

book reviews

enemy may have a future use as a carrier of therapeutic genes for combating cancer and other scourges of mankind. Altogether, this fascinating book provides a rapid and accessible introduction to modern virology. ■

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The rocky road to dating the Earth

The Dating Game: One Man's Search for the Age of the Earth

by Cherry Lewis

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Douglas Palmer

I doubt that many Regius professors and Fellows of the Royal Society today have had to interrupt their academic career to earn their living as a shopkeeper. This necessity fell to Arthur Holmes, one of twentieth-century Britain's foremost geologists. And although such mundane commercial necessity certainly held back his research into the radiometric dating of rocks, it does not seem to have embittered him in any way. In this book, Holmes emerges as a much-admired man, a famously good advocate for geology in Britain and a remarkably persistent researcher.

Much of the book is a biography detailing Holmes' experiences during the first decade of the twentieth century, as a schoolboy and a student of physics at the Royal College of Science in London. This period saw the public debate that led to the final escape from the straitjacket of Lord Kelvin's calculation that the world was only some 20 million years old. Cherry Lewis broadens her scope to explain the background to the debate and how Kelvin was working on a model of the Earth's evolution in which thermal diffusion acted to create a progressively thickening crust on an initially molten Earth.

Kelvin "argued ... that temperatures within the Earth increased with depth. From this he deduced that the Earth was cooling ... from a molten globe." Knowing the temperature at which rocks become molten and the rate at which they cool, he calculated the time taken for the Earth to cool and therefore its age. But, as we now know, this was a serious underestimate.

One of the early workers in the post-Kelvin era was Ernest Rutherford. In 1902, using the decay of radioactive elements, he measured the age of formation of a piece of uranium ore at 700 million years. But his method was flawed because it relied on measuring the gas helium, which can easily escape from rock. This problem with Rutherford's calculations was first recog-

nized over the next few years by Robert Strutt, professor of physics at the Royal College. And in 1907, the American chemist Bertram Boltwood showed that uranium-rich rocks contained large amounts of lead along with helium. Boltwood postulated that the lead was the stable end-product of the decay chain from uranium.

Under the inspired tutelage of Strutt and William Watts at the Royal College, Holmes combined his studies of physics with that of geology. Final-year undergraduates at the Royal College were encouraged to conduct an original piece of research. And in 1910, according to Lewis, "Holmes realised ... it should be possible to obtain an age by measuring the amount of lead present in the mineral, rather than the amount of helium". Holmes eventually calculated the age of a Norwegian rock as 370 million years. As the rock was known to have originated in the Devonian geological system, he thus provided the first date for that system. He also recalculated some of Boltzmann's published data and arranged them to produce a geological timescale. He was to improve on this continuously for the rest of his professional life.

Life for a student in London was as difficult financially then as it is now, and Holmes ran into debt and could not even afford the £5 (US\$7) membership for the Geological Society. For the first, but not the last, time he had to get a job to pay his way. He spent a year prospecting for minerals in Mozambique, and returned — having survived blackwater fever and malaria — with a desire to develop a geological timescale based on radiometric dating and £89 7s 3d profit for himself, but not much for the mining company.

In 1920, by then married with a child, Holmes was trying to survive on £150 a year as a demonstrator at the Royal College, which by then had been transformed into Imperial College. Another foreign adventure was necessary, this time looking for oil in Burma. As unsuccessful as the last one, it was also personally disastrous, as his son contracted dysentery and died there. Returning to Gateshead in 1922, without a job or prospects, Holmes joined forces with his wife's cousin and opened a shop in Newcastle, trading in "oriental crafts".

Holmes' luck changed in 1924, when he got a job as Reader in the newly founded department of geology at Durham University. He stayed there until 1943, spending most of his time building up the department and providing service teaching for the other sciences. But he also managed to continue his work of radiometric dating and extended Alfred Wegener's work on continental drift into a new hypothesis based on sub-crustal



Inspiration: Holmes' pioneering work stimulated generations of geologists.

convection. The role of mantle convection as a mechanism for plate tectonics driven by the circulation of heat from the Earth's interior is now virtually taken for granted. Holmes' speculation was published in 1931, the same year in which he met a London-based academic geologist Doris Reynolds.

But Holmes' personal life led to problems in the ecclesiastically dominated Durham. According to Lewis, Holmes' wife Maggie "did not enjoy university life", and although another child had been born, the marriage did not fulfil either partner. In 1933, Doris Reynolds took up a lectureship in Durham, and rumours spread about her relationship with Holmes. Although Maggie died in 1938 and Holmes married Doris, the university authorities showed their displeasure by renewing Doris's contract for only one year. But Holmes' appointment in 1943 to the prestigious Regius professorship of geology in Edinburgh brought security and freedom.

The publication of the first edition of *Principles of Physical Geology* in 1944 secured Holmes' reputation as the pre-eminent proselytizer of the subject in the British Isles. The book enthused several generations of geologists who built on the work of Holmes and other stalwarts of his generation. Much of the lost reputation for geological research in Britain was thereby regained. In 1953, Claire Patterson was the first to finally date the age of the Earth at about 4,500 million years old. She wrote to Holmes: "I wish to reiterate my personal indebtedness to your pioneering work in this field. It was outstandingly inspiring and ingenious."

Cherry Lewis, a mature student of geology who subsequently worked in research and in the oil industry, is no historian of science. But she has a good understanding of the technical details of the subject and gives a sympathetic portrayal of Holmes' struggle to match economic necessity with research ambition.

One of the book's pervading themes is the pathetic state of British universities, particularly their science departments, during the first half of the twentieth century. Even as Regius professor, Holmes had to make a special application to the university for £74 8s for the purchase of an electronic Marchant calculating machine.

To conclude, *The Dating Game* is a welcome portrait of a gifted British scientist whose abilities were often stymied by lack of funds and resources. ■

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