Professor Sandiford's scientific contributions have focussed on the geodynamic evolution of the continental crust, with specific contributions in the fields of metamorphic geology, structural geology and tectonics. His major contributions have explored the linkages between the thermal state of the continental crust and its mechanical response to tectonic forcing with a focus on how these links are manifested in the geological record. He has proposed that a profound feedback system between primary tectonic processes serves as a fundamental self-organising principle that controls both the first-order geochemical structure of the continental crust and its long-term thermal and mechanical character. His contributions are both diverse and original, displaying a broad command of many diverse sub-disciplines of the Earth Sciences.

Professor Sandiford's career has progressed through a number of discrete phases each with a distinctive contribution. His early research during his PhD studies focussed on the nature of the deep crust primarily based on field studies in ancient metamorphic terranes in Antarctica. These studies demonstrated for the first time that high-grade metamorphic terranes preserve a complex record of collapse of ancient mountain belts. His PhD work on the geology of Enderby Land in Antarctica was critical to unravelling the geological record of some of the oldest known rocks on the Earth which had hitherto been virtually unknown by virtue of their extreme remoteness.

During post-doctoral fellowships at Universities of Melbourne and Cambridge in conjunction with Dr. Roger Powell, Professor Sandiford developed a range of new methods for unravelling the petrological record of high temperature metamorphism in the deep crust. These involved the development of phase diagram techniques based on an extension of "Schreinemakers" methods and lead to some of the first compelling evidence that large parts of the lower crust have been heated to temperatures in excess of 1000°C. The methods employed in these studies have become standard in the interpretation of high-grade metamorphic terranes. A major synthesis of his work until this time, published in 1986 two years after the completion of his PhD, remains a seminal work in the origins and significance of high temperature metamorphism of the lower crust.

The next phase of Professor Sandiford's career, at University of Adelaide, was characterised by the application of numerical methods appropriate to modelling the thermal and mechanical evolution of orogenic systems. This work helped to emphasise the notion that potential energy stored in orogenic systems provides a key determinant in the long-term evolution of orogenic systems – a notion now entrenched in the mainstream of geodynamics. This work was elegantly summarised through the development of a number of simple diagrams designed to provide a quantitative insight into these complex physical systems. The most famous of these, the f_c- f_l diagram, first published in 1989 remains widely used in both research and teaching.

The prime focus in the study of orogenic systems is the response of complex Earth materials to tectonic forcing, rather than the source of the tectonic stress that provides the forcing. Understanding the factors controlling the distribution of stress in the continents has proved a formidable challenge, and is one with many and varied ramifications from hazard assessment through to oil extraction technologies. In the period1992 to 1996 Professor Sandiford's research effort focussed on the origins of tectonic stress at the regional scale. This research, motivated and partly funded by the practical concern of stabilising well-bores for oil extraction, lead to fundamental contributions to our understanding of the stress-field at the plate-scale, particularly in the Indo-Australian, African and Antarctic plate. Amongst other contributions, this work provided the first self-consistent explanation of the time evolution of plate-scale extensional stress regimes such as found in the African plate.

Plate tectonics has provided the governing paradigm for understanding Earth dynamics, since its formulation in the late 1960's with much of the global effort in Earth science research over the last 30 years focussed on the tectonic interactions at plate boundaries. In contrast with plate boundaries, there has been comparatively little focus on the tectonics of continental interiors away from active plate boundaries. Professor Sandiford's research over the last 5 years has helped to focus attention on the rich and varied intraplate tectonic record of continental interiors, and has provided a new framework for understanding this response, particularly in the Australian continent. His work linking the stratigraphic development of sedimentary basins in central Australia to their subsequent "tectonic inversion", has challenged many long-held notions concerning the long-term mechanical stability of continental interiors and focused attention on the geologic evidence for the temperature-sensitivity of lithospheric rheology.

It is well understood that the continental crust comprises a chemically differentiated "scum" derived from partial melting deep within the Earth. The buoyancy of this crust engenders its long-term protection from convective recycling into the interior of the Earth, and is central to the geodynamic behaviour of the continents. Internally, the continental crust shows significant geochemical stratification, the origins of which remain poorly understood. In the period from 1996, Professor Sandiford's research has focussed on the links between tectonic processes and the geochemical stratification of the lithosphere. His work on documenting the distribution of heat producing elements (K, U, Th) in the continental crust is widely recognised as fundamental and has had a wide impact across a range of different Earth science sub-disciplines. The culmination of this work has been Professor Sandiford's hypothesis that a profound feedback system connects the tectonic evolution and geochemical structure of the continental lithosphere, which ultimately leads to the geochemical self-organisation of the lithosphere. His work in this field was recognised with the award, in 2000, of an Australian Research Council professorial fellowship, to further develop and test this notion of “tectonic feedback”.

Throughout his career, Professor Sandiford has played an important role in research training and mentoring, having supervised over 40 research student theses, and 11 postdoctoral fellows. The impact of this training and mentoring is reflected in the subsequent employment of these students and fellows, who have gained teaching and / or research positions at the Universities of Bristol, Calgary, Graz, Copenhagen, Washington, Queensland, Melbourne, Adelaide, and Tasmania and at the Open and Monash Universities.

Mike Sandiford 17 / 7 / 2001