MIKE FULLER

2012 John Adam Fleming Medal Winner

Mike Fuller was awarded the 2012 John Adam Fleming Medal at the AGU Fall Meeting Honors Ceremony, held on 5 December 2012 in San Francisco, Calif. The medal is for "original research and technical leadership in geomagnetism, atmospheric electricity, aeronomy, space physics, and related sciences.

CITATION

Mike Fuller has produced innovative research in geomagnetism for over 50 years. He has been a pioneer who applied magnetic measurements to make major advances in physics of magnetic minerals, obtaining and modeling geomagnetic reversal records, origins of crustal magnetism for the Earth, Moon, Mars, and meteorites, and the role of biomagnetism in pigeons, whales, and human brains. Mike also helped design, fabricate, and bring on line a new generation of highly sensitive magnetometers based on superconducting quantum interference devices (SQUIDs).

Mike joined the Department of Geodesy and Geophysics at Cambridge University to do a PhD in 1958. At the time, it was thought that rocks with variable shape or crystalline anisotropy could cause deviations between the thermally recorded magnetization vector in a sample and the geomagnetic field vector. Mike and colleagues showed, however, that the recorded *incorrect* direction could easily be corrected by measuring susceptibility and remanence anisotropy in the laboratory.

Mike has since made many seminal contributions to fundamental rock magnetism, such as the Lowrie-Fuller test to determine if the observed natural magnetization is from the desirable “single magnetic domain” particles with temporal stability of eons. Even more famous is the much cited 1977 Day et al. paper where Fuller and his students developed a technique to recognize three types of magnetic domain structure that allows us to explain the behavior of many magnetic minerals.Mike and his student Susan
Halgedahl showed further that single grains of magnetite much larger (~μm) than the theoretical upper limit of 80 nm can behave like stable single domain grains because of the difficulty in nucleating reversed domains This discovery provided one explanation why less stable multidomain grains can often provide stable magnetic directions.

He went on to produce invaluable work on lunar samples. Mike’s team showed that relative variation of the lunar magnetic field has been dramatic: very high in the first few hundred million years and then a precipitous fall possibly signifying a dying lunar magnetic dynamo. This discovery was first made by Runcorn’s group but was quite controversial. Mike’s work made believers out of many more researchers. For measuring lunar sample magnetism he collaborated with Bill Goree in the development of SQUID magnetometers whose sensitivity and maintenance-free use are phenomenal. Mike was the first to use a SQUID in a pass-through mode, suitable for measuring the magnetization of long cores so as to investigate secular variation and magnetic field polarity transitions. These magnetometers are now standard and irreplaceable equipment on the drilling vessels JOIDES Resolution and CHIKYU, and in many shore-based laboratories.

These few examples out of many illustrate the exceptional breadth of Mike’s research. His most significant advances have been made in lunar magnetism, rock magnetism, and the development of SQUID magnetometers. His CV demonstrates a person of great curiosity and significant practical skill, who has materially advanced our understanding of multiple fields within solid Earth and planetary magnetism.

–Subir K. Banerjee, School of Earth Science, University of Minnesota, Minneapolis, Minnesota; and Chris Harrison Department of Marine Geology and Geophysics, University of Miami, Miami, Florida

RESPONSE

Thank you Chris and Subir for nominating me for the Fleming Medal, and for your very kind comments on my research. In looking back over the medalists since 1962, it is hard to believe that I could be lucky enough to join such distinguished company. Yet, I have been very lucky through life. First, I was lucky to go to Christ's Hospital and Cambridge University. Second, my Aunt Marjorie married a physicist, Johnnie Clegg, who was an excellent teacher and inspiration for me. Third, to be born in England in the mid-1930s was to be a member of a fortunate generation of scientists. Providing one safely negotiated World War II, one joined the academic world at a time of great excitement, of expansion, and support for science.

My research started at school, where C. F. Kirby and other science masters, encouraged us to plan experimental tests of all our ideas. At Cambridge, as an undergraduate, with Ron Girdler's help, I got started on work on magnetic fabrics and their effect on magnetization directions. After graduation, I joined John Belshé's group. Seiya Uyeda was visiting and helped me in my rock magnetism. On completion of my PhD, a brief Post Doctoral, and a few years in industry at the Gulf Oil Research laboratory, I joined Professor Nagata and Kazuo Kobayashi at the University of Pittsburgh. When Kobayashi returned to Japan, I inherited his group and began nearly 50 years of leading a research group in the style I had learned from Johnnie Clegg and John Belshé.

From my first graduate student at the University of Pittsburgh, Bill Lowrie, to my last, Shao Ji-chen, at the University of California at Santa Barbara, I was lucky to have wonderful graduate students from whom I

have learned so much. Bob Dunn and his experimental skills were at the heart of much that we did. My most important contribution was probably listening carefully to Bill Goree, when he told me about his SQUID magnetometers. Its applications in our field were very obvious. Sadly he passed away at far too early an age. Other ideas came as group efforts and as the years passed we expanded from rock magnetism to reversal records, to the tectonics of SE Asia, to lunar magnetism and to biomagnetism. I thank those at NSF and NASA, who supported our efforts. This work has brought the joy of working with colleagues from all over the world in some of the great scientific adventures of our times.

Despite all that has gone so happily for me, I am saddened by the changes in universities since I was at Cambridge half a century ago. They have changed fundamentally. Inflated and costly administrations now run universities with concerns closer to industrial concepts than to the welfare of the academy. Meanwhile, and not, I think, just coincidentally, tuition fees for college education have reached astronomic levels. I fear that my generation has not defended the academy as well as we should have.

–Mike Fuller, University of Hawaii, Honolulu, Hawaii