



CECIL EDGAR TILLEY (1894-1973)

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THERE can be few petrologists able to remember a petrological world not dominated by C. E. Tilley. Although his death on 24 January 1973 was at the age of just 79, his rise to eminence had been so precocious that the period of his predominance spanned nearly a half-century.

The petrological roots of this patriarch of our Science lay in his native Adelaide, flanked by the Palaeozoic metamorphic rocks and granites of the Mount Lofty Ranges. In 1912, when he entered Adelaide University, teaching in Geology was shared by the stratigrapher Walter Howchin and W. R. Browne, petrologist Demonstrator temporarily replacing Douglas Mawson then absent on Antarctic affairs. There seems to have ensued a battle for the mind of the young Tilley, and, while in a letter at that time he lamented the lack of fossils in the Adelaide hills, Petrology won and he followed Browne to Sydney where in 1916 he graduated B.Sc. in Chemistry and Geology and was appointed Demonstrator in Geology and Mineralogy. Appointment as Chemist to the Department of Explosives Supply, Queensferry, Scotland, during 1917 and 1918 occasioned his first trip to Britain. It was not, however, until 1920, when holder of an 1851 Scholarship, that he went to Cambridge and met his future mentor, Alfred Harker.

Tilley does not seem to have settled too easily into Cambridge, but these were times of immense scientific stimulation for him, and he eagerly seized the opportunities offered. His initial research was carried out on a collection of South Australian granitic and calcareous gneisses that he had brought with him. Soon, however, he was engaged on a study of the schists of Start Point and on Skye tachylites under Harker's guidance. George Barrow conducted him over the metamorphic zones then delineated in the Scottish Dalradian and encouraged extension of the mapping. On a visit to Norway he met V. M. Goldschmidt and W. C. Brøgger, collected avidly in the now classic areas then recently described, and marvelled at the 400 pages and 40 rock analyses devoted by Brøgger to the mere four square kilometres of outcrop in the Fen District. The quality of Goldschmidt's department left a lasting impression on him and may well have influenced the design of the department that he himself was later to create.

After holding a Senior 1851 Exhibition Scholarship, he graduated Ph.D. and was appointed in 1923 to a University Demonstratorship in the Sedgwick Museum (Department of Geology). This solved the immediate problem of employment, but it

appears that Tilley was still not completely settled in Cambridge and hoped that he might return to Australia. It was not until 1928, the year in which he was made a University Lecturer, that loneliness in Cambridge was banished by his marriage to Irene Marshall. Mrs. T was an ideal match for Tilley; her vigorous good humour and staunch support were to form an invaluable asset in the years ahead.

Shortly before this Tilley had met N. L. Bowen for the first time and had accompanied him, with Harker, to Skye where 'the rusty peridotite dykes climb to the Cuillin sky'. The friendship between Bowen and Tilley was to ripen when in 1931 he spent a year at the Geophysical Laboratory, where also he forged a lifelong friendship with J. F. Schairer. After completing the ternary system  $\text{Na}_2\text{SiO}_3$ – $\text{Na}_2\text{Si}_2\text{O}_5$ – $\text{NaAlSiO}_4$ , he made no further direct experimental work, no doubt feeling that his forte lay in the microscopic determination of actual rocks. However, few petrologists of his time had as great a faith as he in the future of experimental petrology, and in his last decade he was to return to that Laboratory to work in the closest collaboration with Experiment.

In 1931 the simultaneous retirement of the Professor of Mineralogy (Arthur Hutchinson) and of the Reader in Petrology (Alfred Harker) presented the University with the opportunity of re-examining the structure of disciplines in these fields. A committee including L. J. Spencer, W. H. Bragg, and Sir Ernest (later Lord) Rutherford recommended the separation of Crystallography from Mineralogy to form a new department, and the fusion of Mineralogy with Petrology into another independent department. The former recommendation was subsequently modified, the Crystallographic Laboratory later being developed as a sub-department of the Cavendish Laboratory. So it was that in 1931 Tilley became Professor of Mineralogy and Petrology and Head of the Department which, in its combination of crystallographic, petrographic, and physico-chemical interest still bears his imprint.

Tilley's energy and clear-sighted sense of purpose now showed as he soon established a vital department of enthusiastic young workers. The publications of the Department in that first decade stand out in the contemporary literature as models of petrographic precision, clarity, and thoroughness. He had the supreme gift in a supervisor of convincing a research student that to him also the project was the most important and exciting topic in the world; his disciplined and unflinching industry set an example that was an inspiration and a continuing stimulus.

He did not, however, find administration congenial, and as a perfectionist his preoccupation in conducting his department, coupled with his natural shyness, led him often to present to his students a rather brusque and occasionally forbidding front. The effect of his powerful physique, penetrating deep voice, and piercing faraway-blue eyes could be shattering to the recipient of an unfavourable comment. For many who knew him only in Cambridge, his fundamental warmth was revealed only when on retirement he shed the anxiety of office; his fortunate friends in America had long been familiar with his geniality. Yet none could ever doubt his innate kindness and concern; many a student, petrified by the Professor's inquiry about a particular unidentified mineral in a thin-section, was reassured by the benevolent 'Well, I'm not sure what it is either—I haven't got my eye in yet.' And what an eye he had! With his old Swift microscope, the stage worn and polished by the passage of a thousand slides,

he always saw more than other men. In this capacity there was compounded immense experience, a complete command of the literature, made possible by his photographic memory and by his industry, and an intuitive faculty that arose out of his consuming passion for rocks.

The second decade of his department saw a steady increase in activities other than his research. Alfred Harker, for the eight years following his retirement Honorary Curator of the rock collections, died in 1939. Tilley took over the task of labelling and cataloguing rock specimens and thin-sections for the ten years that elapsed before the appointment of a Staff Curator. Numbers 41931 to 51600, entered in his hand, indicate that the superb Harker Collection of Rock Slices is as much a memorial to Tilley as it is to its founder. The problems of life during the War years—the difficulties of running a department in that austere period, and additional duties such as those of an Air Raid Wardenship in his home district—he shared, of course, with his contemporaries. Characteristically, however, he did not compensate for these by doing less research; the literature of the forties is as rich in contributions from his pen as is that of the preceding decade. As the pressure of work increased, however, he was able to find relaxation with his family, and the daily routine, familiar to his staff and students, of the cycling back to Harvey Road for tea with his daughter Anne and Mrs. T, followed by a return for arduous hours in the Department, was established in this period.

But the long years of overwork had taken their toll, and in 1950 when he was concurrently President both of the Geological and Mineralogical Societies and Vice-President of the Royal Society, his splendid physique succumbed. Even so this time of nervous trouble, happily short-lived, saw the publication of two of his most significant papers—‘Some aspects of magmatic evolution’, and ‘The zoned contact-skarns of the Broadford Area, Skye’; and he utilized the period of his convalescence in Canada to lay the foundations of yet another—‘Problems of alkali-rock genesis’.

At this summit of his career we may review the character of his scientific progression. His early work was dominantly metamorphic and petrographic in nature, clearly showing the influence of Harker, Goldschmidt, Eskola, and Niggli. He was an early and perceptive proponent of the Metamorphic Facies concept; his handling of metamorphic zones and his introduction of the concept of the isogradic surface anticipated by some forty years the treatment of today. The setting-up of his own Department with its first-rate research facilities ushered in a more mineralogical period in which his work relied more strongly than previously on reliable, abundant, and detailed chemical and optical data. An average of some dozen thin-sections delivered to him on every working day of the year, and more sophisticated facilities for mineral separation and analysis, enabled him to produce a series of paragenetic studies that set the standard in metamorphic petrological research for decades ahead. Much of this work involved carbonate reactions, commencing with the study of the Scawt Hill dolerite–chalk contacts and culminating with the publication in 1950 of his study of the Skye skarns, a work of unchallengeable authority and thoroughness. Here belong the discovery of the new minerals larnite, scawtite, portlandite, hydrocalumite, rankinite, harkerite, latiumite, and bredigite and, appropriately, also the naming in his honour of the mineral tilleyite.

Throughout the preceding years a scattering of short papers had indicated an active interest in igneous rocks, and had ensured the inclusion of his photograph in Vol. IV (1938) of Johannsen's *Petrography*. In 1950, however, his address as President of the Geological Society of London, 'Some aspects of magmatic evolution', signalled a change of course. In this, his first major publication on igneous petrology, he established himself as a master of the subject. While his William Smith lecture (1957) on the Grenville alkaline gneisses is an important contribution to the understanding of metasomatic rocks, the dominant emphasis of his research was now to remain firmly in the field of igneous petrology. He had accepted that he could no longer drive himself as hard as hitherto, and while for the last decade of his professorship he was still working a long day, he made increasingly more frequent visits abroad.

On retirement in 1961 he was at last able to devote himself wholly to the research that he loved. Appointment as a Research Associate of the Geophysical Laboratory enabled him to spend the winter of every year in Washington, where he luxuriated in the atmosphere of scientific endeavour. Dr. Yoder writes (1973) of the 'gentle but persuasive way' in which he gave new directions to many of the projects of that Laboratory and of the insight he brought to the formulation of critical experiments bearing on key aspects of field problems. Doubtless too his unrivalled petrographic skill was invaluable at a time when experimental research was first leaving the secure basis of ternary liquidus systems for the stormy complexities of polycomponental space. A long series of papers, including the monumental 'Origin of basalt magmas' by Yoder and Tilley in 1963, testify to the vigour of this association. None the less, age was beginning to tell, and his once great frame began noticeably to shrink. In 1967 he made his last journey to Washington, but retrenchment did not connote inactivity, and on his return he immediately commenced a new association—with the Laboratory in Manchester of his old pupil MacKenzie, an association that continued to the end of his life.

For a man so devoted to research, Tilley's record of public service in scientific societies and international bodies and in Cambridge is astonishing. He who, in talking of research, once spoke of 'the supreme exhilaration of the chase' was yet ready to give long years of service on committees and as an advisory editor for publications. He was admitted a member of the Mineralogical Society at a meeting of the Council in January 1921 by Arthur Hutchinson, a Vice-President. This was the period in which the Society had just started to redevelop its activities after the war; the publication of *Mineralogical Abstracts* (edited by L. J. Spencer) had begun, and in that same year was published jointly with the Geological Society the Report of the Committee on British Petrographic Nomenclature. Three years later Tilley was elected to the Council for the first time and served as an Ordinary Member in the years 1924–7, 1931–4, 1936–7, becoming Vice-President from 1937 to 1940; he was President from 1948 to 1951 and from 1957 to 1960, and was one of the two Managing Trustees from 1940 till 1968. The Society was one of the prime movers in the founding of the International Mineralogical Association, and Tilley, as President, represented Britain at the first meeting in Madrid in 1958. He served as Chairman of the Programme Committee for the New Delhi Meeting in December 1964, at the end of which he was elected

President of the I.M.A. itself. Except for the sixth, unhappily abandoned, he attended all of the General Meetings of the I.M.A., presiding over two—as host in his own Department in Cambridge in 1966 and then again in Tokyo-Kyoto in 1970.

In 1922 he joined the Geological Society of London, served on its Council in 1928–32, 1937–43, 1948–51, was Vice-President in 1938–43 and President in 1949–50. He was awarded the Wollaston Fund in 1924, the Bigsby Medal in 1937, and the Wollaston Medal in 1960.

Election to the Royal Society came in 1938; he served as Vice-President in 1949–50 and his distinction was recognized by the award of a Royal Medal in 1967.

He held Honorary Doctorates from the Universities of Sydney and Manchester, and was an honorary member of numerous societies in Britain and abroad, including the Mineralogical Society of America, which elected him Correspondent (a title later changed to Honorary Fellow) in 1948 and awarded him the Roebling Medal in 1954.

In Cambridge Tilley became a member of Emmanuel College, the College of W. N. Benson, in 1920 and that he remained for over half a century, becoming a Fellow in 1931, Vice-Master in 1952–8, and a Life Fellow in 1961. In spite of the considerable demands upon his time, it was in the period of rapid growth of his Department in the post-war years that he gave more general service to the University—on the Council of the Senate in 1949–60 and on the General Board of the Faculties in 1951–60.

The Mineralogical was always Tilley's first Society. Except in his later years when abroad, he missed but few meetings in 52 years of membership; his massive figure, prominent on the front bench of the old Meeting Room of the Geological Society, was as seemingly timeless a feature of the 'Min. Soc.' as the busts that adorned the walls of that noble apartment. He read his first paper to the Society there—'On some natural glasses'—just one year after being admitted a member, and from then onwards he was a frequent contributor. Certainly no member spoke so frequently in the discussions on the papers presented as he did, and his comments, distilled from his encyclopedic knowledge and vast experience, were always apt and directed at the core of the matter, although perhaps on occasions unwelcome to an ill-prepared or woolly speaker. It was said that the Thursday afternoon meetings had been fixed by Tilley so that members of his Department could take advantage of the railway excursion fare offered on that day! Many of his old students and colleagues will long remember those return journeys on the late train after attending the Society's Dinner, packed in a gloomy compartment in a haze of tobacco smoke, the Professor continuing to develop various points that had arisen during the meeting. After some such occasions walking back from Cambridge Station at midnight, he could be observed to pass the end of Harvey Road and continue on to the Department for further work.

It is hard to realize that C. E. T. has gone. He guided us for so long, that the immense heritage he leaves is already firmly a part of our Science. If for a following generation schooled in his methods he seems to stand less uniquely than he did when their acceptance was a rarity, this is but a measure of his success. It is unlikely that Petrology will see for many years such a combination of industry, erudition, and sheer love of the beauty and import of rocks: we shall not look upon his like again.

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