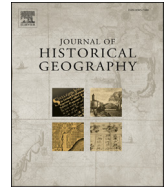




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The art of earth-building: Placing relief models in the culture of modern geography in Britain

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ABSTRACT

This article explores the overlooked history and significance of physical relief models in the development of geographical knowledge and education. By examining their use in academic, educational and public settings, it argues for a broader appreciation of these models as integral to the discipline's material culture. Historical debates around their function and purpose are highlighted amidst developments in modelling techniques, materials, and instructional guides. A deeper investigation into the models, their creators, and their influence on geographical learning and public engagement is advocated for and illustrated through the production and impact of the 1951 book *The Earth's Crust*.

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For much of the modern period, physical relief models were part of the apparatus of geographical instruction and scientific display. Placed in classrooms and corridors, wall-mounted, encased in glass, pointed at, pored over, the relief model could be an arresting presence. Yet the histories, biographies and impacts of these objects and their makers remains under-examined by historians of the geographical discipline. This article makes the case for a fuller consideration of the historical presence, place, and utility of physical relief models in the development of modern geographical culture, in academic and educational spaces, and the wider public sphere.¹ Taking as its starting point the realisation that geography's intellectual history has given primacy to ideas and theories conveyed in the written word, this narrative builds on recent efforts to examine differing practices of geographical inquiry and the discipline's material culture, including use-based accounts of scientific instruments and objects of exploration.² The rise of the relief

model is introduced through, variously, schools' education, in-class exercises, and specialist manufacturing, as well as wider debate about its value as a device to excite interest in Geography. Both the sculptural practices of model-making and aesthetic appeal of expertly made relief models are spotlighted in a brief sketch of *The Earth's Crust*, a book showcasing the art of modelling first published in 1951. Attention is paid to a specific working arrangement that enabled authorship, illustration and publication of a book using photo-illustration of relief models as its selling point.

Modelling in British geography

Among historians of the subject, geography's era of model-building is most commonly associated with the quantitative revolution, which in the 1950s questioned disciplinary orthodoxy and led to the rise of spatial science. To date, far less interest has been shown in an earlier episode – already well underway in the mid-to-late nineteenth century – where a practice going by the same name and involving the fabrication of physical objects rather than the formulation of abstract theorems, made its own mark on geography as a subject of study in schools and university education.³ Towards

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¹ This endeavour follows previous engagements with the historical presence of models in the sciences, see for example *Models: The Third Dimension of Science*, ed. by Soraya de Chadarevian and Nick Hopwood (Stanford: Stanford University Press, 2004).

² See, for example, *Geography, Technology and Instruments of Exploration*, ed. by Fraser MacDonald & Charles W. J. Withers (Farnham: Ashgate, 2015).

³ This observation was earlier made by Ploszajska in a study of school modelling exercises, see Teresa Ploszajska, 'Constructing the Subject: Geographical Models in English Schools 1870–1944', *Journal of Historical Geography* 22 (1996) 388–398.

the end of the nineteenth century, classroom exercises in landscape modelling began to grow in popularity among teachers and pupils. Relief model-making allowed children to learn about the physical environment and the processes forming it, in landscapes to be found both near-at-hand and in faraway parts of the world. Models set new agendas about the future of the discipline. By shifting instruction away from learning-by-rote and attainment measured only by tests of memory, they also advanced geographic pedagogy.⁴ However, not all were convinced. Playfulness in modelling was frowned upon, a preference shown for the 'correct' demonstration of geographical concepts. The challenge of convincing educators and school boards about the value of relief models paralleled some of the skepticism initially directed at lantern slides during the late nineteenth and early twentieth centuries as a new visual technology suitable for geographic knowledge-making, as well as public spectacle.⁵ Halford Mackinder was an influential advocate, offering the view that presentation of expertly prepared models alongside pupils' own modelling efforts served as an effective means to provide referential accuracy and further cartographic information. When enrolled into classroom activities, models, he argued, would act 'not as a limiter of imagination and power, but as an ideal and expander'.⁶ One commentator held the model in high enough regard to speculate on what might have been: 'had Geography reached the advanced stages of development which Zoology and Botany today occupy, the topographic model would have played its essential part in the progress'.⁷

During the first part of the twentieth century, thanks to the efforts of enthusiasts, experts and educators, variously operating in commercial industry and public institutions, the value of the physical relief model as an educational device for use in British schools and universities was successfully asserted. Large-scale versions went on prominent display in schoolhouses, university buildings and museum galleries.⁸ Inside the classroom, along with mapwork and landscape drawing, small-scale model-making became a means to engage and inspire young learning geographers with 'constructive and creative activities'.⁹ In Geography textbooks produced for schools, plate-photographs of relief models were included as arresting visual aids to accompany text-based descriptions of the physical geography of river, valley, glacier, mountain, hill, coast, and estuary environments.

Model-making exercises in school classrooms would ordinarily rely on adapted versions of two techniques, the 'horizontal layer method' and 'vertical section method'.¹⁰ The former involved building up slim layers of material, such as cardboard or wood, each one added representing a contour line on a corresponding map. The latter required the construction of individual cross-section segments, then their arrangement upon a baseboard eventually forming a whole relief model. In both, the joins between layers or sections were later in-filled with a pliable material such as clay. Direction on modelling exercises appeared in articles written by J.A. McMichael, a schoolteacher from Chester, simplifying advanced



Fig. 1. A school pupil flattening clay for preparation of one vertical section of a relief model. Source: McMichael, *A Method of Modelling in Relief*, 20. Used with permission from the Geographical Association, Sheffield.

techniques for use in the classroom (Fig. 1).¹¹ The availability of new and inexpensive materials such as modelling plasticine (a product invented in 1897), and step-by-step explanations of model-making exercises, were key to widespread adoption by teachers. Herbert John Fleure (1877–1969), a prominent advocate, remarked that 'each school should have a home-made relief model now the difficulty of making these has been so reduced by Mr. McMichael's ingenuity'.¹²

Commercially produced relief models could also be purchased for colourful display in classrooms and as a practical apparatus. In this market, George Philip and Sons publishing company, renowned for atlas and mapmaking, specialists in globes, wall-maps and educational publications, was prominently placed. Its acquisition in 1931 of Exelby Reynolds, a Sheffield-based modelling firm, enabled the mass production of relief models. Previously limited to specially commissioned works made at high cost, Philip & Sons was able to supply ready-made plaster models by mail-order, helping change the status of the relief model from private collection holding or museum special feature to staple display item of the geography classroom and university lecture theatre. In advertisements placed

⁴ Thomas G. Rooper, 'On Methods of Teaching in Geography', *The Geographical Teacher* 1 (1901) 4–10.

⁵ Felix Driver, 'On Geography as Visual Discipline', *Antipode* 35 (2003) 227–231.

⁶ Halford J. Mackinder, 'The Development of Geographical Teaching out of Nature Study', *The Geographical Teacher* 2 (1904) 191–197 (p.196).

⁷ Charles R. Dryer, 'Educational Geography at the Eighth International Geographic Congress', *The Geographical Teacher* 2 (1904) 254–258 (p.258).

⁸ Wallace E. Whitehouse and Herbert J. Fleure, *Descriptive Handbook to the Relief Model of Wales* (Cardiff: National Museum of Wales, 1915).

⁹ Thomas W. Birch, 'Constructive and Creative Work in Geography', *Geography* 28 (1943) 19–25.

¹⁰ Alice T. Robinson, 'British Geography at the Japan-British Exhibition', *The Geographical Teacher* 5 (1910) 277–278 (p.278).

¹¹ John A. McMichael, 'A Method of Modelling in Relief by Means of Serial Sections from a Contoured Map', *The Geographical Teacher* 5 (1909) 19–23.

¹² Herbert J. Fleure, 'New School Books', *The Geographical Teacher* 6 (1911) 180–181 (p.181).

in subject-area periodicals like *The Geographical Teacher*, Philip & Sons promoted a range of moulds and models designed to illustrate general landform types (lagoons, dunes, deltas, ravines and valleys and peaks of all kinds) and scale-models of every British district available for demonstration of the locality. All were profiled as 'necessary for permanent display in every geography classroom ... [where] by no other means can the relief of a land area be so graphically depicted, or the lessons to be learnt from it so readily grasped'.¹³

At the height of its popularity, as an object intended to enlarge the child's world of learning in the classroom, the relief model reconfigured accepted definitions of exactly what kinds of teaching exercises were suitable for art and for science; about the relative value of the wall-mounted illustration or the hands-on instrument; and the possible union of creative exercises in making with the seriousness of explanatory inquiry. Consequently, the positioning, status and merit of relief models as instructional devices for use in geographical teaching was at once well-established and keenly contested. Views and perceptions differed on their accuracy, relevance to exercises in mapwork, and the capacity of students to understand intuitively the geomorphological processes that relief models were intended to represent materially. Commonly, models were employed as supplementary devices for exercises in map-interpretation, but concern was still expressed about the potential for confusion with the addition of a third dimension to those landforms first introduced via the two-dimensional properties of the sheet-map.¹⁴ If the making of miniaturised landscapes was a way to activate a youthful geographical imagination, adult interest in the relief model was also judged to be educational.

The Earth's Crust

The publication in 1951 of *The Earth's Crust*, an accessibly written account of the geological structures and geomorphological processes leading to the formation of recognisable topographical features and landscape scenery, brought the visual appeal and explanatory power of geographical relief models to the notice of a general readership (Fig. 2).¹⁵ Colour illustrated, in quarto format, the book was arranged with corresponding text and image on facing and opposite pages. It contains 36 photographic plates, each image a carefully lighted studio-portrait of a series of sculpted and painted plaster relief models that had been commissioned specially for the project. Re-read today, *The Earth's Crust* is a telling demonstration of how the book industry was alive to the eye-catching appeal of relief models, and how it was able to identify new commercial opportunities in science publishing, enrolling public intellectuals, illustrators, and craftspeople in a collaborative enterprise. For its author, L. Dudley Stamp (1898–1966), the book was one instance of a longstanding commitment to the popularisation and application of geographical knowledge, a sphere of activity that would do much to define his professional career and its diverse contributions both in academic and public life.

A former president of the Royal Geographical Society (1963–1966), Stamp saw national and strategic value in having a general public which was geographically literate. Famously, it was Stamp who spearheaded the Land Utilisation Survey of Britain during the 1930s: a nationwide mapping project enrolling school children as surveyors of their local patch. He wrote geographically

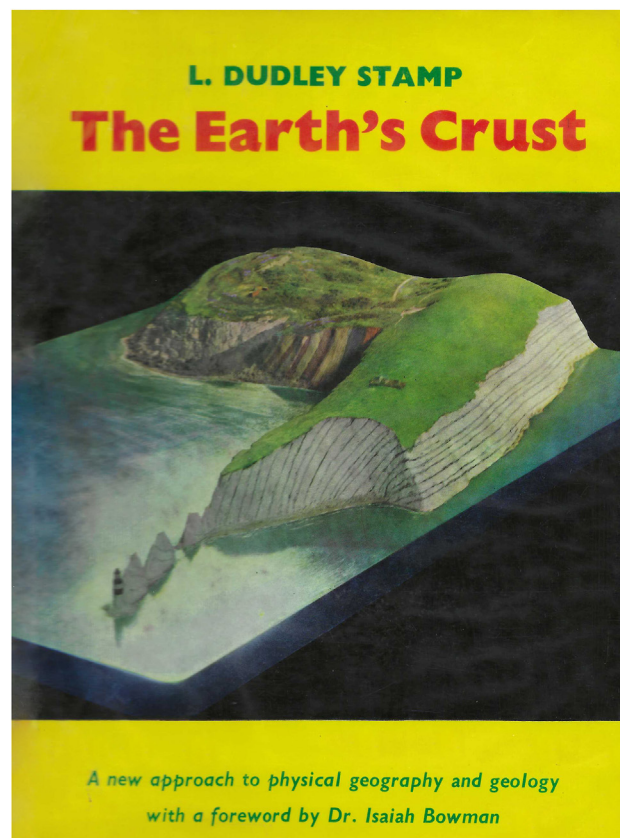


Fig. 2. The bold cover style typified Adprint's captivating approach to book design. Source: *The Earth's Crust*, 1951. Used with permission from Hodder & Stoughton, London.

for newspapers, radio broadcasts, school textbooks and, post-war, was author of three titles in the groundbreaking *New Naturalist* series, produced by the publishers Collins. As an author he was prolific, quickly building a reputation for slick and expeditious writing which had earned him the moniker 'deadly Stamp'.¹⁶ Work contracted with Collins brought him into contact to Wolfgang Foges, an exiled Austrian Jew who settled in London in 1938 and was a leading light in the creative vision for the *New Naturalist* series. Foges was also the founder of Adprint, a company that pioneered the concept of book packaging, where texts were designed, printed and sold on to publishers for distribution under their own name. Adprint gained a reputation for producing books with strong visual design, including vivid colour illustration and photographs, specialising in popular education titles written by prominent public intellectuals including Julian Huxley, Bertrand Russell and Carl Jung. *The Earth's Crust* sprang out of this publishing venture, a popular geography and geology book aimed at British and American markets. Adprint's commitment to uphold production values in books aimed at the general reader struck a chord with Stamp, who said of its inception:

Mr. Foges ... suggested a book on geology based on the preparation of a series of models and their photography in colour ... I welcomed the idea because I had been frequently horrified by

¹³ George Philip & Sons, 'Philips' Relief Model of Geographical Terms', *Geography* 22 (1937) xi.

¹⁴ James Fairgrieve, 'Can we Teach Geography Better?', *Geography* 21 (1936) 1–7.

¹⁵ Laurence D. Stamp, *The Earth's Crust* (London: George G. Harrap & Co. Ltd., 1951).

¹⁶ Stanley H. Beaver, 'Sir Dudley Stamp: An Appreciation by the President', *Geography* 51 (1966) 388–391.

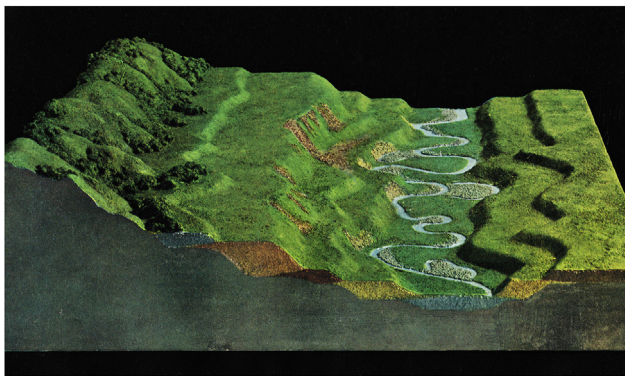


Fig. 3. One of Bayley's models – a 'mature river valley'. Source: *The Earth's Crust*, 1951, 12–13. Used with permission from Hodder & Stoughton, London.

the lack of understanding of even the simplest geological ideas by those who had reached high levels in other fields.¹⁷

Isaiah Bowman, the founding director of the American Geographical Society (1915–1935), declared himself impressed with the results in a foreword: 'The man who is clear is the man who persuades, and Dr Stamp's models are models of clarity as well as models of landscape. Through this book he has given an important life to classroom work as well as to geographical science'.¹⁸

If Stamp's authorial imprint and academic authority were to the fore on the book's title page, the model-maker's contribution was limited to a single mention in the Preface. Taken on by Mr. Thomas Bayley, the job of constructing the series of relief models to feature in the book's photographs had been 'a labour of many, many months'.¹⁹ London-based, a trained sculptor, Bayley spent much of his career as teacher of modelling at Art Colleges in Camberwell and Ealing. His practical classes and instructional guides established new conventions and standards for modelling practices in mid-20th century Britain. The works exhibited in *The Earth's Crust* were dependent on techniques Bayley had given detailed explanation in *The Craft of Model Making*.²⁰ Plywood cross-sections of contours from a map or plan were assembled together, over which muslin sheets, plaster of paris and alabastine were then applied to shape the desired scenery. Creating specific landscape features demanded different kinds of working method. Quarries and cliffs, for example, were made by gluing and pinning pieces of wood together, which were then carved into the correct geological

formation; trees were made from special casts. Bayley introduced his techniques as a means towards popularising model usage in arenas such as the school classroom, where a hands-on approach to education was, principally, an opportunity to engage students with another dimension of their subject:

by the use of models there is no subject in the school curriculum that cannot be made more attractive and more interesting... The earnest student will better grasp the topographical conditions of a country if he has constructed it in model form with a careful regard for accuracy than if he only relates his studies to an atlas.²¹

Through the thoughtful composition of image and text, Foges and Stamp were able to produce a book that made full use of Bayley's creative and technical capacity, allowing imaginative forms of topographic encounter through miniature models of the physical world (Fig. 3).

Conclusion

This brief introduction to the relief model as a material expression of topographical culture has considered the various ways in which models featured in British educational and literary spheres. The example of Stamp's *The Earth's Crust* shows that models operated in both educational and popular spaces of learning. They were 'travelling landscape objects' that saw their function and meaning change as they moved into different places and contexts.²² While the relief model's prominence in the geographical discipline waned towards the end of the twentieth century, advances in digital terrain modelling and 3D printing have prompted renewed interest in re-encounters with physical relief models.²³ Outside Britain, relief models have similarly been employed by geographers and educators, and there are valuable histories to be explored in other countries. There are many other cultural worlds of the relief model yet to be mapped.²⁴

Declaration of competing interest

None.

Acknowledgements

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¹⁷ Laurence D. Stamp, *Unfinished Autobiography*, 1966, SxMs5/28/2, University of Sussex Archives (p.757).

¹⁸ Isaiah Bowman, Foreword, in: Laurence D. Stamp, *The Earth's Crust*, p.v.

¹⁹ Stamp, *The Earth's Crust*, p.viii.

²⁰ Thomas Bayley, *The Craft of Model Making* (Leicester: The Dryad Press, 1938).

²¹ Bayley, *The Craft of Model Making*, p.13.

²² Veronica della Dora, 'Travelling Landscape-Objects', *Progress in Human Geography* 33 (2009) 334–354.

²³ See, for example, Priestnall's recent work on the nineteenth century Mayson model of the Lake District, involving its digital capture and 3D (re)fabrication: Gary Priestnall, 'Rediscovering the Power of Physical Relief Models: Mayson's Ordnance Model of the Lake District', *Cartographica: The Journal for Geographic Information and Geovisualization* 54 (2019) 261–277.

²⁴ Almost all of Thomas Bayley's models created for *The Earth's Crust* survive and are held in the collections of the Royal Geographical Society, South Kensington, London. The models form the centerpiece of an ongoing AHRC CDP studentship undertaken in partnership with the Royal Geographical Society (with IBG).