

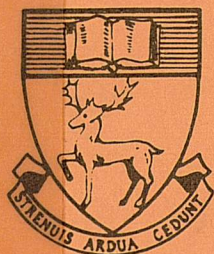
# **Department of Geography University of Southampton**

**Contextual Perspectives on  
Geographical Thought:  
Gillman of Tanganyika  
(1882 - 1946)**

**B.S. Hoyle**

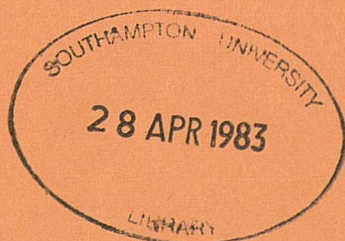
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**The Editor,  
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## ABSTRACT

Clement Gillman (1882-1946) trained as an engineer and worked in German East Africa and in Tanganyika from 1905 to his death in 1946. He was distinguished not only as an engineer but also as a pioneer field scientist and advocate of modern geography. He was a constant traveller and a prolific writer. His numerous published papers and his private diaries provide an insight into the foundations of East African geography and into the formative period when modern Tanzania was in the making. If, as is claimed, colonialism served primarily to reveal the problems of modern Africa rather than to solve them, Gillman was one of the instruments by which those problems were brought to light and first understood. This paper is an outcome of recent and continuing research in Britain and East Africa which is designed to lead in due course to a major study of Gillman's life and work in the context of his time and place.

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Modern geographers are concerned, individually and collectively, with the continuing development of their subject and with the cultivation of the frontiers of geographical research. The subject of this paper is the life and work of a geographer whose concern for research was very similar in spirit to that of his present-day counterparts, but was set in a very different context of time and place. Clement Gillman was trained as an engineer in the early years of this century; he worked in East Africa for over 40 years, and became a distinguished field scientist and an ardent advocate of modern geography. I became interested in Gillman when I first went to East Africa as a young assistant lecturer in 1960; I was intrigued by the career and character of a man who had been a prolific writer on geographical topics, yet was by profession an engineer. Repeatedly I came across articles he had written, and maps bearing his signature; and gradually through correspondence and discussion I made the acquaintance of people who had known and worked with him. In the mid-1960s I wrote a paper on his life and work (Hoyle, 1965), and now after a gap of almost twenty years I have returned to this subject. On the basis of materials not previously available, I am working on a biography which will mark, somewhat belatedly, the centenary of Gillman's birth.<sup>1</sup>

The study of the life and work of any individual, and of his contribution to society, inevitably raises fundamental questions concerning identity, achievement and importance. These are obviously interdependent issues in the sense that a person's achievement is in part dependent upon who and what he was; and his importance, as perceived by his contemporaries or by others at a later date, clearly reflects that achievement. Yet these interactions are themselves dependent upon the context in which a person's life is set - in geographical and historical terms, in relation to economies and societies, and in relation to the evolution of scientific thought and the development of research in a particular subject. It is virtually impossible for people of one generation fully to realise what life was like in earlier times; yet an attempt must be made to do so, and must

guard against discussing figures from the past as if they were our own contemporaries. For we are all largely the creatures of the world into which we happen to have been born, and our outlook is conditioned by its beliefs and assumptions, customs and conventions, experience and knowledge. This is true to a large extent even of rebels and eccentrics, pioneers and reformers, who reject many of the accepted norms of their society and press against its boundaries, seeking ever to enlarge knowledge and experience, and thereby to transform the known world and to create a new social and intellectual order.

### European context

That Clement Gillman was both a pioneer and a rather eccentric character cannot be disputed by anyone who has read his published papers or, more particularly, his private diaries. The essential context for an understanding of his work is provided by the geographical environment and socio-political development of East Africa. To understand his development as a geographer, however, we must first outline his family background and education which provided the context out of which Gillman stepped on to the East African stage (Fig. 1). His identity involves rather complex links with England, Spain and Russia, although his European homeland was in southern Germany and Switzerland. Gillman was English by nationality, but he did not visit England until he was 25 years of age. His essential cultural context during his formative years was German, but from his student days onwards he was fundamentally an internationalist in outlook. Gillman's father, Fritz, was a mining engineer who worked for many years in Spain, and Clement Gillman was born in Madrid on 26 November 1882. His mother was probably a stronger influence: she was born Margarete von Petzholdt, the daughter of a distinguished German professor of agricultural chemistry and soil science who worked in Russia. When Gillman was born, his maternal grandfather was living in retirement in Freiburg, Germany, and Gillman and his mother and sister lived there while his father Fritz continued his work in Spain. Gillman went to school in Freiburg and then to university in Zurich where he graduated as a civil engineer in 1905.

Looking around for a job either at home or abroad, Gillman was offered a post as assistant engineer with the Frankfurt engineering firm of Phillip Holzmann who had been awarded the contracts for the railways then under construction in what was German East Africa. So the great adventure

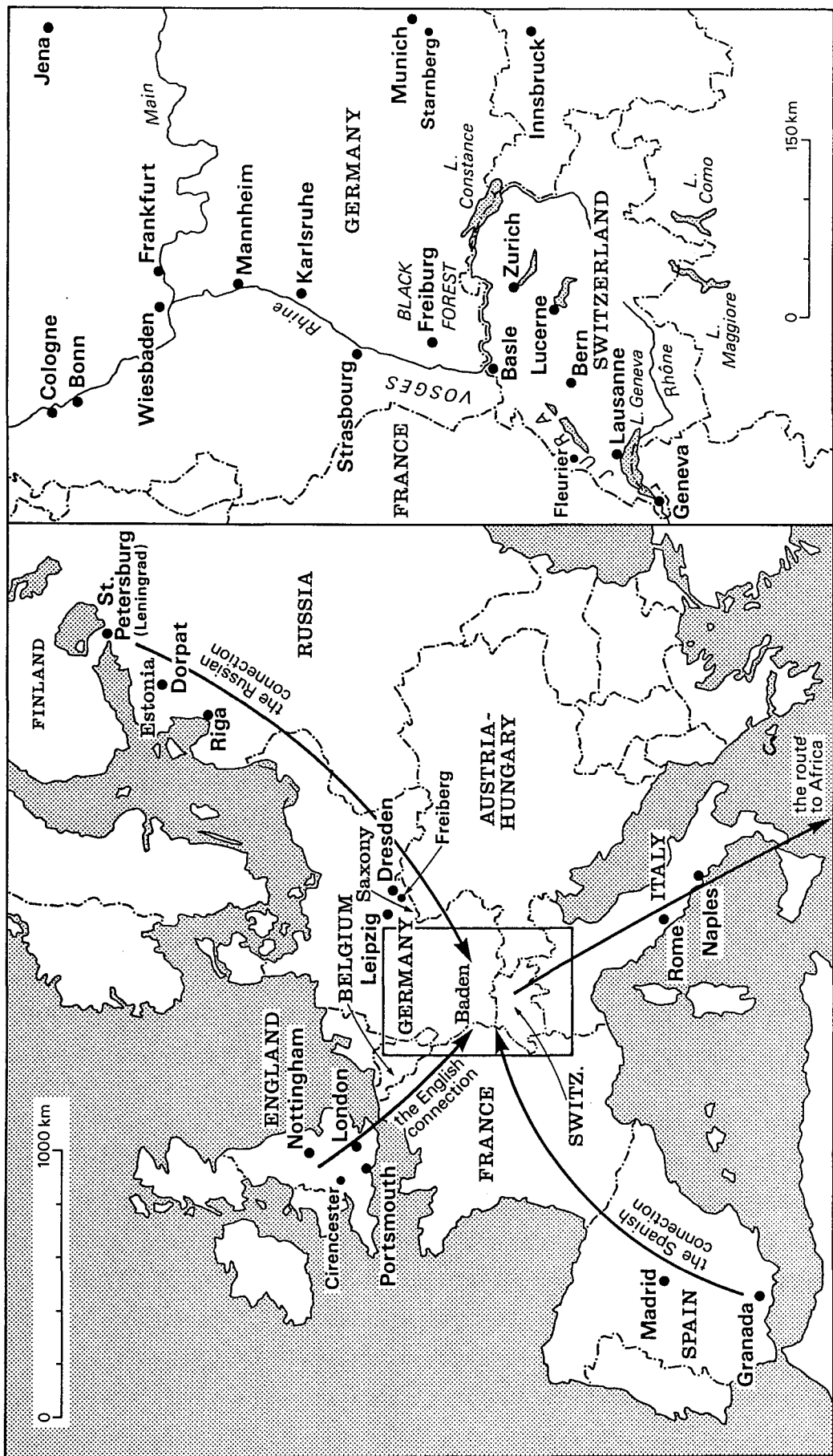


Figure 1 : The European context of Gillman's early life.

During his schooldays in Freiburg and student days in Zurich around the turn of the century, Gillman's world centered upon the middle Rhine valley and the northern foreland of the Alps. His development was influenced, however, by links with Spain, England and Russia.

began, and Gillman sailed out to East Africa and arrived in Dar es Salaam towards the end of 1905, just a few months after the building of the railway across central Tanzania (Figs. 2, 4) had started. East Africa remained the basis of his activities for over 40 years, so that he experienced the last ten years or so of German control, the upheaval of the First World War, the period of post-war reconstruction and the foundation of modern Tanzania during the years of the British mandate. Gillman's career therefore spans several major periods in Tanzania's history; it also encompasses the emergence of modern geography; and the formative years during which the nature and essential characteristics of Tanzanian societies and environments were made more generally known (Fig. 3).

#### THE YEARS OF ADVENTURE

Gillman's East African career falls naturally into five major periods. Borrowing from Margery Perham's classic biography of Lord Lugard, I would classify the first three periods (covering the years 1905 to 1927) as the years of adventure; and the two later periods (from 1928 to 1946) as the years of authority (Perham, 1956). The first period, from 1905 to 1914, was essentially the Holzmann period during which Gillman served four tours of duty in German East Africa, with three intervening leaves in Europe. He started as a very junior assistant engineer; when he arrived in Dar es Salaam in 1905 only about 40 km of line had been built; his first base camp was at km 45, in the middle of a rather difficult stretch of line where his skills as a surveyor were fully tested.

Under the influence of an entirely new environment, where the possibilities for observation were vastly increased, and made good use of, where hard work and solitude were the dominant aspects of his life, Gillman recorded an increasing love for life away from 'civilisation'. With his command of the Swahili language gradually improving, he seems to have dealt effectively with most if not all of the very varied problems presented by his new environment. Continually fascinated by the novelty and strangeness of his surroundings, and occasionally almost overwhelmed by the striking beauty of the landscape he was helping to transform, Gillman seems even at this early stage in his career to have developed an increasingly close rapport with many of the Africans with whom he came into contact, and to have developed a distinct disaffection, not to say contempt, for the activities and characteristics of some of his fellow Europeans. Gillman

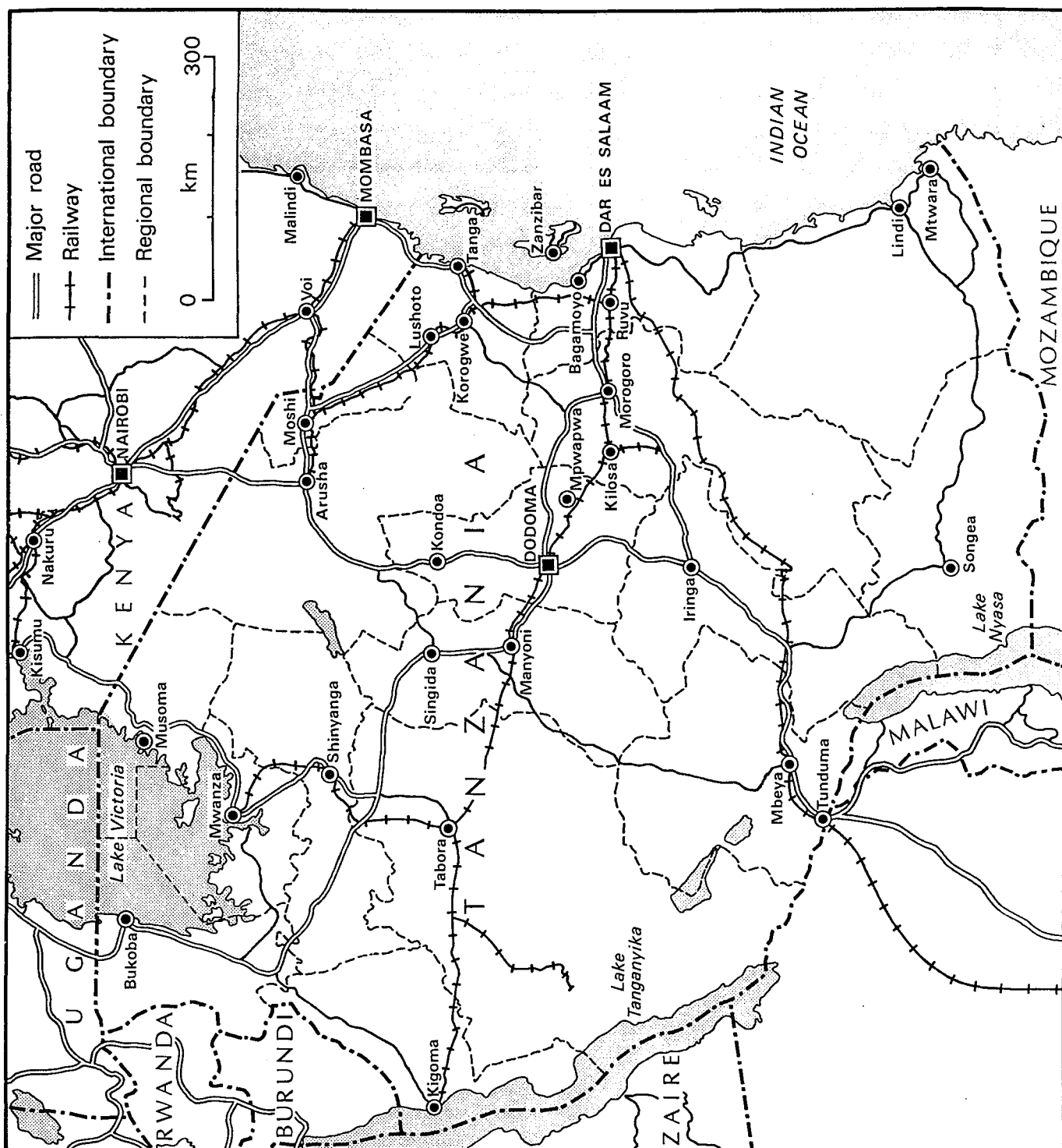


Figure 2 : Modern Tanzania

Modern Tanzania is derived in geopolitical terms from that part of East Africa which was colonised by Germany towards the end of the nineteenth century, and from the former British Protectorate of Zanzibar. Most of German East Africa (1885-1919) became Tanganyika Territory (1919-1961), administered by Britain under a League of Nations mandate; Rwanda and Burundi were administered by Belgium (1919-1962). Tanganyika achieved political independence in 1961, followed by Zanzibar in 1964, and in that year the United Republic of Tanzania came into being.

obviously found railway survey work both challenging and enjoyable: "In spite of this heat I have to work more than ever", he wrote on 25 January 1906, "and am rushing about from one place to another, having three bridges under construction at present .... In addition the controlling, advising and ordering about of a good many transport caravans passed through of late, or that I had to make up, gives lots of troublesome and ungratifying work ... but in spite of the heat I feel I am up to it alright" (I, 9, 68).<sup>2</sup> On a visit to Dar es Salaam in February 1906, however, his first after three months on safari, he was highly critical of railway company affairs: "The engine drivers, railwaymasters etc are mostly drunk and I felt very much disgusted with the state of things .... Not 100 km of the railroad are completed! .... Dar es Salaam is a place full of drunkards and I was glad when I left it again .... Absolute anarchy in my firm ... everybody does what he likes. The station buildings are growing slowly but the harbour is scarcely started yet!" (I, 9, 72-73). Discussing conditions with another assistant engineer and a stationmaster from further down the line, Gillman agreed that "the management of the line is in bad hands and an enormous amount of mistakes has been made and are still being made .... But from what I saw there must be an absolute anarchy amongst the employees in Dar es Salaam and on the 1st section" (I, 9, 71). Returning to kilometre 45, Gillman wrote: "I really was very glad to be back in my lonely camp and hope not to see Dar es Salaam again before I leave this country for good!" (I, 9, 74).

On leave in Europe early in 1908, Gillman married Eva Kerber, who was to share his long African experience; Harold, the elder son, was born in Dar es Salaam at the end of that year. The life of a peripatetic railway engineer in those days was not easy; problems of food and water supply, difficulties with the local labour and the German authorities, floods and droughts and the occasional marauding lion all diversify the story. But the railway made rapid progress; Gillman was in charge of survey work on several sections of the main line from Dar es Salaam to Tabora, which was reached in 1912 (Fig. 4). The outbreak of the First World War in 1914 brought this phase of Gillman's career to an abrupt end; his position as an Englishman working for a German company became untenable, and so he was dismissed and placed under house arrest.

The second period was that of the First World War from 1914 to 1919, spent by Gillman and his wife and two sons (Frank had arrived in 1913) in Tabora

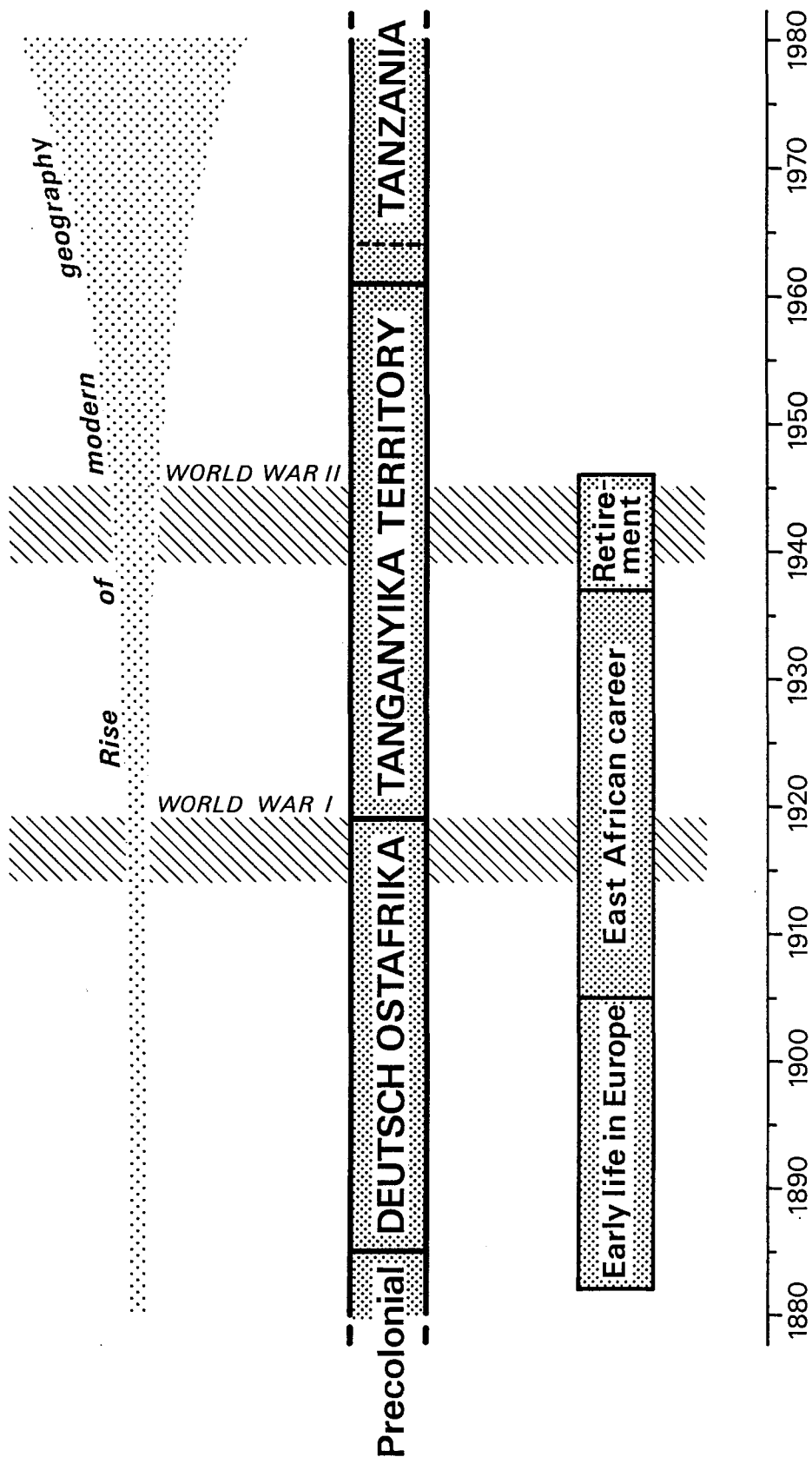


Figure 3 : Gillman's career in historical context.

During Gillman's early years European powers established political control in many parts of the African continent, and his East African career included the final ten years of German authority in the territory which became Tanzania. Subsequently , he experienced the upheaval of the First World War, the period of post-war reconstruction and the foundations of modern Tanzania during the years of the British mandate. Gillman's career not only spanned several important periods in history of Tanzania but also encompassed the emergence of modern geography.



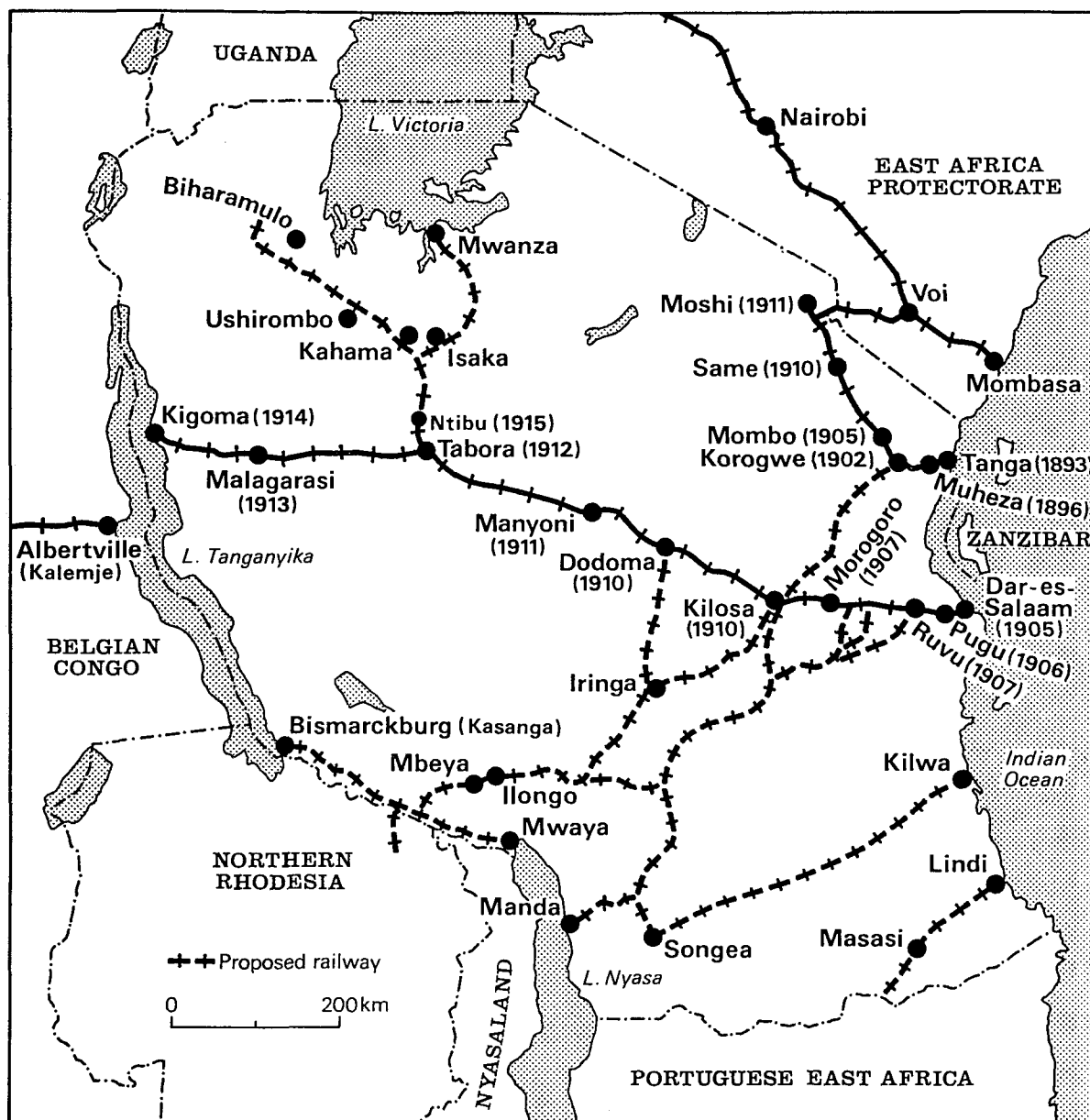


Figure 4 : Railway construction in German East Africa, 1893-1914.

The dates indicate the progress of the Nordbahn and the Tanganjikabahn from Tanga and Dar-es-Salaam respectively. Some German surveys and proposals for additional railways, both north and south of the central line, are also shown.

which was the inland headquarters of the railway construction company. With no job and few resources, Gillman's wartime situation was problematical and uncertain, although perhaps less directly dangerous than it might otherwise have been. Gillman and his family spent most of the war years in a small house of traditional design, ostracised because of their German associations by many other Europeans in the area. In 1916 Tabora assumed strategic importance as the anti-German forces penetrated German East Africa, the Allied forces (under South African command) from the north and the Belgians from the west. As tension heightened, European civilian prisoners in Tabora were concentrated in a rather unpleasant prison camp; that situation was brought to an end by the relief of Tabora by Belgian troops, and the Allied forces controlled most of German East Africa (except the southernmost areas) for the remainder of the war years. Released from prison, Gillman was soon able to join the military railway forces under British control, where his knowledge of local railway affairs was of course extremely valuable during the reconstruction process.

#### An ascent of Kilimanjaro

The third period of Gillman's career began with his appointment in 1919 as a District Engineer with the newly-named Tanganyika Railways under the British Colonial Office, first in Tanga in the north and then in Dar es Salaam. After the restrictions of the war years he enormously enjoyed the opportunities for extensive local travel: there were not only routine tours of inspection up and down the lines, but also a chance to climb Africa's highest mountain, Kilimanjaro, which fascinated him throughout his life. In January 1919 he had climbed to a height of 4,800 metres, reaching the saddle plateau between the twin peaks of Mawenzi and Kibo. On 15 October 1921 he left Moshi with three European companions (the Hon. Charles Dundas, Mr P. Nason and Mr F.J. Miller) and a party of African porters. Gillman had planned for more than a year to climb the mountain with Dundas, the Chief Commissioner of Moshi, but it was in fact with Nason that he reached the crater rim of Kibo on 19 October. Their climb was the first successful attempt on the mountain after it had become British territory in 1919. "The fight up there was grim and twice I was near despair", recorded Gillman in his diary; but "victory, at last, was mine ... Kibo, my great and glorious giant friend is conquered, my daring dream has become reality" (VI, 52, 140-141). A year later Gillman described his climb to the Royal Geographical Society in London in a paper which now stands as the first of his major publications: "At 9.45 we stood at last on the crater rim. Bathed

in light Kibo's vast crater lay at my feet, with its walls and battlements of ice, white and blue, in mighty solitude under a sky of steel. A few rags of cloud passed over the plateau and tore up the slopes of Mavenzi, which now looked like a molehill far below. And as wide as the eye could reach the great continent was hidden beneath a continuous veil of mist. Only far away to the north a heap of cumuli rising from the seemingly uniform level of the cloud sea indicated the position of Mount Kerya, the brother giant" (Gillman, 1923, 15-16). The point on the crater rim reached by Gillman and his companion has subsequently been known as Gillman's Point, although Gillman himself objected to the term: in 1926 he wrote that "I dislike the idea of replacing 'Johannes Notch' with 'Gillman's Point'. Neither term is geographically descriptive, and if it is necessary to bring in proper names to designate features which, like the notches in Kibo's ice-cap, are probably only very temporary surface forms, then Major Johannes' priority of more than twenty-five years ought to be respected, all the more so as his name is already embodied on all existing maps" (Gillman, 1926, 504). Gillman's name is recorded on modern maps, however, slightly below the 5895-metre summit, at the point on the crater rim which he calculated to be 5880 metres above sea level.

#### The Nyasa reconnaissance expedition, 1925

Gillman's major professional achievement during these years was his contribution to the protracted debate concerning proposed railway routes southwards from the central line through the southern highlands of Tanganyika and on into Northern Rhodesia (Fig. 5). In 1925 and again in 1927 Gillman undertook arduous and extensive reconnaissance safaris, almost entirely on foot, through the areas across which it was intended that the new lines should pass. The proposal to build a railway to link the central line with the southern part of Tanganyika marked the beginning of a long-continued and complex controversy which led eventually to the construction of the Tanzania-Zambia railway which was opened in 1975. The first stage in this process was a reconnaissance survey carried out by Gillman during the latter half of 1925 from Ngerengere on the central line via the Kilombero valley to the north-eastern shore of Lake Nyasa at Manda, a route which had already received some attention from German railway authorities in the years prior to 1914. In professional terms Gillman set out with high hopes: "For years I have worked to make this expedition possible, and at last I have been able to persuade the powers that be that it is essential before anything definite can be decided with regard to

railway extensions in this territory .... I am not going to shirk any fatigue of brain or body, and I want to come out of this as the recognised authority on all matters concerning railway surveys in this part of the world" (IX, 72, 1).

Gillman and his wife, together with an Assistant Engineer named R.W. Norton, left Dar es Salaam on the evening of 13 July, knowing that they would not return for a year and a half; they were joined at Ngerengere on the following morning by 121 Wanyamwezi porters, many of whom had travelled with Gillman on previous occasions, some as early as 1908. "The loads are distributed among the men, the instruments are checked, the aneroid corrections determined ... I am ready to dive into the wilderness, to leave behind for some delightful months the blisses of civilisation - all except Norton's gramophone, which I had not the heart to stop him from taking" (IX, 72, 2). The survey party proceeded southwards, following the eastern and southern foot of the Uluguru Mountains, and reached Kisaki on 23 July. "It took only a day or two to get the large caravan going, and by now everything is working as smoothly on the road and in camp as if we had been together for weeks. No straggling, no disorder, clean and beautiful camps in readiness every day under the charge of Mataruma who travels a day ahead and rouses the local inhabitants" (IX, 72, 2). Beyond Kisaki the organisational difficulties increased: "I had to prepare for food and water for the next fortnight's tachometric work through an uninhabited wilderness ... (but) with the aid of Akida Leo, one of the old school, I got what I wanted from the mountain tribes, many loads of rice and quite a large flock of goats, and my water-diggers ahead have reported favourably" (IX, 72, 3). Continuing through what is now the Mikumi National Park, the caravan was not infrequently disturbed by buffalo and other wildlife, sometimes coming to inspect their tents during the night. By day, "the Wanyamwezi were splendid, but often harassed by herds of elephant in their strenuous work of cutting our traverses through that impenetrable jungle and across the steep-sided ridges between the deeply-eroded streams" (IX, 72, 4). Norton, however, was already the subject of critical comment: "He is willing enough and a good walker as long as he has a path and a village at the end of it. But pathless cutting through the bush, with elephant and buffalo and leopard about, seems to upset him to such an extent that attention to terrain and instrument is suffering" (IX, 72, 4). Poor Norton! Far worse was to come before the survey party reached its goal. Eva, for her part, looked after the stationary instruments, constructed daily pressure and temperature diagrams,

and took upon herself the essential but sometimes unpleasant daily sick-parade each afternoon.

Continuing south-westwards and crossing the Ruaha river near Kidatu, the caravan reached "the mighty alluvial plain of the Kilombero, endless flat country, seamed by high mountains and beyond it in the south the island-horst of the Mahenge hills. All new to me ... but all so full of problems, of unanswered, unanswerable questions!" (IX, 72, 7). At Ifakara, an established focus of trade routes from several directions, Gillman discussed with local inhabitants and traders the potentialities of the great plain for agricultural development, and found them generally optimistic; he remained, as usual, unconvinced by enthusiasm which he considered ill-founded. The safari then continued along the sweltering Kilombero plain, following a route north of the river via Mgeta and Kihanzi to the region which Gillman described as an East African Punjab, "the region where the five great headwaters of the Kilombero break from the mountains and are building up the wide alluvial plain with its swamps, its river arms, its half-submerged villages of fishermen" (IX, 72, 13). There followed two weeks of great difficulty as the caravan made its way up the Pitu valley and across the Rufiji-Nyasa divide, a route which had been previously surveyed very inaccurately by a German party in 1911. A constant problem in a sparsely-populated area was the supply of food, which meant that the topographical work had to be done as quickly as possible so that the party could move on to draw supplies from new areas: the resources of any one locality could not support a party of over 150 travellers for more than a day. The district officer at Songea had provided a knowledgeable young guide named Rupia, who proved invaluable during this stage of the survey. Gillman described him as "a wonderful fellow who seemed to know every headman for dozens of miles around ... (he) would lie down at night by the lamp, would scribble one barua after another, and sure enough next day a long string of women would descend from God knows where and would find our camp in the pathless wilderness" (IX, 72, 14). The Waryamwezi porters, too, seemed to respond to the challenge of the Pitu valley: "How they got our loads through those gorges, across the hundreds of gullies, along the countless miles of narrow elephant path I do not know. But they did it, and in camp their laughter never ceased and they, the children of the dry savannah, had the time of their lives splashing and bathing in the shallow rivers ..." (IX, 72, 14).

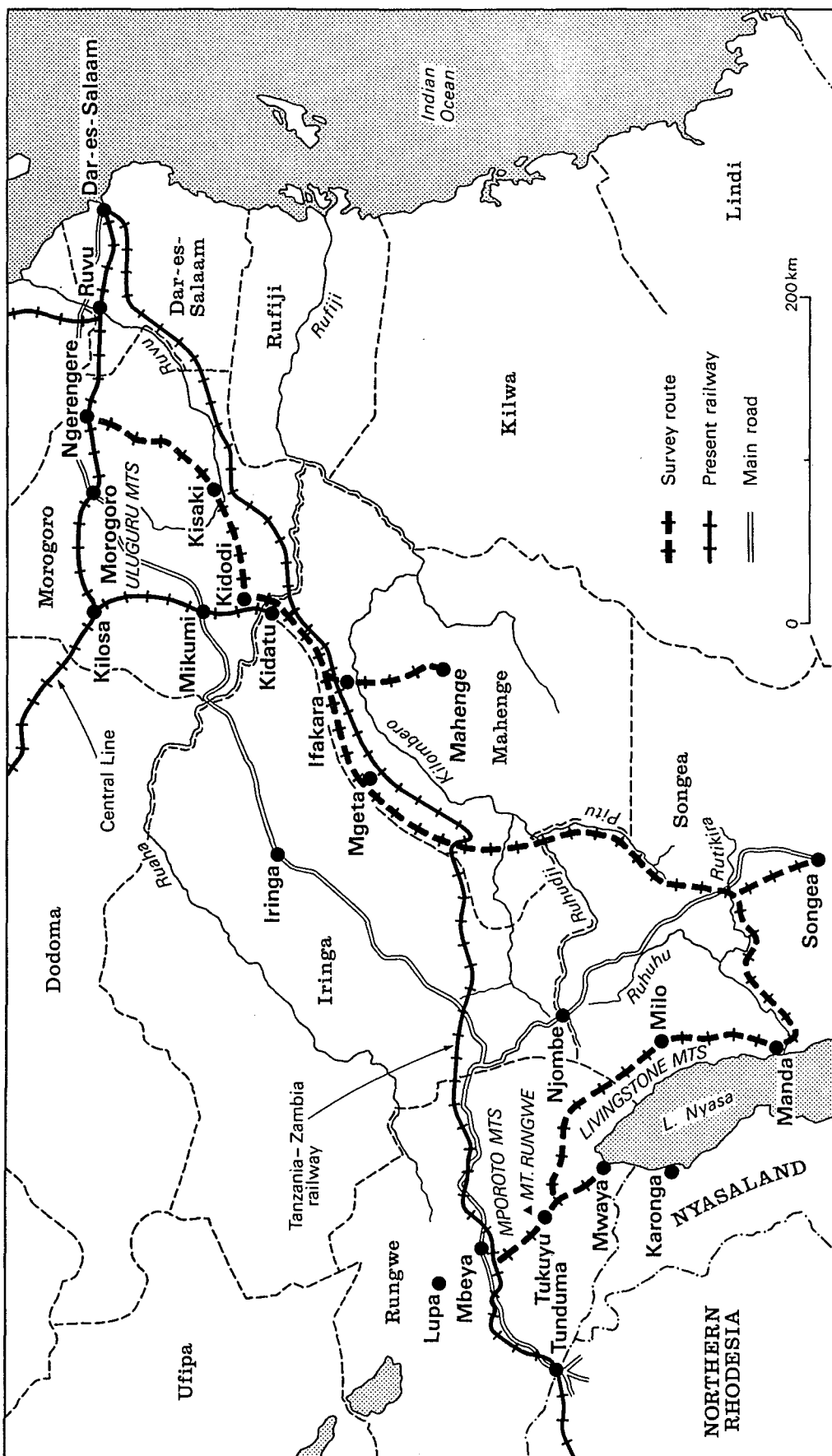


Figure 5 : The Nyasa reconnaissance survey, 1925

The survey route from the central line at Ngerengere to Manda on Lake Nyasa is shown in relation to present-day railways, including the Tanzania-Zambia railway and the Kilosa-Kidatu branch line. Districts are shown as in 1925.

The most difficult part of the entire safari involved the negotiation of the Pitu gorge, where it must have seemed at times impossible that a railway could ever pass: "I dived into the deep gorge of the Pitu river which here bars progress even for porters. Ten or twelve of my best men were with me, and we were guided by a youngster of about 13 years who knew the gorge and lateral hills from former youthful rambles after wild honey ... Crossing and recrossing the foaming stream, often jumping from boulder to boulder in midstream as the shores were too steep to be traversed, we somehow got to the steepest middle portion of the gorge where cataracts between sheer rocks bid us to stop. So we came back across the mountains, pitilessly steep and tiring. But I had seen what I wanted, I had got all my heights and bearings, and I was satisfied that a line is possible .... But what a line it will be! Shall I be justified to recommend so expensive a line to open up so very poor country?" (IX, 72, 16-17). Throughout this very difficult stretch, Eva displayed her characteristic cheerful pluck, walking every step and fording every stream just like everybody else, organising meals and medical services, and generally helping to maintain the smooth running of the entire operation. Only the unfortunate Norton failed to rise to the occasion: "During those trying days ... all he did was a few hours of computation in the afternoons .... Inwardly I am sorry for him but outwardly I must be frightful. It is the only way to push him on, and if I leave him to his hypochondria he might, one day, peg out from sheer funk" (IX, 72, 15).

From the Rufiji-Nyasa divide at the head of the Pitu valley the caravan began its descent towards the lake down the valley of the Rutukira towards the Ruhuhu river; numerous minor detours were involved, as Gillman sought out the most acceptable alignment for the proposed railway. Here, as elsewhere during the Nyasa survey, the reader detects in Gillman's diaries an illuminating symbiosis of technical expertise and landscape appreciation: the engineer and the geographer producing results of which neither, alone, was capable. "A lot of ground had to be investigated closely in an attempt to cut off the great northern bend of the Rutukira, for I saw that the existing map is entirely wrong, that the present drainage is full of weighty morphological problems and that, by following up certain theories regarding the history of that drainage, I would find a solution to the technical problem. To me this point is of importance for it shows that the very considerable saving in length and cost of the line which I could at last



effect ... are due entirely to scientific fundamentals; for had I looked at the situation merely from the technical point of view, it would never have struck me as an engineer to leave the great valley which, *prima facie*, formed the only feasible solution .... By zig-zagging backwards and forwards I finally succeeded not only in finding a very excellent short cut but, incidentally, obtained all the material to map a large so far quite unknown area correctly both with regard to its topography and its geological outlines" (IX, 72, 20). Having solved the problem of how to cut off the northern bend of the Rutukira river, Gillman claimed that he had reduced the probable cost of the proposed railway by no less than a quarter of a million pounds.

Anxious to reach the lake before the onset of the rainy season made further field survey work impossible, the reconnaissance party pressed on down the valley of the Ruhuhu and reached Manda on 13 November 1925, just four months after leaving Dar es Salaam: "the goal was reached - from the deep white sand of Manda Point we looked upon the great blue water and its wonderful mountain frame .... Soon afterwards we were comfortably installed in the old, somewhat tumbledown German boma, from the verandah of which we had a magnificent view. There was food in plenty for the men, meat and fish and grain, so the joy was great and the splashing on the shore lasted till late at night" (IX, 72, 23).

A similar reconnaissance survey was undertaken in 1927 from Dodoma via Mbeya to Fife in Northern Rhodesia (Figs. 2, 4), and Gillman submitted detailed reports on both surveys to the Tanganyikan authorities. The importance of finding the most appropriate solution to the problem, in the context of the apparent need for an Imperial through-line linking southern and eastern Africa, and in response to the vociferous demands of the European settlers anxious to promote white-farmer colonization in the southern highlands, led the Governor, Sir Donald Cameron, to authorize the publication of an amalgamated and shortened form of the original documents. This report (Gillman, 1929), possibly the most significant and influential of Gillman's many publications and other writings on railway affairs, proved to be highly controversial. On the assumption that a line to or through south-western Tanganyika would eventually be constructed, the essential issue was whether the western Dodoma-Fife route was preferable to the eastern Ngerengere-Manda route; the principal factors affecting the decision were the somewhat parochial interests of European settlers, the wider questions of longer-term development potential, and the geographical

characteristics of the areas through which the proposed lines would pass. Gillman's report was regarded as covering far more ground than might have been expected; an unsigned review article published in the Geographical Journal (75, 1930, 379-380) states that "It is a document of high geographical value, for the writer rightly holds that such a survey is by no means merely a technical task for the railway engineer, but that economic and political considerations may be of prime importance in deciding on the best line to adopt. He therefore studies the whole complex of geographical and economic conditions which govern the question. As regards general principles he points out that when such a broad survey shows that a country possesses potentialities of development by the construction of a railway, this may be justified even though the railway as such may not pay its way for a long time. Again, as the line cannot touch every point of possible productivity it must be regarded as the central line of a zone of beneficial interest, so chosen as to include as many such points as possible and to ensure that offshoots can be efficiently joined to the main trunk." Both the review and the report itself display an unassailable confidence in the power of railways to promote regional development, a belief which would not be so wholeheartedly shared in modern times but which was considerably more relevant to the conditions and circumstances of Tanganyika in the 1920s.

Gillman's own account of his report and its impact, written in later years, is terse and to the point. "The investigations ... had been conducted throughout with an eye on the geographical foundations, whereby much of the optimism expressed in the old German survey reports ... was proved exaggerated or futile. The reports, therefore, widely exceeded the limited, purely technical aspects of the various alternative schemes" (Gillman, 1942a, 51). The principal recommendation of the report was that a line from Dodoma to Fife could only be regarded as "an impossible proposition" and "in no circumstances to be recommended" (Gillman, 1929, 64-65; 1942a, 51-52). The eastern alternative, in contrast, Gillman considered to be not only technically more straightforward and therefore cheaper, but also much more promising with regard to its potential influence on economic development. "It is geographically, technically, and economically the correct line", Gillman concluded, and "it alone can hope to compete for the rich copper traffic of Northern Rhodesia" (Gillman, 1929, 65). He therefore proposed that construction should begin as soon as possible northwards and southwards from Kilosa (rather than Ngerengere, for technical reasons), so as to realise an early connection with the Tanga line and with Kenya to the north, and with the Kilombero valley to

the south. Beyond this, Gillman suggested, "at a convenient moment one might push on either to Manda or into Ubona and beyond ..." (Gillman, 1929, 65). The final paragraph of the report reads: "If it should prove feasible to enlist the cooperation of the Northern Rhodesian copper interests for coming to an intercolonial understanding with regard to the Dar es Salaam share of the Central African copper traffic, construction to Manda should be commenced at once and pressed forward with the utmost speed" (Gillman, 1929, 65). The convenient moment did not arrive, however, until many years later, when (Southern) Rhodesia's unilateral declaration of independence in 1965 forced Zambia (formerly Northern Rhodesia) to channel copper exports and oil imports through Dar es Salaam. Political and economic circumstances combined at that time to encourage the construction of the Tanzania-Zambia railway in a context which Gillman would have understood and along an alignment of which he would almost certainly have approved; but his cherished vision of a line through the Pitu valley to Manda on Lake Nyasa has never been realised.

Gillman's arguments were based on a broad and deep understanding of geographical realities and development potentials rather than upon narrow sectoral interests, and in the end his views gained the full approval of the decision-makers. An important by-product of these railway surveys was a paper on the physical and human geography of south-western Tanganyika, presented to the Royal Geographical Society in London in November 1926 (Gillman, 1927). This paper was well received by an audience which included Sir Halford Mackinder, who used the occasion to expound his own views on imperial expansion, envisaging "a row of white aristocracies amid the native populations of Africa", from South Africa to the Nile and including Tanganyika.<sup>4</sup> Gillman was characteristically more conservative, emphasising problems and the need for integrated rural resource surveys, as we might term them today. The conclusion to the 1927 paper set the tone for much that was to follow: "I have endeavoured," he wrote, "to give a rough outline sketch of a land full of beauty, full of hopeful possibilities, and above all of a land inhabited by nearly three-quarters of a million souls who are at present doomed to unproductive stagnation owing to their remoteness from the pulse of commerce and industry. I have purposely laid stress on the difficulties of topography, climate and population, not because I hold them insuperable, but because I believe that facing facts is preferable to mere hopefulness .... I must insist on the necessity for much more thorough and detailed regional surveys by fully qualified specialists under the guidance of a geographer. Such surveys alone can show us the right path, can keep us from trespassing against the laws of nature and from erring

in our judgement of the human material at our disposal" (Gillman, 1927, 124). The language may seem archaic and the approach outmoded but the sentiment was sincere; Gillman was convinced of the value of geography as an integrative science, and was expounding what has become a cardinal principle of modern development strategy, namely that integrated resource surveys must precede development investment at every level and every scale.

#### THE YEARS OF AUTHORITY

The year 1928 in which Gillman was appointed Chief Engineer of the Tanganyika Railways marks the transition from the years of adventure to the years of authority. In the fourth period of his railway career, from 1928 to 1937, Gillman was professionally occupied with constant travelling and inspection tours; from this time onwards until his death he produced a constant stream of papers, notes, letters and reviews on a great variety of topics. His interests in geomorphology, hydrology and population geography began to find expression. In Europe as well as in Africa he developed frequent contact with other field scientists including the American geologist Bailey Willis, the eminent French geographer Emmanuel de Martonne (whom he met in Paris in 1932), and many German scientists. In Tanganyika Gillman was a member of an important group of field scientists with largely complementary interests which Tanganyika was very fortunate to possess during this formative period, and which included geologists, soil scientists, entomologists and botanists with whom Gillman was often in contact.

#### Development as a geographer

As if to counteract to some degree the disillusionment he felt in the context of his professional life as a railway engineer, Gillman was determined from the early 1920s to develop his interests in geography to the full. "I have made up my mind to use every minute of my own time for my private studies ... there is so much I want to do that I feel I cannot afford to waste a single minute. I am over forty and I have only just grasped the bare essentials of physical geography and biology ... and how much more I would like to know" (VIII, 65, 9). His diary reveals in a number of ways how, during these years, Gillman the geographer began to emerge more positively from Gillman the engineer. An interesting passage written soon after an inspection of the central line in 1923 illustrates the way in which his mind was working: "An inspection of the troublesome Kidete River which, by wandering about on its own debris cone, is a permanent danger to the railway crossing this cone, led me to a discussion of the close relations between geomorphology and engineering. It is a remarkable fact that nobody, apparently, dreams of

giving an engineering student a sound teaching in geomorphology. And yet the man who builds railways, roads, canals, who has to build on or in a long but narrow strip of the earth's surface should know more than anyone else of the laws to which the forms of that surface are subject in their perpetual change. We would never entrust the design of a bridge to a person unacquainted with the theory of strains and stresses, but think nothing of asking a man to train a river course who has not even got the most fundamental notions of the natural history of running water. The least one ought to expect is that the engineer responsible for the location of new works should be thoroughly educated with regard to geomorphology" (VIII, 65, 13).

It was at about this time that Gillman came under the influence of the American pioneer geomorphologist Professor W.M. Davis, whose profound influence on the development of modern geography is well known to all modern practitioners of the subject. Unable to obtain a copy of Davis' classic collection of Geographical essays (Davis, 1909), Gillman succeeded in getting a copy of Die erklärende Beschreibung der Landformen (Davis, 1912) in which Davis' deductive methods of geomorphological analysis are set out in terms of his genetic approach to landscape analysis through structure, process and stage. Gillman found himself in complete agreement with Davis' ideas on geography and its relationships with geology, and considered that Davis' work "makes most fascinating reading not only from the point of view of the scientific geographer, but also because it is a most valuable document for the student of the human mind .... Scientifically trained imagination plays a most active part in the method and this ... is one of its chief merits. For science, however much it has to rely in the first instance on observation, cannot grow without that faculty of mind which alone enables us to progress towards our goal" (VIII, 65, 16). Today it is of relatively little importance in this context that Davisian ideas on geography, geology and geomorphology are considered to be outmoded, having been superseded by the development of more refined theories, a more diverse methodological base and a far wider conception of the nature of modern human as well as physical geography. What matters is that Gillman was brought into contact, at a crucial stage in the process of his geographical self-education with one of the foremost methodological thinkers of his day. Nevertheless he did not accept unquestioningly all that he read, and was ever ready to compare in detail the viewpoints and methods of those writers whose books and papers he had managed to acquire: Passarge (1912), Reck (1912) and De Martonne (1920) all came under scrutiny in this way, and a comparison of what these various authorities had written on the subject of incised meanders

led Gillman to comment that "In my opinion there ought to be an international body for each science whose duty it would be to keep watch over the terminology (somewhat in the manner in which the Académie Française keeps watch over the French language), and to prepare glossaries and lists of definitions .... And nobody should be allowed to publish his writings unless he adheres strictly to the official definitions and terms" (VIII, 65, 21). More seriously, Gillman began to feel that the rapid growth of scientific knowledge, publication and debate during the post-war years was beginning to lose a sense of direction; this sentiment may have arisen in part from his personal position as an embryo geographer, beginning to draw together data from a variety of scientific sources; but it also reflects the uncertainty that besets every student as he embarks upon the uncharted waters of a rapidly developing subject. "The deeper I enter the realm of science and the more I have to draw on several or all of its branches, the greater my doubt. Are we really on the right path? Are we actually approaching Truth? Or are we merely led to believe so by a, to all appearances, beautifully built up structure which, by its very vastness and elaborateness, hides the very weak foundations it rests on? Just as modern business and modern government has outstripped the capacity of even the best human brains, so has modern science, through its obviously unavoidable specialisation and the narrowness of outlook engendered by specialisation, become entirely unmanageable; and instead of making straight for our goal we are wandering like lost sheep in the wilderness" (VIII, 65, 19).

The mid-1930s were particularly full and successful years for Gillman. For a time he was Acting General Manager of the Tanganyika Railways, and a member of the Legislative Council. With Dr (later Sir) Edmund Teale, the Director of Geological Survey, he made a major survey of the water resources of northern Tanganyika (Teale and Gillman, 1935); and in 1936 published his population map in the Geographical Review, a paper that was widely praised for its methodology and execution, which drew attention for the first time to the detailed distribution of Tanganyika's widely scattered population, to the distinction between the water requirements of crops and those of man as an influence on settlement patterns, and to the fact that, if the detailed patterns provided by the map had been available earlier, some of the branch railway lines built in Tanganyika in the 1920s and 1930s might have been differently and more wisely aligned. A major theme of the paper is the relationship between water resources and population distribution, and Gillman concluded with a plea for "the urgent necessity of a hydrographic

survey and to illustrate once more the difficulties, the precariousness, of life in the much-overrated tropics" (Gillman, 1936, 373).

Gillman retired from railway service at the end of 1937, and the last three years of his working life were spent as water consultant to the Tanganyika government. He persuaded the authorities that this was what was needed, and the post was in effect created for him. In this capacity he made a number of hydrographic reconnaissance expeditions - to Masailand (Gillman, 1939), and to other specific areas of the territory - and also wrote a lengthy report on the water resources of Tanganyika as a whole (Gillman, 1943). After his final retirement from public service in 1940 Gillman continued to undertake research tours and to accept hydrological consultancy work, especially for sisal estates. The last six years of his life were spent in almost continuous research and writing. He was a founder member of the Editorial Board of an important local research journal, the Tanganyika Notes and Records; he was the first President of the Dar es Salaam Cultural Society, and a major promoter of the Dar es Salaam museum of which his wife was the first Curator. Papers dating from this final period include an historical summary of the growth of the Tanganyika railway system (which he was uniquely qualified to write) (Gillman, 1942a); an analysis of the origins and growth of Dar es Salaam, a city he knew for 40 years (Gillman, 1945); and a study of white settlement in the tropics (Gillman, 1942b). But the crowning achievement of this period, and indeed in a sense of Gillman's career as a whole, was his splendid vegetation-types map of Tanganyika which was published posthumously in the Geographical Review (Gillman, 1949).

### Methods

Gillman was largely self-taught as a geographer; he came to the subject, like most pioneer geographers, via another field, in his case engineering; the attraction of geography in that context was that it provided a means of seeing in mutual association things previously seen in isolation. The concept of Zusammenhang, pioneered in 19th century Germany and popular throughout Europe in the 1930s, is one which Gillman strongly supported as a pivot of geographical philosophy. In this he was perhaps not unusual; but he was probably unique in the way in which he applied these ideas to the study of a developing country during its formative period, and he was certainly the only geographer working in detail in the field over many years in Tanganyika during his lifetime. Gillman attempted as far as possible to relate the results of his field surveys to developments in modern geography



as a whole; he read everything he could get hold of, developed links with major geographical societies, corresponded with geographers around the world, and in every way he could he tried to promote and foster and influence the subject closest to his heart.

Gillman's method was to observe, and to record in detail, numerous aspects of the lands and societies through which he travelled so constantly. From his first arrival in Dar es Salaam in 1905 to his death in 1946 it was his constant habit to make notes while travelling - whether by sea, or in the the railway inspection coach, or by car (which he disliked) or by air (which for him, from 1930 onwards, was a glorious revelation); everything was recorded, and subsequently classified, written up and commented on, stored away to be used in due course in his writings. At times he must have felt like one of the early explorers travelling through the unknown, but he belonged to a different generation in which a spirit of scientific enquiry had superseded mere description, and to a period in which foundations for future development were being effectively laid. Gillman the geographer was essentially a bi-product of Gillman the engineer; his scientific approach to geography was rooted in the meticulous methodology of the field engineer. Precision in recording, objective analysis and realistic appraisal of problems and potentials were the basis of his thought process as much in the one subject as in the other. The precise surveys and engineering drawings of bridges and embankments in his early years gradually gave way to equally meticulous geological and geographical field sketches analysing the components of landscape. Without accurate measurement, the bridges would fall down and the embankments would be washed away; equally, the inadequately prepared development plan would be likely to fail or at least be seriously misdirected.

With his diversity of interests, his unflagging energy and his meticulous attention to detail, Gillman probably acquired a greater knowledge of Tanganyika as a whole than any other individual before or since. A contemporary said of him that in a sense he was Tanganyika; his career encompassed several major formative periods in the development of the country, and his accumulated store of knowledge of the environmental problems and characteristics of Tanganyika was vastly impressive in its breadth and depth, moreso than that of any other living person in East Africa at that time. Before Gillman, information on East African patterns and problems was scanty and unreliable; after Gillman, research has inevitably

become increasingly specialised. Had he lived a few more years, Gillman might have attempted to write a masterly synthesis of the geography and development problems of Tanganyika, but this magnum opus never materialised. From the early 1930s onwards he made frequent references in his diaries to the synthesis that was gradually taking shape in his mind, and he certainly had accumulated sufficient data in the form of detailed field evidence for a well-supported and integrated overview of the physical environment of Tanganyika and its problems, ranging from geological and geomorphological characteristics through problems of soil erosion and water control to a more limited interest in land utilization and what would now be termed land systems. Whether he was equally well-equipped to write a synthesis of the human geography of Tanganyika is perhaps a more open question.

### Ideas

The basic thesis which runs through much of Gillman's writing is essentially a very straightforward one, that modern economic and social development must be based on a detailed knowledge of the facts of environment and society and on realistic interpretations of these facts and situations. Today we perhaps tend to take such objectivism for granted - indeed, caution and reluctance to innovate or initiate may sometimes be taken too far - but in Gillman's day over-ambitious development schemes (in agriculture, for example, or transport) were often proposed on a very scanty data base, and Gillman's advice was often unpopular because it was thought pessimistic when in fact he was merely trying to make a realistic assessment of possibilities. Perhaps the best example of this essential attribute is provided by his contributions to the southern highlands railway debate of 1925-30, to which reference has already been made (Gillman, 1927 and 1929). Many of Gillman's writings also reflect the synthesis of his dual interests in engineering and geography, and reveal the trained mind of the engineer applied to environmental issues. It is not surprising that geomorphology and hydrology were the aspects of the environment which chiefly interested him, and he was undoubtedly a competent geologist. A detailed illustration of the way in which he successfully combined his engineering skills and his geomorphological insight is provided by his analyses of the floods which repeatedly assailed the central Tanganyika railway line in 1930 (Gillman, 1930 and 1931). A broader view was expressed in an address to the South African Geographical Association in 1932 when Gillman's perception of environmental facts as geographical controls was again set out, and when he attempted to present realism as a far more logical and tenable viewpoint on African development

than the unguarded optimism of some of his contemporaries (Gillman, 1932).

Although Gillman's interests in geography were initially in those aspects of the subject more directly related to engineering, his awareness of and involvement in the growing subject soon began to transcend geomorphology and hydrology. As a railway engineer he used a methodical, analytical approach to landforms which led directly to a growing appreciation of geomorphology (in the Davisian context of structure, process and stage) and of the role of water in landform development. Out of this there came a deep concern for the problems of soil erosion and water control, and it was through this concern that he developed his views on the complex set of environmental constraints influencing East African development. In comparison with his appreciation and understanding of the physical environment, Gillman's concern for human geography was relatively limited; his major publications on population distribution (Gillman, 1936), on the history of the Tanganyika railways (Gillman, 1942a), on white colonization in East Africa (Gillman, 1942b) and on the urban geography of Dar es Salaam (Gillman, 1945) are all in a sense an outcome on the one hand of his more fundamental perspectives on the physical environment, and of the ways in which he perceived human societies to be controlled by that environment, and on the other hand of the long experience and vast accumulations of information which he had acquired. In his early years in Tanganyika, Gillman's interests in African societies were peripheral, almost incidental to his main preoccupations; in contrast to some of his contemporaries (e.g. Dundas, 1924), he took little interest in the ethnography or demography of the country. Subsequently, however, his perspectives evolved and he began to appreciate and to investigate patterns of human geography and man-environment relationships in greater depth. His masterly synthesis of East African geography, had it ever been written, would not have begun with an exposition of human patterns and problems, however, and would not have sought explanations in the physical framework. Rather he would have adopted a more conventional approach to the human condition, analysing first the environmental controls and setting out the resultant population patterns and economic characteristics as though they were directly dependent upon physical geography. In adopting this perspective Gillman was of course a product of his time and place, and his achievements must be viewed within the dual contextual perspective of the emergence of Tanganyika as a territory and the emergence of modern geography as a rational science. He would not entirely have welcomed the modern distinction between physical and human

geography, and would certainly have deplored the fragmentation of the subject today whilst applauding its undoubted vitality. His fundamental philosophy was that an understanding of geography is essentially useful both in itself and as a framework for the organization of further scientific enquiry, and as a realistic and integrative viewpoint essential to modern development planning.

#### The wider context: influence and perspectives

Gillman's engineering background provides the essential personal context within which to review his work, but beyond this there are several other relevant contextual perspectives. Gillman was fond of describing himself as "the preacher in the wilderness", as though he alone was able to perceive the dangers of soil erosion, the necessity of water conservation, or the constraints imposed by environmental conditions. In fact, as has been indicated earlier, although he was probably the first to argue the need for an integrated regional approach to environmental management, he was by no means the only pioneer field scientist working in Tanganyika in the 1920s and 1930s. There were geologists at Dodoma, entomologists at Shinyanga working on tsetse control, a team of agricultural research officers at Amani, and various others; all were laying the foundations for modern development, and each recognised the value and limitations of their various perspectives. Sometimes they came together as a group, with representatives of the administration, to discuss problems such as soil conservation; and bilateral contacts, as between Gillman and Teale, were particularly productive (Teale and Gillman, 1935). Within Tanganyika Gillman was a much respected figure in many circles towards the end of his career; not everyone agreed with him, of course, and he often found the laissez-faire policies of the colonial administrators frustrating and infuriating. Eventually, however, the validity and genuineness of his approach was more widely appreciated, although he was perhaps too unwilling to recognise the practical and financial restraints imposed upon government services by the Colonial Office in London.

One of the disadvantages as well as one of the supreme opportunities of working in Tanganyika during the inter-war period was that the territory was in many respects a rather neglected and half-forgotten corner of the Empire. It was not a colony (like Kenya) nor a protectorate (like Uganda) over which the British government had acquired control of its own volition; Tanganyika was a former German colony which Britain agreed to administer from 1919 under a League of Nations mandate. Relatively few people were

involved, or interested, in the development of this tract of African territory which seemed singularly devoid of resources comparable with those of other dependencies. As a pioneer geographer, Gillman made the most of his opportunities in this rather unpromising context; he regularly drew the attention of geographical societies and others in Europe, the United States of America, and South Africa to problems and developments in Tanganyika. He published a very considerable number of papers, reports, memoranda and notes arising out of his African experience; many appeared in Tanganyika itself, but several major papers were published in leading international geographical journals, and two geographical societies (the Royal Scottish and the South African) honoured him with their research medals.

Gillman's life and work undoubtedly provide an interesting and unusual perspective on the development of geographical thought as well as on the development of modern Africa. In some ways Gillman provides a direct link back to the nineteenth-century methodology of the German pioneer geographers such as Ratzel whose essential philosophy was that meticulous observation and the accurate recording of facts lead automatically to logical conclusions. It is important also to remember that German East Africa had been scrutinized in some considerable detail between the 1880s and the outbreak of the first world war by a number of scientists whose substantial volumes bear witness to the emphasis that was placed upon the collection of detailed information as a basis for subsequent development (e.g. Bornhardt, 1900; Fulleborn, 1906; Meyer, 1900 and 1916; Paasche, 1906; Peters, 1895; Stuhlmann, 1909; Weiss, 1910). Several of these writers might be regarded as geographers to a certain extent, although Gillman himself was inclined to recognise only the work of Hans Meyer as truly geographical. In the inter-war years, however, Gillman made a point of welcoming German scientists to Tanganyika and saw himself as a practical living link between the pre-1914 and post-1919 scientific endeavours in the area. But he also looked forward, through his constant emphasis on scientific analysis as a basis for development planning, to our own day when relevance is paramount and integration is a keynote of development strategies. The essential importance of Gillman's work seems to me to lie in his appreciation and application of sound and straightforward geographical principles and methods to a part of the less-developed world during its formative period, at a time when no-one else was doing precisely that.

Gillman's ideas were forcefully expressed, often accepted, but sometimes

refuted, and he was certainly not always right. He was a pioneer, but was he an original thinker? Did he accept too uncritically some of the ideas in vogue in his day? Geographical bandwagons are, after all, no novelty. Did he rely too much on the analysis of local problems and past situations, and say too little (except in general terms) about planning for the future? These are questions I need to consider as I write his biography and re-read his papers. At present Gillman seems to me to stand out clearly as the leading pioneer geographer in and of East Africa; the subject, and the area, have changed enormously since his day; but modern Tanzania is still battling against the problems which Gillman tried to analyse. In this sense, like many other officials of colonialism, he served to reveal problems rather than to solve them; but in that context he at least contributed a new realism to the analysis of underdevelopment.

In November 1936, a few days before he sailed from Southampton for Africa for the last time, Gillman visited Edinburgh to receive the Research Medal of the Royal Scottish Geographical Society and to address the Society on the subject of 'Geography and the civil engineer' (Gillman, 1937).<sup>5</sup> It was his last public appearance in Europe, and appropriately drew together the two essential strands of his career - the one by which he made his living, and the other to which he had become increasingly devoted. The remaining few years of his life were spent entirely in East Africa, where he continued to be active in research and writing and to engage in a variety of other cultural pursuits. He died in 1946 during a flight from Dar es Salaam to Moshi, in northern Tanganyika, and is buried at the foot of Kilimanjaro. His epitaph<sup>6</sup> contains no reference to his work as engineer or geographer, but there is no doubt that in both respects he was held in high esteem. He was clearly a man of strongly-held and forcefully-expressed opinions, a man who was widely admired but whom some must have found a constant source of irritation; a man whose agnosticism set him apart from many in his community; and whose internationalism received a cool reception during the rampant nationalism of the two World Wars. Yet in the last analysis he was a man of tremendous drive and enthusiasm, of vast experience and wise counsel, and a pioneer to whom all concerned with modern development planning in East Africa today owe a considerable debt.

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## Notes

- 1 The primary source for a study of the life and work of Clement Gillman is the Gillman Diaries which comprise some 40 volumes deposited in the library of Rhodes House, Oxford, as part of the Colonial Records Project initiated in the 1960s by the late Dame Margery Perham. Quotations from the Diaries are made by kind permission of Mr Harold Gillman. Other sources include the records of the Geological Survey in Dodoma, Tanzania, and family papers. A biography of Gillman based on these materials is in preparation.
- 2 Numbered references in this style refer to quotations from the Gillman Diaries (note 1 above). In each case the reference includes the volume number, the original diary number and the page number(s).
- 3 The Hon. (later Sir) Charles Dundas (1884-1956) was an Assistant District Commissioner in the British East Africa Protectorate (1908-14) and a Senior Commissioner, Tanganyika Territory (1920-24). He held various administrative appointments during a long career in East and Central Africa and the West Indies, and eventually became Governor of Uganda (1940-44). His publications included Kilimanjaro and its people (London, 1924).
- 4 In 1922 Sir Halford Mackinder (1861-1947) was Reader in Economic Geography at the London School of Economics and was also a Member of Parliament. He made the first ascent of Mount Kenya in 1899 (Geographical Journal 15, 1900, 453-486). For further biographical details see Gilbert (1972), 139-179.
- 5 A shorter version of this paper was presented at the Annual Conference of the Institute of British Geographers held in Edinburgh in January 1983.
- 6 The inscription on Gillman's grave reads as follows: "To the memory of Clement Gillman, 26th November 1882 - 5th October 1946, who led a commonsense and therefore happy life because he stubbornly refused to be bamboozled by his female relations, by his scientific friends and by the rulers spiritual and secular of the society into which without his consent he was born."



## References

- BARBOUR, K.M. (1982), 'Africa and the development of geography', Geographical Journal 148, 317-326.
- BORNHARDT, W. (1980), Zur Oberflächengestaltung und Geologie Deutsch-Ostafrikas (Berlin, Dietrich Reimer).
- DAVIS, W.M. (1909), Geographical essays, ed. D.W. Johnson (New York, Ginn and Co.) (Republished 1954, Dover Publications Inc.).
- DAVIS, W.M. (1912), Die erklärende Beschreibung der Landformen (Leipzig).
- DUNDAS, C.C.F. (1924), Kilimanjaro and its people (London, Witherby).
- FREEMAN, T.W. (1961), A hundred years of geography (London, Duckworth; repn. 1965, Methuen).
- FULLEBORN, F. (1906), Das Deutsch Njassa- und Ruvuma-Gebiet (Berlin, Dietrich Reimer).
- GILBERT, E.W. (1972), British pioneers in geography (Newton Abbott, David and Charles).
- GILLMAN, C. (1923), 'An ascent of Kilimanjaro', Geographical Journal 61, 1-27.
- GILLMAN, C. (1926), 'Note on D.V. Latham, 'Kilimanjaro and some observations on the physiology of high altitudes in the tropics' (Geographical Journal 68, 1926, 492-503)', Geographical Journal 68, 503-505.
- GILLMAN, C. (1927), 'South-west Tanganyika Territory', Geographical Journal 69, 97-131.
- GILLMAN, C. (1929), Report on the preliminary surveys for a railway line to open up the south-west of Tanganyika Territory (London, Crown Agents).
- GILLMAN, C. (1930), 'First memorandum on the Mukondokwa valley floods of 1930', appendix to Annual Report, Tanganyika Railways and Marine, 7pp.
- GILLMAN, C. (1931), 'Memorandum on the flooding of the Usinge basin, 1930', appendix to Annual Report, Tanganyika Railways and Harbours and Lake Steamer Services, 75-79.
- GILLMAN, C. (1932), 'Some geographical controls in East Africa', South African Geographical Journal 15, 3-14.
- GILLMAN, C. (1936), 'A population map of Tanganyika Territory', Geographical Review 26, 353-375.
- GILLMAN, C. (1937), 'Geography and the civil engineer', Scottish Geographical Magazine 53, 242-248.
- GILLMAN, C. (1939), A hydrographic reconnaissance into parts of Masailand, Tanganyika Territory, Water Consultant's Report No. 1 (Dar es Salaam, Government Printer), 82pp.
- GILLMAN, C. (1942a), 'A short history of the Tanganyika railways', Tanganyika Notes and Records 13, 14-56.
- GILLMAN, C. (1942b), 'White colonization in East Africa, with special reference to Tanganyika Territory', Geographical Review 32, 585-597.
- GILLMAN, C. (1943), A reconnaissance survey of the hydrology of Tanganyika Territory in its geographical settings, Tanganyika Territory, Water Consultant's Report No. 6 (Dar es Salaam, Government Printer).
- GILLMAN, C. (1945), 'Dar es Salaam, 1860-1940 : a story of growth and change', Tanganyika Notes and Records 20, 1-22.

- GILLMAN, C. (1949), 'A vegetation-types map of Tanganyika Territory', Geographical Review 39, 7-37.
- HARLOW, V., CHILVER, E.M. and SMITH, A. (ed.) (1965), History of East Africa, Volume II (Oxford, Clarendon Press).
- HILL, M.F. (1957), Permanent way, Volume II, the story of the Tanganyika railways (Nairobi, East African Railways and Harbours).
- HOYLE, B.S. (1965), 'Clement Gillman, 1882-1946 : biographical notes on a pioneer East African geographer', East African Geographical Review 3, 1-16.
- HOYLE, B.S. (1977), 'Clement Gillman, 1882-1946', in Geographers: biobibliographical studies, ed. Freeman, T.W., Oughton, M. and Pinchemel, P. (London, Mansell Information/Publishing Ltd., for the International Geographical Union Commission on the History of Geographical Thought), Volume I, 35-41.
- ILLIFFE, J. (1968), Tanganyika under German rule, 1905-12 (Cambridge University Press).
- ILLIFFE, J. (1979), A modern history of Tanganyika (Cambridge University Press).
- MARTONNE, E. de (1920), Traité de géographie physique (Paris, 3rd edn.).
- MEYER, H. (1900), Der Kilimandjaro (Berlin, Dietrich Reimer).
- MEYER, H. (1916), Die Barundi (Leipzig, Otto Spamer).
- PAASCHE, H. (1906), Deutsch-Ostafrika (Berlin, Schwetschte).
- PASSARGE, S. (1912), Physiologische morphologie (Hamburg).
- PERHAM, M. (1956), Lugard, the years of adventure, 1858-1878 (London, Collins).
- PETERS, K. (1895), Das Deutsche-Ostafrikanische Schutzgebiet (Munich and Leipzig, R. Oldenburg).
- RECK, H. (1912), 'Die morphologische Entwicklung der sueddeutschen Schichtstufenlandschaft, im Lichte der Davis'schen Cyclustheorie', Zeitschrift der Deutsche Geologische Gesellschaft 64.
- STUHLMANN, F. (1909), Beitrage zur Kulturgeschichte von Ostafrika (Berlin, Dietrich Reimer).
- TEALE, E.O. and GILLMAN, C. (1935), Report on the investigation of the proper control of water and the re-organization of water boards in the Northern Province of Tanganyika Territory (Dar es Salaam, Government Printer).
- WEISS, M. (1910), Die Volkerstamme in Norden Deutsch-Ostafrikas (Berlin, Carl Marschner).





