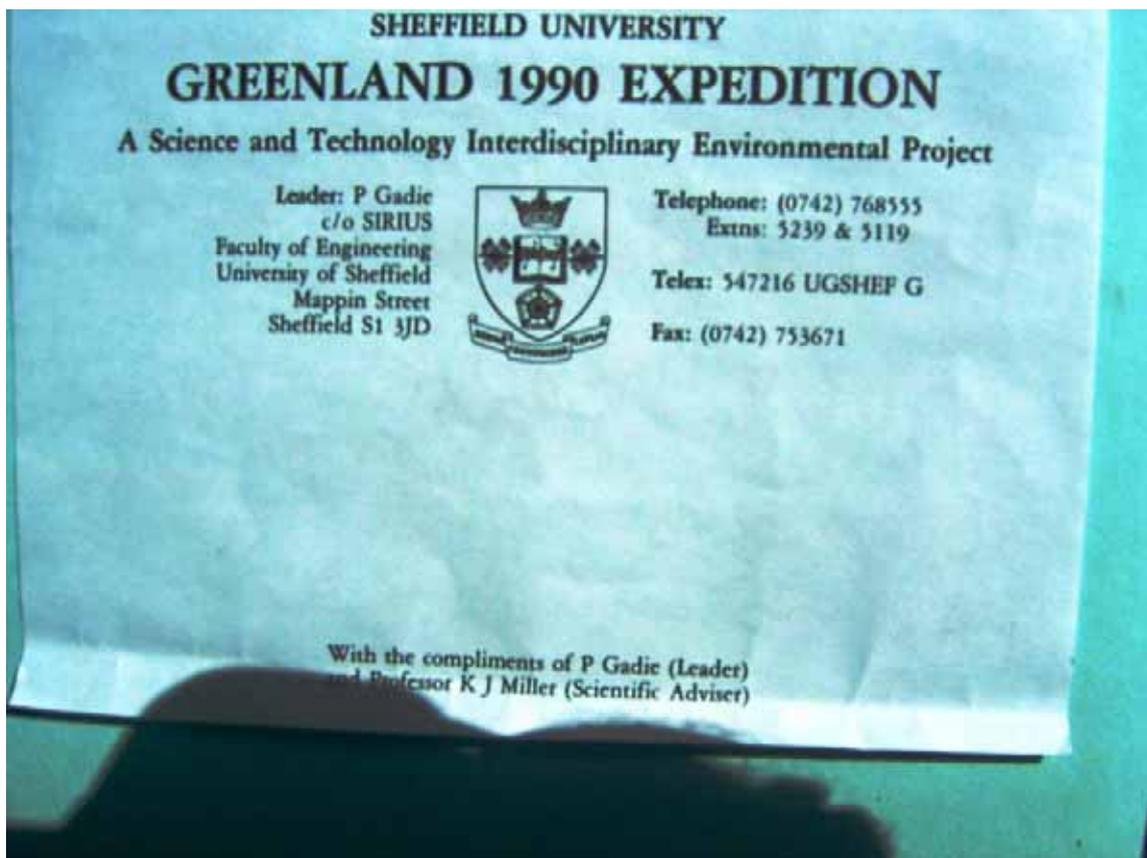
where radio-echo sounding equipment was used to obtain detailed thickness measurements of the ice mass

RADIO ECHO SOUNDING ON A VALLEY
GLACIER IN EAST GREENLAND

BY

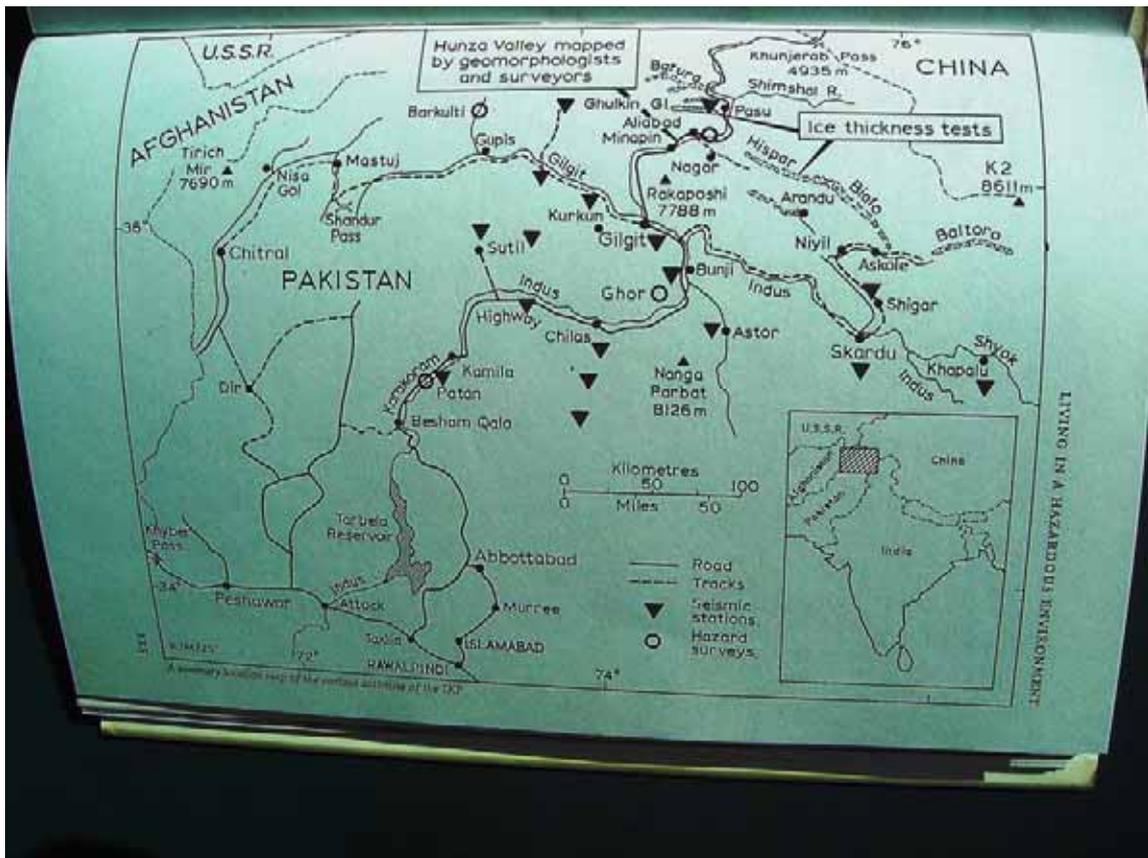
J. L. DAVIS, J. S. HALLIDAY and K. J. MILLER

I also dug up the notice for the 1990 Sheffield University expedition to Greenland.



(Keith had crossed a part of Greenland in a previous expedition. In 1975 he led a four-man team in the first North-South traverse of the Staunings Alps). On one occasion he disappeared for a while when he fell into a crevasse. Fortunately some of his equipment was caught on the edge providing enough rope or other item dangling down to enable him to extricate himself. Ironically, I remember that Keith had studied the fracture of ice and had worked out a formula involving K which gave the spacing and depths of crevasses in a crevasse area. I often wondered how close his calculations were in the case of his own very private crevasse.

Undoubtedly the crowning event in his exploration career came in 1980 when he was appointed to lead The Royal Geographical Society's 150th anniversary expedition, the International Karakoram project 1980. It was not the first time he had been to the Karakoram. This was a mainly scientific expedition involving some fifty to seventy participants of various disciplines and nationalities. It was not devoid of danger (no exploration is). The Karakoram Range has the greatest concentration of high peaks of any. It is situated near a triple point of three continental tectonic plates and is extremely seismic.



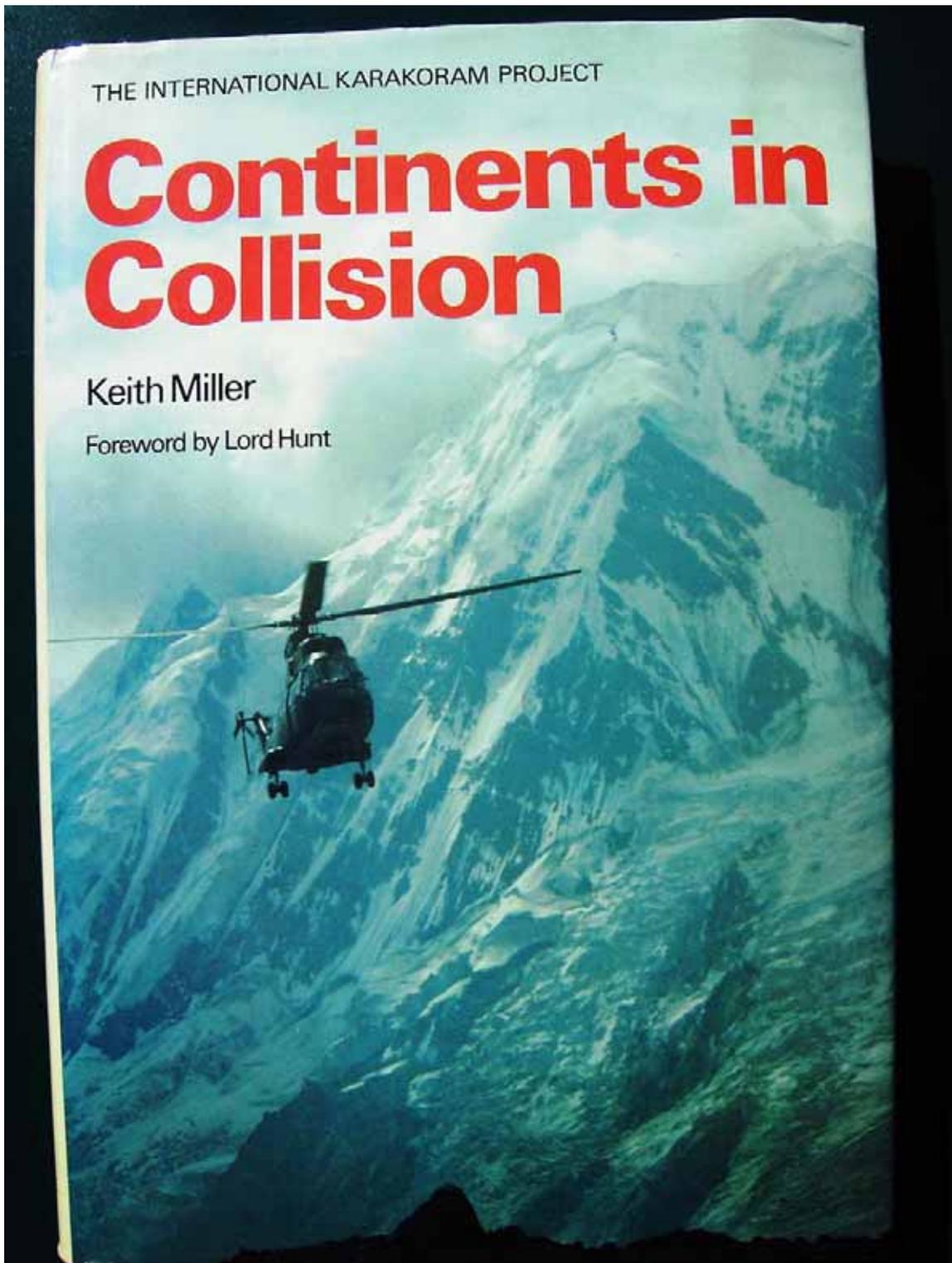
There are constant rock falls; a large boulder narrowly missed Keith. Karakoram was a success but there was also tragedy and Keith was terribly distressed when he heard that one of his closest, very experienced companions, Jim Bishop, who had been with him on several previous expeditions, was seen by an eye witness falling down a precipice after having attained the height of 4730 m.

THE INTERNATIONAL KARAKORAM PROJECT

Continents in Collision

Keith Miller

Foreword by Lord Hunt



The expedition is described in Keith's splendid book, *Continents in Collision*, with a foreword by Lord Hunt who, you may remember, led the Tenzing-Hillary Everest Expedition in 1953.

THE INTERNATIONAL KARAKORAM PROJECT

Continents in Collision

Keith Miller Foreword by Lord Hunt

To mark its 150th anniversary, the Royal Geographical Society sponsored an expedition to the little-known Karakoram mountains, one of the most spectacular, unstable and remote areas on earth tucked behind the north-west end of the Himalayas.

Keith Miller and an international team of specialists including geologists, geomorphologists, seismologists, surveyors and glaciologists, set out to use the Karakoram as a testing-ground for theories about continental drift, mountain building and decay, and to look at how the local population coped with living in such a hazardous area.

Keith Miller graphically describes what was involved in getting the expedition off the ground, from the political problems he encountered in Pakistan to financial problems at home. His vivid picture of the awe-inspiring grandeur of the Karakoram and of the problems and dangers that the expedition experienced, together with a striking collection of colour photographs, provide a memorable and lasting record of the expedition and its achievements.

32 pp colour illustrations

17 maps

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£12.50

To: The General Office Royal Geographical Society
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Please send me copy/copies of CONTINENTS IN COLLISION
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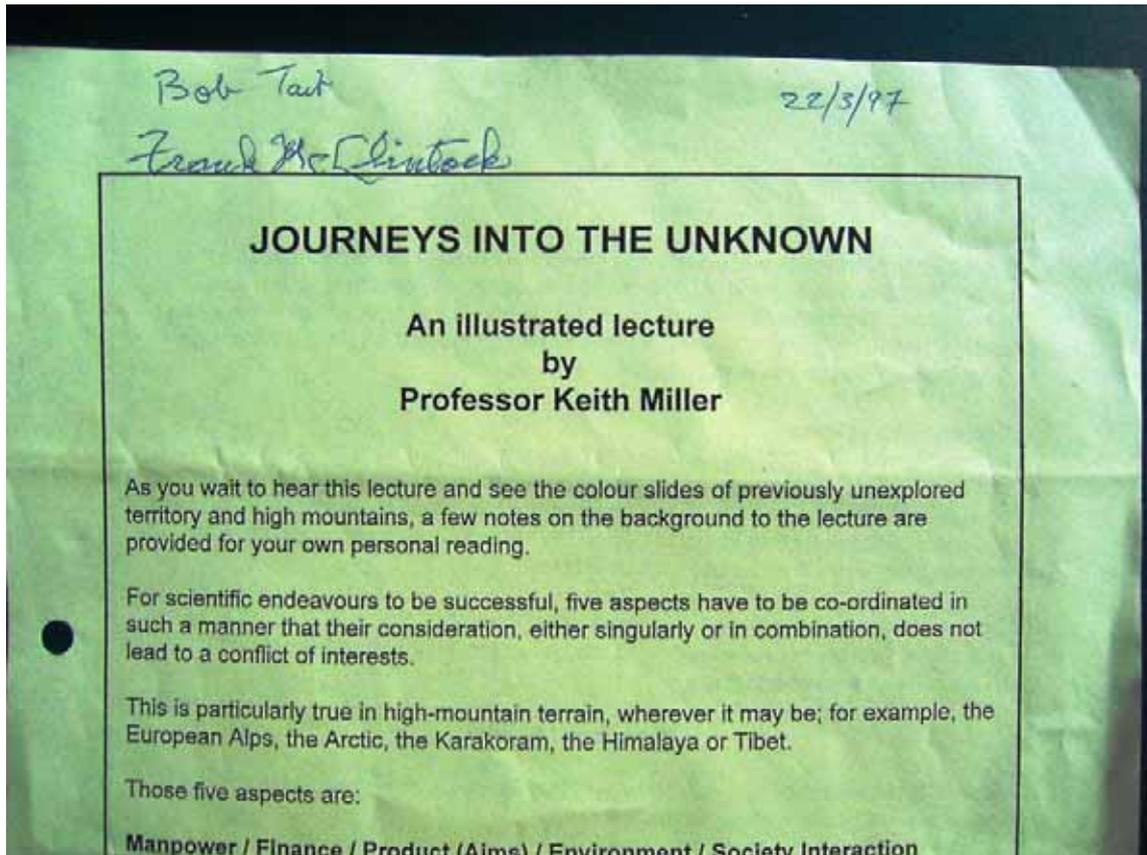
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Keith was awarded The Royal Geographical Society's Founder Gold Medal and the Mungo Park Medal of the Royal Scottish Geographical Society for his contribution to the

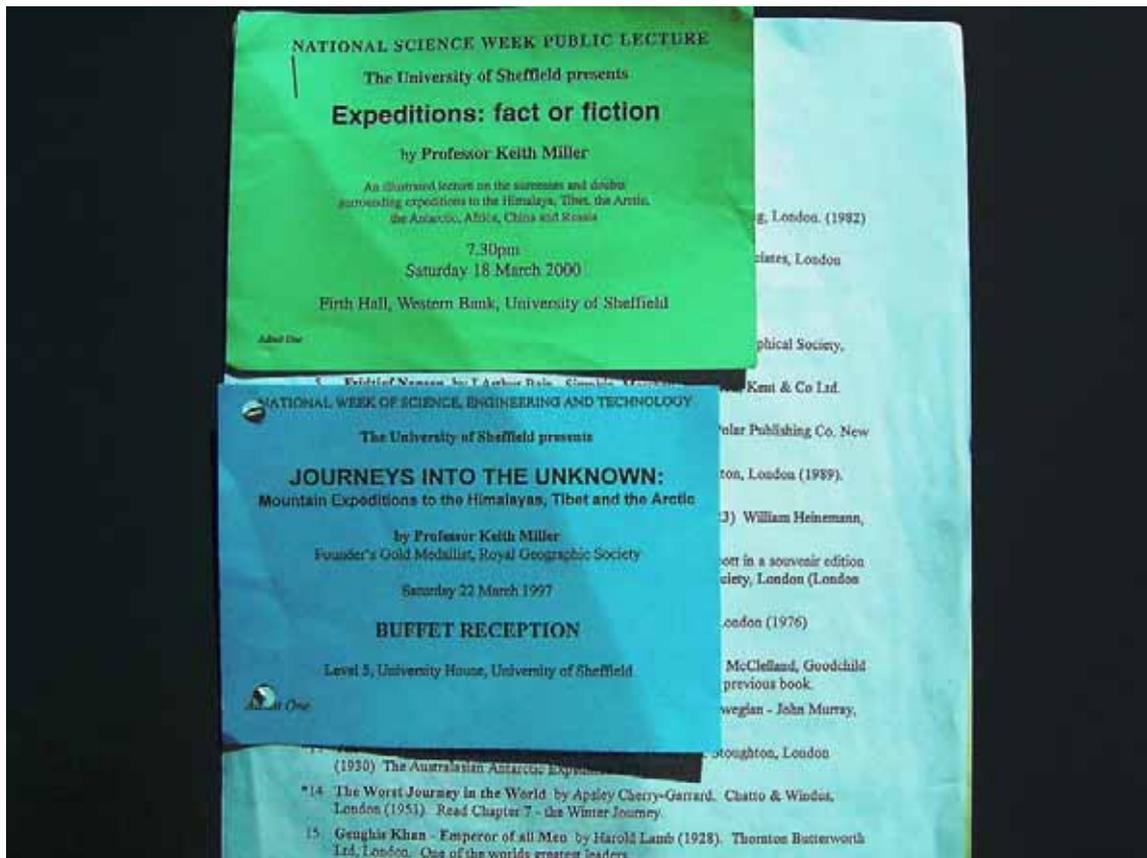
Earth Sciences. These were indeed great honours when one considers that the names of members of these societies dot our maps of the globe.

Keith was also a great speaker. His talks were on epics of his favourite explorers, often from the Scott Antarctic Expedition with perhaps Shackleton as his main hero. They were tales of adventure, heroism, endurance, ingenuity and solidarity that enthralled his audiences, sometimes several thousands strong. I have managed to find one or two old brochures



(The autographs on the top left corner are of the South African Bob Tait who spent some time in Sheffield and Frank McClintock's)

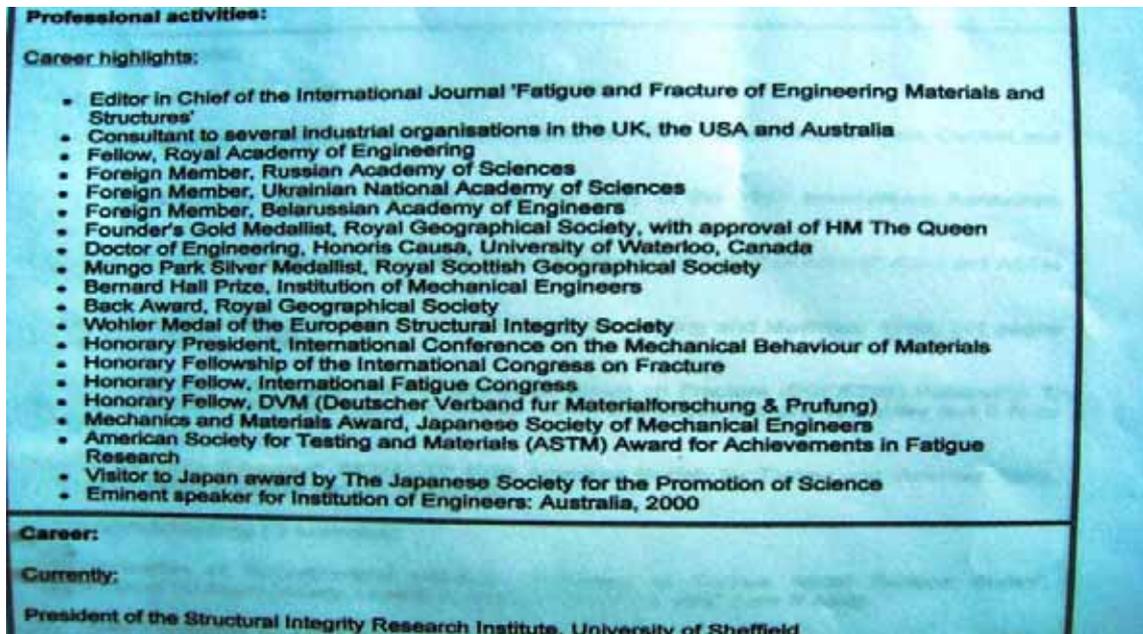
However there was one which gave the reverse side of the coin, a story of glory seeking and deceit. I happened to find a brochure about this talk.



Keith's method of relaxation after an arduous session or conference was often to escape to the Lake District. After the long drive to get there he would go on a 15 mile ramble over vales and hills, climbing a few peaks in passing and exploring virgin areas. (Many of you who have taken part in the walks organised by Keith during conference breaks will remember the ecstasy of the walk but in my case also the agony of trying to keep pace with him) There was one exception however (in Moscow I think) when after having completed some strenuous work he was looking forward to an extra hour's sleep in the morning but was woken up at 6:00 a.m. by a phone call informing him that he had been appointed a Foreign Member of the Russian Academy of Sciences.

Keith Miller's career highlights can be found on his Internet page.

Keith Miller's Career Highlights



They make impressive reading. He received honours from many nations. The last on the list is somewhat different: Eminent speaker for Institution of Engineers Australia 2000.

Mention must be made of Keith's other love, Blackburn Rovers. On weekends he would often drive to Blackburn to join his brother in supporting their team. He usually liked to be accompanied. When his team did something which met with his approval he showed it in characteristic fashion, by leaping to his feet, arms raised, emitting a loud cheer. (We see a lot of this these days)

One would like to recall all the anecdotes recounted by Keith but they do not come to mind when they are wanted. However there is one I do remember and which always brings a smile when I think of it.

The scene is the Fellows Common Room at Trinity College, Cambridge. In this College fellows were never retired and some of them were well past the usual retiring age. Two such fogies were (I was told) the eminent mathematician Littlewood. I do not recall the name of the other. Keith was sitting in his armchair, when he overheard something like the following conversation between the two.

Littlewood: Are you going to the concert to-morrow.

Reply: What are they playing?

Littlewood: (It was a violin piece by Brahms)

Reply: Oh no! I have a very unpleasant memory of that tune. As an undergraduate I had a heavy cold and some person in an adjoining room was practicing this tune incessantly on his violin. It caused me great distress.

Littlewood: My dear fellow. I am so *terribly* sorry. Why did you not tell me!

Keith thought this was the tardiest apology he had ever come across.

Keith worked to the end. He was engaged in writing a monumental book on Fatigue with Professor Yuktaka Murakami which, I was told, was very near completion and we all look forward to its appearance in print.

These photos were taken during my last visit to Sheffield in July 2004 showing Keith in apparently good form although he was in constant pain. The very last one I took of him was before he accompanied me to my bus station









I would like to end with these words: “Keith, We admire you for all your contributions to the advancement of Science, for making our lives a little safer, for your adventurous spirit which serves as a model to the younger generation. We express our gratitude for your generous friendship and for having enriched our lives very much. For all of this we thank honour and salute you. Adieu and God bless.”