An unsung hero put on the map

The Map That Changed The World: William Smith and the Birth of Modern Geology
by Simon Winchester
Viking: 2001. 338 pp. £12.99

Douglas Palmer

In 1797, William Smith, a surveyor and the orphaned son of an Oxfordshire blacksmith, produced the first list of the rock strata in the west of England; 1815 saw the publication of his geological map of England, the first of any country on a scale of five miles to the inch. Four years later Smith was in King's Bench Prison in Southwark for debt. And in 1831, nine years after his release, the Geological Society of London awarded Smith the first Wollaston Medal and he received a pension of £100 a year from King William IV.

But who today, outside the world of professional geology, has heard of this quintessentially English technical genius, a 'doer' rather than an intellectual? One reason is the lack of a modern biography of Smith. Simon Winchester now makes an honourable attempt to tell this remarkable story of scientific achievement against enormous odds: how Smith's great map was plagiarized, his financial failure and his belated recognition. The book will help to bring Smith the wider attention he deserves, as unsung heroes are in short supply. But there are considerable difficulties in writing a popular biography of a man such as Smith, difficulties that I suspect have deterred previous would-be authors.

There is little documentation on Smith's early years. Most of his professional life was spent trudging around the country surveying land, obsessively looking at rocks and making lists of the strata and their fossils — hardly the riveting stuff of popular biography. Smith did not write easily, although he did write a good deal, and his achievements are largely encapsulated in his beautiful and innovative geological maps. These were a huge technical achievement, but their niceties can be difficult for the uninitiated to appreciate. The problem for the biographer is to explain all this, to put it in a wider historical context and yet to retain the reader's interest.

In a popular account, Winchester cannot take background knowledge for granted. So he must provide potted explanations of the Agricultural and Industrial Revolutions, the social and economic environment of the time, and geology as a developing science with its plethora of characters, who must all be introduced. Inevitably, Smith barely figures in much of this, and yet he and his achievements have to be intruded as much as possible to keep the plot going.

Smith's public rehabilitation can be traced

Rocky representation: part of Smith's geological map of England and Wales.

to the first volume of Charles Lyell's *Principles of Geology* (1830), the book Charles Darwin took on the *Beagle* voyage as his geological bible and in which Smith's achievement was first praised. The following year, Adam Sedgwick, president of the Geological Society, in his Wollaston Medal encomium for Smith, felt "compelled ... to perform this act of filial duty ... and to place our first honour on the brow of The Father of English Geology ... he that gave the plan, and laid the foundations, and erected a portion of the solid walls, by the unassisted labour of his hands".

The title has stuck ever since. Winchester comments, "an injudicious hyperbole, some churlish few will say". In one sense I join the ranks of the churls, in that I would like to know more about how and why the perception of Smith changed so radically within the predominantly middle-class membership of the Geological Society. On this, Winchester has little to say. Why exactly did grandees of the society such as Lyell promote Smith when they did? Was it perhaps to do with competing claims for innovation in geological mapping from abroad? These date back to Johann Lehmann's 1756 section of strata in the Harz mining region of Germany, Georg Füchsel's 1761 map of Thuringia and the 1811 map of Paris and its environs by Georges Cuvier and Alexandre Brongniart in France, which was directly inspired by Smith's work and by Sir Richard Griffith's work in Ireland. None of these names figure in Winchester's account.

What did Lyell, Sedgwick and the other bigwigs of the society really think of Smith? I am sure there are clues in their private correspondence. In acknowledging help from historians of science, Winchester admits that "this short book should be thought of simply as the hors d'oeuvre". The chef for the main dish he is referring to is Hugh Torrens, a historian of geology who, according to Winchester, is also writing a biography of Smith. I hope that promise is fulfilled — Smith deserves it after all this time. ■

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How the old became new

Revolutionizing the Sciences: European Knowledge and its Ambitions, 1500–1700
by Peter Dear
Palgrave: 2001. 208 pp. £45 (hbk), £14.99 (pbk)

Michael Hunter

The concept of a 'Scientific Revolution' — a radical transformation of ideas about the natural world that occurred in the sixteenth and seventeenth centuries — seems to have survived the attacks on it in recent years by revisionists who stress the continuity between old and new ideas in the period. On the other hand, it has become more rather than less difficult to write about the topic. This is partly due to the accumulation of research and partly to the proliferation of different approaches to the subject.

The marxist view of science as being moulded by social forces still exerts a strong influence on ideas about developments in the sixteenth and seventeenth centuries. This period saw the emergence not only of modern science but also of modern capitalism, raising questions about how the two are related.

There was a powerful intellectualist reaction against this view in the postwar years, associated particularly with the historian of science Alexandre Koyré, which stressed the internal dynamics underlying the evolution of scientific ideas. This tradition, too, remains very much alive. More recently, we have seen the rise of cultural history, which looks for subtler social and institutional links between ideas and their context. Peter Dear's brave attempt at a general survey of the way scientific ideas developed in the sixteenth and seventeenth centuries reflects the opportunities and also some of the tensions resulting from these contrasting approaches.

The book is perhaps at its best on the sixteenth century, where Dear clearly illustrates how researchers into all facets of the natural world sought to restore a correct understanding of the ideas of antiquity, rather than to go beyond them. Vesalius, Copernicus and others are all convincingly placed in this context. Dear also brings out well the impact of printing on this, as on other, fields of knowledge, and the significance of ideas about magic in stimulating intellectual change.

When dealing with the seventeenth century, the book becomes more technical and in some respects slightly more traditional. Much space is devoted to an exposition of the ideas of a succession of thinkers — from Bacon, Galileo and Kepler to Descartes, Newton and Huygens. Indeed, Dear is perhaps at his strongest in his lucid descriptions of the technical aspects of natural philosophy and the way in which ideas inherited from Aristotle were transformed during the period. He also throws interesting light on the changing criteria used to evaluate natural knowledge, especially the increasing emphasis on experiment. And he does not neglect the biological sciences, even though his main emphasis is on mathematical physics. As a full and accurate account of such matters, this book is the best available, and I would recommend it to anyone.

The later part of the book also describes the context in which ideas developed. It deals in particular with the significance of courtly patronage in supporting intellectuals, and the role of the universities and the new scientific institutions. In this connection, Dear also brings in the rise of museums and botanical gardens, which housed new specimens from exotic locations.

Yet it could be argued that the focus of this part of the book is narrower than in earlier chapters, and readers may be disappointed to find that certain broad issues concerning the changing role of science are dealt with slightly perfunctorily. For example, Dear makes much of recent research that has placed Galileo's ideas in the context of the controversy that existed then between mathematicians and natural philosophers, with mathematicians making increasingly strong claims that they could describe reality rather than purely hypothetical constructs. But Galileo's famous trial is mentioned only briefly, as are other skirmishes between natural philosophers and the Church, such as the burning of Giordano Bruno. Moreover, Dear says virtually nothing about the impetus given to scientific study by rival religious positions, and particularly the vexed issue of the role of 'Puritanism'.

Even the book's dominant — and highly convincing — claim that scientists' ambitions shifted during this time from a desire to understand nature to a wish to control it could have been placed more fully in context. For all Dear's stress on how widely natural philosophers such as Newton or Huygens differed from their ancient and mediaeval precursors in stressing the usefulness of their work, this idea is not fully anchored in its milieu. Without needing to revert to a crude marxist interpretation, Dear could have explored the broader cultural implications of this characteristic of early modern science at greater length. On the other hand, the extensive bibliography will enable readers to pursue themes that are dealt with tangentially in the book as well as those central to it. Overall, Dear's synthesis is an effective and stimulating one. ■

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Physics from the inside

The Physics of a Lifetime: Reflections on the Problems and Personalities of 20th Century Physics
by V. L. Ginzburg
Springer: 2001. 513 pp. $74.95, £51.50

A. M. Bradshaw

A list of the important remaining problems in physics compiled at the dawn of the twentieth century might not have been very long. Several noted physicists, including Albert Michelson, Lord Kelvin and Philipp von Jolly, had already agreed that the cathedral of physics was virtually complete, with only a few turrets and pinnacles to be added, a few roof bosses to be carved. Reality turned out quite differently: quantum mechanics, relativity, elementary-particle theory and cosmology became some of the greatest scientific (and cultural) achievements of the twentieth century.

The same danger lurks in part I of this book by the renowned Soviet physicist V. L. Ginzburg. It is a list, or rather a compendium, of the exciting areas in physics where unsolved problems remain or where interesting developments are likely to occur in the next few years. The first edition of part I (the "Problems" of the subtitle) was published in 1971 and has been updated in successive editions. The present text is a translation of the 1995 edition (with a few addenda and notes), which Ginzburg claims is the last.

The author is aware of the intrinsic problems: "many outstanding discoveries and accomplishments in science come entirely unforeseen and unexpected." Indeed, his 24 topics under the headings 'macrophysics', 'microphysics' (elementary particles) and 'astrophysics' are not a definitive list of the most important problems in physics (although they might resemble this shibboleth, were it to exist). Rather, Ginzburg claims to provide thoughts of "an arbitrary and subjective character" which aim to promote a greater awareness and appreciation of physics, particularly among young people.

The short descriptions of each area are written in lucid, matter-of-fact prose, which is also a compliment to the (unnamed) translators. The level is suitable for an undergraduate, or a layperson with more than a passing acquaintance with physics. But the work is hardly the "popular science publication" Ginzburg claims.

What can be said about his choices and the book's content? The opinions of a great physicist on physics are invariably interesting, and Ginzburg has proved both persistent and perspicacious over the years. A glance at the 1979 edition, which was also translated into English, shows that the importance he attached then to achieving controlled nuclear fusion for energy purposes has not diminished. The search for high-temperature superconductivity has always been an important topic for him, although the celebrated discovery of the effect in a series of rather complex copper oxides did not occur until 1987. Atomic and molecular physics and quantum optics, on the other hand, have never been among Ginzburg's priorities. The recent experiments on Bose–Einstein condensation of gases — almost universally regarded as a very 'hot' topic in physics — receive some attention in a comment. But they are praised mainly as an achievement in experimental physics that was made possible by laser cooling and traps, rather than as a discovery of something unexpected and essentially new.

Current experiments on the interpretation of quantum mechanics are given shorter shrift: "[they] testify to the perfect validity and, one can say, the triumph of quantum mechanics ... critics of quantum mechanics are dissatisfied with the probabilistic nature of part of its predictions. They would, apparently, like to come ultimately to know where each electron goes in a diffraction experiment. There is no hope for this now."

So who is Vitaly Lazarevich Ginzburg, and how has he produced what must be described as a phenomenal overview of physics? Born in 1916, Ginzburg is a theoretical physicist who worked with the Nobel prizewinners I. E. Tamm and L. D. Landau at the Lebedev

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Colleagues: (from the right) Ginzburg, Rudolf Peierls, Freeman Dyson and I. E. Tamm in 1956.