the latter to see that the exact information he needs is carefully collected and made available for purposes of research. This is done in the case of borings for minerals, and it seems essential that it should be done systematically in regard to temporary sections of all kinds.

The importance of such investigations and of their repercussions not only on scientific but also on economic problems is not sufficiently realized, and the opportunities they offer for adding to our knowledge are too often neglected. Certainly they will often be of small importance individually, but collectively they may well amount to an impressive body of valuable geological data. Their significance in the preparation of detailed geological maps need not be stressed. Temporary excavations have contributed much to our knowledge of the geological succession and structure in different areas, notably, so far as Scotland is concerned, around Edinburgh and Glasgow. On the other hand, it would be easy to cite examples of temporary exposures which were not examined and about which little or no information is now available. The cumulative loss to geology must be very considerable, and it is in the hope of minimizing it that the problem is raised anew. In the past, the preservation of records has been left too much at the mercy of accident, and it would seem essential to establish, or try to establish, some definite system of efficient safeguards.

Thus there are two objects to keep steadily in view. The first of these is the preservation, wherever possible, of sections of outstanding or critical significance. In a number of cases this has been secured through the co-operation and assistance of public bodies, and geologists must feel deeply indebted to these for their action. Private assistance has, as already stated, come to our aid in the case of the Jed River unconformity, while acknowledgment should certainly be made of the generous action of Major-General J. W. Stewart, when in 1930 he conveyed to the ownership of the

Royal Society of Edinburgh the ground at Inchnadamph on which the Peach and Horne memorial stands (Geol. Surv. Photos. C. 3550–51). Where preservation of important sections is possible, however, appeals for co-operation and assistance will come more effectively from a committee representative of geological opinion throughout the country. One other thing must be said in this connexion. It will not be out of place to suggest that geologists themselves are not always entirely free from blame in this matter, and that some restraint might be put on indiscriminate collecting at specially important and limited exposures.

The second and, in my opinion, the more urgent claim on our attention, is the preservation of carefully annotated records of exposures that are likely to be destroyed or to disappear, and of sections that are temporarily opened for examination. Included among the latter are excavations of all kinds as well as borings for whatever purpose these may have been sunk. The information they yield, scientific and economic alike, ought to be made available in a permanent and accessible form. To ensure this will require the active co-operation of geological and natural history societies and of university geological departments throughout the country, each responsible for a particular region and each reporting annually to a central organizing committee, either of the British Association or of the Geological Society. Brief abstracts of the work done in the different regions should be published at intervals, and these abstracts ought unquestionably to indicate where the fuller details are available, whether published or preserved in manuscript form. What is required is a register of new information derived from temporary sections and some system of ensuring that the full records, including any diagrams and photographs, are permanently retained. There is nothing extreme in this suggestion, and it ought to be possible to institute an efficient system of precautions against avoidable loss.

OBITUARIES

Sir Thomas Heath, K.C.B., F.R.S., F.B.A.

SIR THOMAS LITTLE HEATH, who died on March 16, was one of the most learned and industrious scholars of our time. He was born on October 5, 1861, the third son of Mr. Samuel Heath of Thornton Curtis in Lincolnshire. Sent to school at Clifton College, Heath went on with a foundation scholarship to Trinity College, Cambridge; and there, reading for double honours, he took a first in both parts of the Classical Tripos, and was twelfth Wrangler in 1882. Those years in Trinity are pleasant

to look back upon. Henry Jackson was at his best; Acton, Glaisher and Robertson Smith intensified the atmosphere of learning; William Wyse, H. H. Turner, Henry Head and Alfred North Whitehead were among the undergraduates; James Gow was writing his "History of Mathematics"—a "convenient compilation", as G. J. Allman called it, but good enough to start Heath on the work of his life. He won his Trinity fellowship in 1885, as his eldest brother, R. S. Heath, afterwards professor of mathematics in Birmingham, had done two years before; and many

years later the College awarded him its honorary fellowship, the most prized of all his many honours.

In 1884 Heath entered the Treasury, after heading the list in the Civil Service competition. He was a faithful servant, and, winning all the promotion open to him, rose to be permanent secretary of the Treasury and controller of the Civil List, conjointly with Sir John (afterwards Lord) Bradbury. After the War of 1914–18, when even the Treasury was greatly changed, Heath left it for the responsible but less arduous office of comptroller-general of the National Debt Office, which he held until his retirement in 1926 ; in the following year he published "The Treasury", a little volume of reminiscences of Whitehall. He was succeeded at the Treasury by Sir Warren Fisher ; the two men had married sisters a few years before.

Heath was one of those fortunate men who live two lives in one, and enjoy both without neglecting either. Cayley was a busy London solicitor for many years, during which much of his finest work appeared ; and Heath wrote one big and famous book after another, after the day's work in Whitehall was done. He took to Greek mathematics as an undergraduate ; he came to be the acknowledged master of his subject in Great Britain, and to rank with Loria, Tannery and Zeuthen, next after Heiberg, the greatest Hellenist and historian of them all. While he was still an undergraduate, or very soon after, he wrote articles on Pappus and on "Porisms" for the "Encyclopædia Britannica" under Robertson Smith ; and about the same time he published, in Henry Jackson and Ingram Bywater's *Journal of Philology*, a little paper on "The σ of Diophantus", an old puzzle which Heath succeeded no better in solving than others had done*. This and the article on "Porisms" were a foretaste of his first book, on "Diophantus of Alexandria", which came out in 1885, the year of his fellowship. This "youthful work", as Heath afterwards called it, won immediate acceptance, and ran out of print before long. It was written before Paul Tannery revised the text and redirected attention to the remarkable connexion between Diophantus and Fermat ; twenty-five years later Heath republished the book, re-written in great part, with a long and admirable supplement on Euler and Fermat.

A year after his Diophantus, Heath published his "Apollonius of Perga" (1896), next year that on "Archimedes", and eleven years later (1908) his great three-volume edition of "Euclid". For "Archimedes" and for "Euclid" Heath had Heiberg's text to build on, save that the "Archimedes" lacked Heiberg's subsequent and very valuable discoveries. But with all due allowance for this, what great books these of Heath's are ! No English editor had dealt with Apollonius since Halley two hundred years before, and even the received translations of Euclid were a hundred years old. To translate these books faithfully, and annotate them with all that had been most use-

* The Diophantine equations hark back, as Heath explains, to the *hau*, or *heap*-calculus, of the Egyptians, and I suggested long ago that the Diophantine σ, answering to our *x*, might stand for σωρός, a *heap*. But Heath saw reasons to the contrary.

fully written by Cantor, Bretschneider, Camerer and the rest, had been Heath's labour of love for years.

Heath had now dealt with Apollonius, Euclid and Archimedes, the three great "Greeks", who in Asia, Egypt and Sicily made the Golden Age of Greek mathematics ; then he set to work to end and crown his labours with "A History of Greek Mathematics". It is a book not only for the mathematician but also for every scholar, for mathematics is the greatest of all the legacies of Greece. Of that Golden Age, of the dim Pythagorean times before, and of the later Silver Age, with Diophantus, Pappus, Ptolemy and the rest, we find all or well-nigh all we want to know in Heath's orderly and copious book. It has, doubtless, the *défauts de ses qualités*. Heath has little of the critical taste and gift of brevity which make Allman's book look like a little gem, after fifty years ; nor had he Heiberg's fathomless erudition, deep as his own was ; nor does he show, or ever want to show, much imagination or speculative curiosity. Like so many other classical scholars he never seemed to care about what Egyptians or Babylonians *may* have known or done ; but when at last these great secrets began to be explored Heath became deeply interested, and he reviewed Otto Neugebauer's "Vorgriechische Mathematik" for NATURE with full insight and appreciation.

There are yet other works of Heath's, and not a few. After finishing his "Diophantus" and before settling down to the "History", he wrote a book on that 'Copernicus of Antiquity', Aristarchus of Samos, led on to do so (as he says) by H. H. Turner, his comrade both at Clifton and at Trinity. Half of the book deals with Aristarchus ; the other half is a sketch of Greek astronomy, from the starry heavens of Homer and Hesiod down to Plato and Eudoxus, then on more briefly to Hipparchus and Ptolemy.

I think that Heath was at his best when he dealt, encyclopædically, with the life and work of individual men. As a historian he was more sober than a man need always be ; he lacked colour, and was afraid of imagination. He found even Paul Tannery "prone to run away with an idea", and *ex abundante cautela* is a tag I have heard him use and recommend. He might have told stories, even about I.47, which would have helped to lighten the three volumes of his "Euclid". But this was not Heath's way. He was a quiet, patient scholar, rejoicing in the things which mattered to him, and which, after all, are the things which matter most to all lovers of learning. Not many years ago he brought out a pretty little volume containing the Greek text of Euclid's first book. The introduction and notes are interesting, but I find the short preface still more so, in which he talks of the "thrill of pleasure" with which he first cast eyes on the Greek text, in the days when he was young and when that text was extant only in old and rare editions. Now he has brought this and many another famous book within reach of us all ; and in doing so he has left us an example of sixty years of unstinted and unwearied work, all done for the mere love of it.

D'ARCY WENTWORTH THOMPSON.