

## The mines of Southern and Central Africa: an ecological framework



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### Abstract

**The mines of Southern and Central Africa can be seen as a congeries of microenvironments whose suitability for human habitation has been transformed as the result of capital investment as constrained by government policies. Mine managers sought improved living conditions to enhance productivity but minority governments imposed strict controls on African migration, which allowed only a unisex labour force in the gold mines of South Africa whilst permitting family settlement in the copper mines of what is today Zambia and Za•re.**

My research over the past 25 years has been concerned with identifying and explaining the differential effects of colonial rule on the peoples of Central Africa. My first monograph was a history of Lubumbashi, the largest city in the Za•rian copperbelt, which I found to have provided benefits to its residents unavailable in villages in surrounding territories (Fetter 1976). Using terminology then current among historians of urbanization, I concluded that the city was parasitical on its hinterland. My next study addressed the disparities between the distribution of colonial resources and the emplacement of the rural African populations (Fetter 1983). I concluded that colonial rule in what is now Za•re, Zambia, and Malawi had fostered a spatial system in which the principal government resources went to those who lived near colonially created cities, a condition which I called regional imbalance.

My approach deviated from that of the majority of scholars in the field, whose work falls under the general rubric of political economy (Perrings 1979; Parpart 1983; Higginson 1989). Their major concern has been to show how European capital investment has caused the immiseration of African workers through the expropriation of the fruits of their labour. While I would never deny that Africans often suffered because of the labour demands imposed on them in the course of colonial rule, I feel that obsession with the evils of capital has obscured other important elements which also determined their experience.

In recent years, in search of a more complete description and explanation of the colonial experience, I have turned to demography. Statistically, the inhabitants of Central African mining camps are perhaps the best documented people in the region (Fetter 1990).<sup>1</sup> A preliminary examination of the available evidence showed that although the mines were initially very dangerous to the health of African workers, conditions soon improved and within a maximum of 30 years after their opening, the mines were healthier than the villages from which mineworkers were recruited (Fetter 1986, 1987). See Table 1.

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**Table 1**  
**Crude death rates for African mines, 1903–55**

Year	Katanga <sup>a</sup>	N. Rhodesia <sup>b</sup>	S. Rhodesia <sup>c</sup>	Witwatersrand <sup>d</sup>
1903				71 (81)
1904				43
1905				46
1906			76	35
1907			61	35
1908			50	34
1909			47	36
1910			49	33
1911			33	32
1912			36	(25)
1913			28	(18)
1914	65 (118)		28	(19)
1915	52 (54)		26	(15)
1916	92 (94)		27	(13)
1917	106 (106)		22	(20)
1918	202 (202)		113	(17)
1919	51 (51)		19	(18)
1920	33 (33)		18	(14)
1921	27		21	(13)
1922	31		21	(15)
1923	33		16	(14)
1924	30		18	(13)
1925	50	16	15	(12)
1926	53	13	16	11 (13)
1927	45	21	16	14 (16)
1928	33	20	19	14 (16)
1929	23	14	21	13 (13)
1930	18	25	17	13 (14)
1931	12	25	15	12 (13)
1932	8	12	12	10 (11)
1933	7	13	11	9 (11)
1934	6	18	12	11
1935	6	10	14	10
1936	8	7	12	15
1937	9	10	11	15
1938	8	9	12	
1939	5	6	9	
1940	5	7	8	(6)
1941	6	7	9	
1942	6		8	
1943	6	7	8	
1944	4		9	
1945	4	5		
1946	4			
1947	3	4		
1948	4			
1949	3	4		(5)
1950	4	4		(5)
1951	3	4		(5)
1952	2	3		(4)

**Table 1**  
**Crude death rates for African mines, 1903–55 (continued)**

1953	3	3	(5)
1954	4	3	(5)
1955	3	3	(5)

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Source:

<sup>a</sup>Mouchet 1943; Union Mine 1955, 1957; Fetter 1976; Perrings 1979. Elisabethville only in parentheses.

<sup>b</sup>Kuczynski 1949; Northern Rhodesian Chamber 1957; Perrings 1979.

<sup>c</sup>Kuczynski 1949; van Onselen 1976.

<sup>d</sup>Abrahams 1937; Rand Mines 1964; Perrings 1979; Richardson 1982; Turrell 1987. Materials relating to Chinese labour in 1903 and those relating to the Rand Mines group rather than the entire industry are in parentheses.

Whatever the disparity between the mines and their hinterlands, however, I concluded that national-level generalizations about the demography of Africans living under colonial rule were not possible in the current state of our knowledge. Instead, I turned to the study of limited microenvironments which had been created as the result of colonial activity. My first local study compared mortality patterns among schoolboys at an elite school in what is now Malawi in the early years of the twentieth century (Fetter 1989). The statistics derived from a missionary rollbook suggested that conditions for schoolboys improved as the result of a new water supply installed by the missionaries, while those for school leavers deteriorated as a result of colonial policies which forced them to leave their villages in search of salaried employment.

Central Africa is not, of course, the only region of the world where the demography of cities has differed from that of the surrounding countryside. Most industrialized countries of the world have passed from a time, often just before and during the industrial revolution, when cities had higher mortality rates than the surrounding countryside, to one in which the cities had lower rates (Preston and Van de Walle 1978; Szreter 1988). The explanation for that crossover, however, requires detailed knowledge of conditions both after the improvement of city health and before, when times were at their worst. The analysis of these earlier times has been extremely difficult, but in recent years, Landers (1990) has demonstrated that for London, at least, the work can be done.

Landers's work breaks new ground in that it presents eighteenth-century London not just as a place where humans died of many diseases but as a loosely bounded epidemiological microenvironment, where animals ranging from large mammals to single celled parasites interacted. Indeed, his analysis also extends to plant life, bacteria, and viruses. In short, his work demonstrates the feasibility of a broad approach to industrializing urban areas based on the entire spectrum of biological factors which affect human health.

Considering human interaction with the environment is by no means unique to Landers, but unlike the vast majority of his fellow anthropologists, he has chosen to study an industrial rather than a preindustrial or prehistoric society (e.g. Hardesty 1977). The approach of ecological anthropology has been a slippery one in that scholars have defined the field in a number of different ways. Most have considered it a branch of what used to be called man-environment studies, investigating the way in which individual groups have taken advantage of local resources and ways in which they have altered that environment. All too rarely, however, do anthropologists ask how humans fit into the total scheme of things. Two notable exceptions have been Ingold (1986) and Vansina (1990).

Ingold approaches the philosophical problems of differentiating human adaptive behaviour from that of other animals. In *The Appropriation of Nature* (1986), he establishes a series of polarities to distinguish human actions based on self-consciousness and creativity from seemingly similar behaviour in animals: hunting-collection versus foraging predation; sharing versus simple co-operation; land tenure versus territoriality; storage versus accumulation; and purposive hierarchy versus individualist inequality. His explanation of how hunters and collectors differ from other predators and social insects

demonstrates that an analyst with a good appreciation for non-human ecology can gain insights into the human condition.

In a more specifically African context, Vansina, in *Paths in the Rainforest* (1990), explores the relations between Western Bantu-speakers and their equatorial environments. Vansina adopts the term, 'biotope', which he defines as a 'host of habitats varying by soil, placed on a catena, and striving toward different biological climaxes.' He then analyses the adaptation of historical African populations to a broad variety of biotopes and to the ecotones, which lie on the frontiers between them. Within this framework, he reconstructs the history of peoples who lived for 5000 years in a region covering two million square kilometres of Equatorial Africa.

With the work of Landers, Ingold, and Vansina in mind I have undertaken the construction of an ecological framework for the recent history of the mines of Central and, indeed, southern Africa, which provided the technology on which the tropical mines depended. The framework is distinctive from those mentioned above in that it explains the effects of industrial technology in a specifically colonial setting. At this point it is not possible to present a full analysis, but in sketching an outline, I would like to propose a framework in which other scholars and I can work and, in the process, challenge each other.

The mines of industrial Africa constitute a set of discontinuous microenvironments defined by the presence of minerals which could be profitably exploited through Western technology of the late nineteenth and early twentieth centuries. These minerals include diamonds in South Africa, gold in South Africa, Zimbabwe, and Za•re, lead and zinc in Zambia, and copper in Za•re and Zambia. These deposits lie in a broad variety of ecotopes ranging from the Kalahari edge in the northwest Cape to the Highveld in the Transvaal and Zimbabwe and to the savannahs of north-central Zambia and southeastern and northeastern Za•re.

Just before the mine development, the human occupants of these territories consisted of rainfall and alluvial agriculturists who domesticated animals (cattle at higher elevations, sheep, goats, and poultry at lower ones), supplemented by hunting and collecting. Aggregation of human settlement was inhibited by poverty of the soils which could not, given existing technology, support large populations from local resources; by the near-absence of transport facilities capable of profitably importing high-bulk low-value commodities; and by the presence of epidemic diseases whose occurrence was exacerbated by urban population densities. Indeed, the minerals themselves are to be found in places seldom settled by humans, in the ridges between river systems rather than on the riverbanks which were preferred by African cultivators.

Although European prospectors sometimes identified mineral deposits before colonial conquest—deposits which had often been previously worked by Africans—the transformation of these environments took place under European minority rule. These minority governments all relied on their ability to coerce the earlier inhabitants into a variety of activities which they would not have otherwise chosen: migration away from lands desired by Europeans or toward work for those Europeans; and the payment of taxes in European money which frequently could be obtained only through the sale of the labour of able-bodied men.

Despite these commonalities, European governments took a variety of forms: those controlled by settler minorities in South Africa and in Southern Rhodesia after 1923; arbitrary regimes, including those run by the British military during and just after the Boer War and by the British South Africa Company for the Rhodesians between 1890 and 1924; and bureaucracies dependent on a colonial ministry in the European metropolis. These latter, although resembling one another in their hierarchical organization, showed enormous variation according to nationality: the British created legally distinct regimes for each of their colonies and consciously sought to incorporate African authorities into their

system in the policy of indirect rule; the Belgian government, subjected to threats from larger colonizers, centralized their authority in a single hierarchy and consciously delegated governmental functions to Catholic missions and Belgian companies.

Colonial governments therefore provided a legal framework and guaranteed civil order and a labour supply, which facilitated the transfer of European and American capital to Africa. This capital, in turn, made possible the importation of Western technology which transformed the microenvironments on which they were concentrated; along the railway lines, in urban areas, and at mine sites. These latter underwent the most profound changes due to the importation of mining equipment, energy (coal and electricity), food, water, and medical services (including public hygiene). Decision-making power resembled that of colonial bureaucracies as opposed to that of settler regimes. It lay in the hands of a hierarchically ordered bureaucracy with a line and staff organization whose membership was chosen from superordinate to subordinate by co-optation and which was ultimately accountable to managerial organs in South Africa, Europe, and the United States.

Local managements sought to optimize profits by establishing a delicate balance between output and unit production costs. This involved neither maximization of production—some deposits cost more to excavate than they could bring in as income—nor minimization of labour costs: in most cases, reducing labour costs to the lowest levels was more than matched by declines in productivity. Indeed, workers who were hungry, sick, or dead were of no use to the mining companies. It should be pointed out that this consideration is by no means limited to human behaviour in the mines, but is characteristic of animal communities generally. As one biologist puts it,

the productivity of a species in a particular habitat depends on the level of activity it can maintain and the relative cost of supporting that activity ... Costs include more than energy expenditure; they encompass all factors that increase mortality and reduce fecundity (Ricklefs 1973).<sup>2</sup>

The mines of colonial Southern and Central Africa in this respect can be considered a congeries of related social and biotic environments.

Socially they were ruled by colonial dominance hierarchies led by white company managers and their chosen African subordinates. Relations between managers and employees and between whites and blacks can be considered a form of intraspecific competition which was regulated by company authority, specialization of work functions, and, to a certain extent, co-operation among all members of the enterprise. African employees were constrained in their choice of adaptive responses by company policies and colonial laws. For example, Masters and Servants legislation restricted their ability to move to more suitable environments. Malingering, in this case the closest human analogue to dormancy, could be punished by beating and deprivation of salary. The principal forms of social adaptation therefore occurred between workers and their immediate superiors (black and white) and among workers (strong-weak, experienced-young, interethnic rivalry); practices of cultural adaptation could be easily learned and spread rapidly through the mining populations.

Collective adaptation to the mines as biotic environments, by contrast, was almost exclusively the purview of white managements. The early managers had little trouble clearing the mine sites of large mammals including carnivores. Smaller organisms, as an almost inverse function of their size, caused greater problems. Snakes, rodents, and insects were impossible to eliminate; fleas, ticks, lice, and mosquitoes communicated their own microscopic pathogens to their human hosts. In the early years of each mine, human populations suffered from epidemic outbreaks of infectious disease. Mine managers

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<sup>2</sup> Vansina (1990:41) finds similar behaviour on the part of the Djue of Cameroon.

could not afford to wait for the development of a natural equilibrium between parasites and human hosts. Mortality and morbidity rates were high and workers eagerly quit the mines for their villages at the end of their work contracts. Even healthy workers were less productive when confronted with the combination of work demands and exposure to microscopic parasites.

Management could therefore not keep the mines running without spending money to diminish morbidity and mortality among workers. By the end of the nineteenth century, Western technology had already developed a number of devices for reducing epidemic illness in temperate climates: quarantines against bubonic plague, vaccination against smallpox, inoculation against diphtheria; treatment of water to reduce typhoid fever and cholera; and the beginnings of treatment of milk and other foods. In addition, tropical diseases such as malaria and yellow fever were proving amenable to vector control and medications such as quinine. Indeed, Colonel William Gorgas showed that 'seasoned' workers living with their families on the Panama Canal works were far less likely to die of pneumonia than a constantly renewed supply of unexposed workers. These measures all cost money and could therefore not be implemented simultaneously, but as they were, mortality and morbidity rates dropped substantially.

As microenvironments, the mines by the 1930s had become healthier than the villages from which miners were recruited. This marked a reversal from the mines' earlier days, when workers in the camps were at greater risk than people in the villages, owing to denser population and concomitant exposure to a broader pool of infectious disease, tainted food, and polluted water. Village economies had, moreover, deteriorated as a result of the periodic removal of able-bodied men from their labour forces. Recognizing the disparities between the villages and the European sector, rural Africans began to migrate voluntarily to urban areas. Since mine managements exercised strict control over the number, sex, age, and health of their workforce, not everyone attracted by the mines could find work there; migrants were diverted from the mines to urban areas where wages were lower and amenities fewer. Thus, alongside the mines developed related colonial microenvironments which lacked the elaborate facilities provided for the mineworkers but which were far better provided than the villages. The boundaries between the environments of the camps and those of the villages are thus not absolute but consisted of a series of thresholds determined in large part by colonial expenditures on public-health facilities for Africans.

Needless to say, the major determinant of where colonial government monies were spent was the location of Europeans, not the location of Africans. For politicians in settler societies, this choice was a matter of electoral survival; even in metropolitan-dominated bureaucracies, however, public amenities were geared to the needs of Europeans, who were deemed both more susceptible than Africans to tropical disease and more vital to the functioning of the colonial society. As a result, European mortality rates were lower than those of Africans.

Public-health facilities were not the only determinant of the Europeans' lower risk of death. Beginning just before World War I, cultural changes relating to personal hygiene began to disseminate in Europe, North America, Australia, and New Zealand. These changes included washing food and hands before meals and a general intolerance for dirt. By the 1930s, these practices coupled with inoculation and public hygiene reduced Western mortality rates for children and young adults to the lowest level known in human history, a phenomenon now known as the epidemiological transition (Ewbank and Preston 1990; Preston and Haines 1991).

Some of the same personal hygiene practices were adopted at this time by a small proportion of the African population of the mining camps although most Africans were not in a position to implement them until the 1970s. They lacked both the physical facilities to implement them and the predictability of daily life necessary to implement new routines. Without running water, ready access to treatment

centres, and money sufficient to guarantee subsistence, mothers could not be expected to take up new health practices such as washing vegetables and hands. Such changes in routine also required a certain residential stability which comes from security of urban tenure.

African adoption of European hygienic practices thus depended on the willingness of European authorities to allow them to live in cities. Paradoxically, the greatest objections came from ostensibly democratic settler governments where voting was limited to the European minority, which was particularly threatened by African urbanization. The 'self-governing' regime in South Africa, notably, did its best to limit African urbanward migration. For that minority of Africans deemed necessary for the maintenance of the urban economy, the South Africans imposed increasingly stringent policies of segregation. African urban residential areas, moreover, did not receive the same amenities as European ones: running water, electricity, and health services. Many urbanites, additionally, lived in cities illegally, renting cramped quarters from 'legitimate' householders. In sum, racial segregation inhibited the adoption of private hygienic practices which would undoubtedly have lowered African mortality rates.

The ultimate rationale for these restrictions was economic. Europeans were migrating to South African cities at the same time as Africans and were often competing for the same jobs. But the poor whites of South Africa enjoyed an important advantage over the poor blacks. The former could vote, giving them the power to remove elected officials who were insufficiently zealous in the protection of European economic privileges. This issue arose soon after the Boer War with regard to employment on the Witwatersrand gold mines. In the very first Transvaal elections under British auspices, General Louis Botha came to power in large part because of his opposition to the mining companies' use of indentured Chinese workers, who were seen as potential rivals for European jobs (Richardson 1982).

The situation arose again during the first major white strikes of 1913–14. The Chamber of Mines, alarmed that high mortality rates would discourage black workers from coming to the mines, asked for the advice of Colonel William Gorgas, who had so successfully reduced mortality for black workers on the construction of the Panama Canal. Gorgas observed that on the Witwatersrand, as in Panama, the principal causes of death were pulmonary diseases, whose incidence was increased in a constantly changing labour supply. He therefore recommended that the mines 'stabilize' the African labour force, that is, encouraging long-term residence at the mines by African men living with their families (Gorgas 1914). His recommendations, which were anathema to the striking miners, were flatly vetoed by the South African government, led by the same Louis Botha, on the grounds that stabilized black labourers might take away jobs from white workers (Meintjes 1970). In South African mines, then, as in the cities, European politics prevented African settlement in microenvironments where Africans would have survived longer than in rural areas.

The question of stabilization took a very different turn in the Belgian copper mines. The management of the Union Minière du Haut-Katanga, originally an Anglo-Belgian venture, was captured by Belgians only at the end of the First World War. The new executive in Africa saw labour problems in a very different light from the former Anglo-Saxon management. Black labour, owing to horrendous conditions during the first decade of operations, was in exceedingly short supply. White labour, by contrast, was relatively abundant and troublesome. White South African trade unionists in Katanga were demanding the privileges enjoyed by their comrades on the Witwatersrand. Unlike South African white miners, however, they had no hold on either the government or the management. They were aliens who could be replaced by Belgians from the Borinage who were eager for the work.

As early as 1921, Belgian managers began to consider stabilizing African labour, and within five years, the Union Minière was attempting to establish a permanently resident African labour force in the mining camps. The government had reasons of its own for encouraging this company initiative. The

original workforce had come primarily from British territories near the mines. This allowed British officials to register complaints against the mining company on behalf of the workers to Belgian authorities. Africans from British territories, moreover, had their salaries paid in sterling rather than in rapidly depreciating paper francs. Potential workers could be found within Belgian territory but at greater distance from the mines. Transportation costs would be minimized if these workers could be brought to the mines and kept there for three-year terms.

The government therefore welcomed the Union Minière's proposal to stabilize its work-force relying on African labour from exclusively Belgian sources. One manager referred to this policy as 'breeding' a labour supply. Despite changing sources of labour supply and the Great Depression, the company succeeded in attracting a labour force of mainly married men whose wives and children lived with them in the camps. Company doctors, social workers, and Benedictine missionaries taught personal hygiene practices, and camp mortality rates, according to company reports, dropped to levels as low as those of Western Europe between the wars (Union Minière 1955). See Figure 1.

**Figure 1**

Belgian managerial practices were so effective in creating a loyal and productive work-force that British and South African firms operating on the Northern Rhodesian Copperbelt were forced to adopt similar measures in order to prevent their best workers from moving to the Katanga mines (Parpart 1983). By 1960, these camps on both sides of the Copperbelt nearly equalled the health conditions enjoyed by white workers. Labour for the copper mines would never again be in short supply.

In the early 1960s, when Central African territories became politically independent, the ecological distinctiveness of the mining camps was breaking down. North of the Zambezi, the boundaries between camp and town were beginning to disintegrate and the two microenvironments were coming to have

common characteristics. South of the Zambezi, in the Republic of South Africa in particular, the distinction between town and camp remained. Either as the result of government pressure or because of perceived economic interest, the South African mines remained basically unisex operations dependent on short-term migration from rural areas in the Republic and its neighbours. In Central Africa access to urban areas, too, was limited but not to the degree practised in South Africa. The local dominance hierarchy had maintained its pre-eminence in these microenvironments and would continue to do so until the 1980s.

The ecological framework has proved particularly useful for the analysis of the recent history of the mines of Southern and Central Africa. It brings together the problems of the social environment with those of the biotic environment. It should also prove a powerful tool for understanding subnational differences in industrial societies.

## References

- Abrahams, J.C. 1937. *Report on Nyasaland Natives in the Union of South Africa and in Southern Rhodesia*. Zomba: Nyasaland Government.
- Ewbank, D. and S. Preston. 1990. Personal health behaviour and the decline in infant and child mortality: the United States, 1900-1930. Pp. 116-149 in *What We Know about Health Transition: The Cultural, Social and Behavioural Determinants of Health* (2 vols.), ed. John Caldwell, Sally Findley, Pat Caldwell, Gigi Santow, Wendy Cosford, Jennifer Braid, Daphne Broers-Freeman. Canberra: The Australian National University.
- Fetter, B. 1976. *The Creation of Elisabethville, 1910-1940*. Stanford: Hoover.
- Fetter, B. 1983. *Colonial Rule and Regional Imbalance in Central Africa*. Boulder: Westview Press.
- Fetter, B. 1986. Relocating Central Africa's biological reproduction, 1923-1963. *International Journal of African Historical Studies* 19,3:463-478.
- Fetter, B. 1987. Decoding and interpreting African census data: vital evidence from an unsavory witness. *Cahiers d'Etudes Africaines* 27,1-2:83-105.
- Fetter, B. 1989. Colonial microenvironments and the mortality of educated young men in northern Malawi, 1897-1927. *Canadian Journal of African Studies* 23,3:399-415.
- Fetter, B. (ed.). 1990. *Demography from Scanty Evidence: Central Africa in the Colonial Era*. Boulder: Rienner.
- Gorgas, W.C. 1914. Recommendation as to sanitation concerning employees of the mines of the Rand made to the Transvaal Chamber of Mines. *Journal of the American Medical Association* 62,24:1855-1865.
- Hardesty, D. 1977. *Ecological Anthropology*. New York: Wiley.
- Higginson, J. 1989. *A Working Class in the Making: Belgian Colonial Labor Policy, Private Enterprise, and the African Mineworker*. Madison: University of Wisconsin Press.
- Ingold, T. 1986. *The Appropriation of Nature: Essays on Human Ecology and Social Relations*. Manchester: Manchester University Press.
- Kuczynski, R.R. 1949. *Demographic Survey of the British Colonial Empire*, Vol. 2. London: Oxford University Press.
- Landers, J. 1990. Age patterns of mortality in London during the 'long eighteenth century': a test for the 'high potential' model of metropolitan mortality. *Social History of Medicine* 3,1:27-59.
- Meintjes, J. 1970. *General Louis Botha: A Biography*. London: Cassell.
- Mouchet, R. 1943. Documents anatomo-pathologiques sur la nosologie de la main d'oeuvre indigène ^ Elisabethville de 1915 ^ 1921. *Bulletin I.R.C.B.* 14,2:422-452.
- Northern Rhodesian Chamber of Mines. 1957. *Year Book 1956*. Kitwe.
- Parpart, J. 1983. *Labor and Capital on the African Copperbelt*. Philadelphia: Temple.

- Perrings, C. 1979. *Black Mineworkers in Central Africa: Industrial Strategies and the Evolution of an African Proletariat in the Copperbelt, 1911-41*. New York: Africana.
- Preston, S. and M. Haines. 1991. *Fatal Years: Child Mortality in Late Nineteenth Century America*. Princeton: Princeton University Press.
- Preston, S. and E. van de Walle. 1978. Urban French mortality in the nineteenth century. *Population Studies* 32,2:275-297.
- Rand Mines. 1964. *Annual Report*. Johannesburg.
- Richardson, P. 1982. *Chinese Mine Labour in the Transvaal* London: Macmillan..
- Ricklefs, R. 1973. *Ecology*. Newton: Chiron.
- Szreter, S. 1988. The importance of social intervention in Britain's mortality decline, 1850-1914. *Social History of Medicine* 1,1:1-37.
- Turrell, R. 1987. *Capital and Labour on the Kimberley Diamond Fields, 1871-1890*. Cambridge: Cambridge University Press.
- Union Minière du Haut-Katanga. 1955. Service Médical, Rapport annuel.
- Union Minière du Haut-Katanga. 1957. *Evolution des Techniques et des Activités Sociales*. Brussels: Cuypers.
- van Onselen, C. 1976. *Chibaro: African Labour in Southern Rhodesia*. London: Pluto.
- Vansina, J. 1990. *Paths in the Rainforests: Toward a Political Tradition of Equatorial Africa*. Madison: University of Wisconsin Press.