American Mining Engineers and the Labor Structure in the South African Gold Mines

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> "Johannesburg, in the Transvaal is like an American city, and is the center of the mining industry."
> *The Engineering and Mining Journal* December 3, 1887

> ". . . many of the leading men in Johannesburg are Americans; indeed, the mining industry is chiefly under the guidance of American mining engineers."
> *The National Geographic Magazine* November, 1896

> "The place [Witwatersrand] has an attraction for the American. It has size in its favour; its plant is designed on a large scale — on an American scale."
> *The South African Mining Journal* April, 1907

American Mining Capital and the Witwatersrand

The first quote is from a brief news piece written by Richard P. Rothwell and Rossiter W. Raymond, two of America's distinguished mining engineering writers who were co-editors of *The Engineering and Mining Journal* (E&MJ) which was based in New York City. Rothwell and Raymond were informing their readership in general terms how the diamond mines of Griqualand West (especially Kimberley) and the gold mines of the Transvaal (the Witwatersrand in particular) had attracted capital and labor from nearly every part of the world as well as how both mining industries were "developing at a wonderful rate."[1] The *E&MJ* was established in March 1866 and was the major medium through which American mining engineers communicated with one another their knowledge, experiences and opinions concerning mines in which they had worked throughout the world.

The second quotation is from a paper titled "The Witwatersrand and the revolt of the Uitlanders" authored and read by Dr. George F. Becker before the National Geographic Society on October 16, 1896.[2] Dr. Becker's paper dealt essentially with the geology of the main gold-bearing rock strata, estimates of its gold content made by experts from England, Germany and France, the history of the Afrikaners, particularly why and how they came

to settle across the Vaal river (Transvaal) and founded the South African Republic (S.A.R.) in which promising gold deposits were "discovered."[3] Becker was employed by the United States Geological Survey Office based in Washington, D.C. as a representative of the western states' mining industry. He was the first of many eminent American and European geologists to visit the Witwatersrand gold fields where, early in 1896, he conducted a geological survey for the S. Neumann group of mining companies.[4] One of his primary investigations was to search for the westward continuation of the main reef series which were discovered in 1884 and were similar in importance to the mother lode in California. After several months of work, he established the existence of an extensive fault, a sudden break in the rock structure in which the gold vein was embedded, beyond which the main series was lost.[5] He constructed a model to illustrate his findings which were subsequently proved correct and useful in determining how to pursue the lost veins. Dr. Becker late became an honorary member of the mine-owners' organization. The Witwatersrand Chamber of Mines, which was formed in 1887.

Dr. Becker's paper focused on the conflict that developed with the growing influx of "uitlanders" (outlanders or foreigners) who came from many parts of the world to search for and mine gold or trade on the mining fields within the republic, especially on the Witwatersrand (White waters ridge) where they were concentrated. These outlanders comprised mining capitalists, mining engineers, miners, petty capitalists, vendors of wares used on the mines and other fortune seekers. The mining capitalists and mining engineers in particular had organized themselves into what they called a Reform Committee which consisted of eighty armed men, seven of them Americans.[6] This Committee was an important detachment of Cecil John Rhodes' and Dr. Leander Starr Jameson's abortive attempt around late 1895 and early 1896 to seize the Witwatersrand and overthrow the Afrikaner republic. Of the seven Americans in the Committee, five were very well-known in mining engineers. These were John Hays Hammond, a leader in the Committee, Thomas Mein, Charles Butters, Victor M. Clement and Joseph Curtis Story. John H. Hammond was the consulting engineer for Cecil Rhodes' Consolidated Gold Fields of South Africa, a position he retained as he operated out of London from late 1896 until 1900 when he returned to the United States where he continued to be a mining consultant for large mines financed by British capitalists. In 1903 he became general manager, consulting engineer, and a director of the Guggenheim Exploration Company which was then the largest mining corporation in the world. When he severed his relations with this firm in 1907, he was "the highest salaried man in the world".[7] At the Republican Party Convention of the summer of 1908, he was the leading Vice-Presidential candidate from the state of Massachusetts

but dropped out at the last minute when word arrived that any but a New York Vice-Presidential candidate would jeopardize the election of William H. Taft.

The two remaining Americans who were in the Reform Committee were Richard A. Parker who had helped smuggle guns and Gardner Fuller Williams who was also Cecil Rhodes' General Manager of De Beers Consolidated Mines Limited and American Consular Agent in Kimberley. Gardner F. Williams was one of the earliest graduates of the University of California and the first in the long line of American mining engineers who constituted the technical backbone of South Africa's mineral industry during its formative years.[8] He operated from Kimberley where he supervised the packing of guns into Standard Oil drums with false bottoms and assigned these to John Hays Hammond in Johannesburg who had them stored on different mining properties under his charge. It is therefore evident that Dr. Becker's article on the revolt of foreigners, who included Americans, against the South African Republican regime and the Rothwell-Raymond news piece on the growth and development of the diamond and gold mining industries reveal respectively the earlier connections between United States mining engineers and the South African mining industries as well as the growing interest in these industries in the United States especially among mining engineers, mining geologists and prospective investors.

The third quote was by W.R. Grace, one of two sons of William Russell Grace, the "Pirate of Peru," founder of W.R. Grace & Company, the first Catholic Mayor of New York City (1881–2, 1885–6), and a major stockholder of Ingersoll-Sergeant Drill Company whose mining drills were used extensively on the Witwatersrand but were also in fierce competition with another American drill manufactured by the Rand Drill Company. This competition was eliminated in 1905 when both firms merged into what is now Ingersoll-Rand (I-R) under the state laws of New Jersey. The younger W.R. Grace was the first vice president of Ingersoll-Rand and a director of W.R. Grace & Company. He had gone to South Africa to visit his company's operations which had started in 1904 under the name Ingersoll-Sergeant as well as gather intelligence on business opportunities in that country. In the interview which was reported in *The South African Mining Journal* (S.A.M.) of April 27, 1907 Grace was asked a number of questions including the following: his impressions of Johannesburg, how the Witwatersrand compared with American mining fields, whether the Witwatersrand was likely to attract American capital, and whether the Transvaal [British] colony had an agricultural future.[9] His replies to these questions were that the Witwatersrand was the most "Yankeelike" and "hustling" place he had seen outside the United States; the Witwatersrand mining fields compared "very well indeed" to those of the United States;[10] There was "no reason why our in-

vestors should not follow our engineers in the exploitation of the [Witwatersrand] Rand, but many that they should;" the Transvaal most decidedly had an agricultural future.

An analysis of Grace's interview shows a few interesting aspects of how the Witwatersrand was Americanized. Plant design on the Rand gold mines (and on the Kimberley De Beers Consolidated Mines Limited) was on a large scale like the large mines in the western mining districts of the United States such as the Bunker Hill & Sullivan Mining and Concentrating Company in Idaho, the North Bloomfield in California and the Standard Consolidated at Bodie, also in California. These mines were operated on the principle of specialization in the execution of numerous and differentiated tasks involved in mine exploration and development in particular. Efficiency in mining the ore, transporting, crushing and treating it in large quantities at minimum cost per ton was the most desirable objective pursued by every mine manager. Large-scale plant layouts, both on the surface and underground, and the efficient as well as cost effective processes were brought to the Rand (and Kimberley) by American consulting mining engineers who had acquired the requisite technical knowledge and experience in managing large and deep level mines primarily in the United States. Surface mining equipment on the Rand gold mines was modern and as good as that which was found anywhere else. Some of this equipment was imported from the United States especially from the Chicago and New York-New Jersey areas. Firms such as Babcock & Wilcox, Fraser & Chalmers, General Electric and Ingersoll-Sergeant were house-hold names on both the diamond and gold mines of the Cape [British] colony and the Transvaal respectively long before the Union of South Africa came into existence in 1910. Evidently, early United States-South Africa connections went beyond technically skilled and very highly-paid American mining enginers who worked on the diamond and gold mines of South Africa.

W.R. Grace's remark concerning American capital following American mining engineers into the Witwatersrand mines was realized a decade later in 1917 when the Anglo-American Corporation (now the single largest foreign investor in the United States) was formed with British and American capital.[11] The latter was put up by J.P. Morgan & Company and Newmont Mining Company following the advice of yet another prominent American consulting mining engineer W.L. Honnold who had served as a consulting engineer to the Consolidated Mines Selection Limited on the Rand where he later became a director. Honnold cooperating with another leading American mining engineer, Herbert Clark Hoover, who has also been employed by British mining capital, facilitated Morgan's and Newmont Mining's willingness to invest in Ernest Oppenheimer's (Harry Oppenheimer's father) mine holdings on the Witwatersrand.[12] Herbert C. Hoover later

became the thirty-first President of the United States from 1929 to 1933. Apparently, British and American capitals at different stages in the history of mining in many parts of the world, relied heavily on American consulting engineers for advice, technical evaluation of mining properties and mine management. Consequently, their services were in great demand especially in regions where mining was underdeveloped when compared to the United States. South Africa was one such place. Others were South America, Russia, parts of Asia and Australia.

The American mining engineer in the United States grew out of California's unsophisticated placer mining of 1849 and the early 1850s and developed when large scale deep level mining began on the Comstock in Nevada in the late 1850s.[13] When the Comstock lode began to disappear in the late 1870s, he became a central figure in the mining of Colorado's silver lead ores where he introduced two radical inventions, effective gold-dredging machinery and *low-grade copper production techniques*. From being a jack-of-all trades like his earlier mentor, the artisan miner from Cornwall, he began to specialize towards the turn of the century. In addition to the experience earned the hard way on the job as well as from British immigrant miners including those from Cornwall, the American mining engineer went to a mining school in a university, if he could afford it. Herbert C. Hoover wrote in his *Memoirs*

> "American universities took engineering away from the rule-of-thumb surveyors, mechanics, and Cornish foremen and lifted it into the realm of application of science."[14]

The California placer miners of 1849 to early 1850s were self-taught men while the mining engineers of the late 1880s were mostly university trained mining graduates from the Lawrence Scientific School at Harvard University, the University of California, and the Columbia University School of Mines to name a few. The ascendancy of the technical and university trained mining engineer occurred between 1890 and 1914, a period Hoover called "the golden age of American mining engineers in foreign countries," where their services were in demand at premium salaries, bonuses and shares of stock. This period coincided with what John H. Curle, a British engineer and author of *The Gold Mines of the World* called the "Elizabethan age of gold mining . . ., short and brilliant, like its prototype in dramatic literature."[15] Only one thing, the replacement of British mining engineers by American mining engineers hired by British mining capital was viewed with resentment and grave misgivings in Britain.[16]

The early development of copper, diamond and gold mining industries in South Africa occurred later than that of gold, copper, silver and lead mines of the United States. Placer mining started in California in 1848 two years

before elementary opencast copper mining began in Namaqualand, South Africa. When deep level gold mining began on the Comstock lode in Nevada during the late 1850s, copper mining in Namaqualand had just started and the diamonds in Griqualand West and gold in the Transvaal had not been discovered in large and payable quantities. When the silver-lead lodes of Coeur d'Alene in Idaho were discovered in 1885 and the Bunker Hill and Sullivan Mining and Concentrating Company was formed, the Struben brothers in the Transvaal had only a year earlier discovered the "Confidence Reef" whose panning results were not impressive even though they inspired confidence. The "main reef series" which gave birth to South Africa's gold mining industry were then unknown. American mining was thus advanced when South African mining was in its infancy, a fact that British mining capital recognized and understood. Nonetheless, both countries' major mining industries went through somewhat similar experiences in their development from simple production by the small individual capitalist miner, through the technical stage typified by larger capital from partnerships and amalgamation of small individual capitalists, to the scientific stage which was characterized by centralized and highly concentrated capital as well as larger mining "factories". It was in this third phase that American mining engineers became a dominant technical and managerial force on the Witwatersrand from around 1890 to 1914.

The cooperation between American mining engineers and British mining capital seems to have begun with an invitation extended to Baron Edmond de Rothschild by Hamilton Smith, an American mining engineer who was president of the North Bloomfield hydraulic mine in California, to visit this operation late in the 1870s.[17] After this visit, Hamilton Smith became consulting engineer for the Rothschilds in Paris and London where he was based. He recruited another American mining engineer, Edmund De Crano, and both formed the London Exploration Company which was backed by the Rothschilds. It was on De Crano's recommendations that the Rothschilds gave Cecil Rhodes the capital with which the last diamond mining firm holding out against amalgamation was bought out and complete control over the whole Kimberley mine was achieved and the De Beers Consolidated Mines Limited, a monopoly, was born. It was also through the London Exploration Company that Gardner F. Williams from California was recruited first for the Transvaal Gold Exploration and Land Company in the Lydenburg district and later for the job of managing the De Beers Consolidated Mines for Cecil Rhodes' syndicate. Henry C. Perkins was also recruited by Smith and De Crano and recommended by Lord Rothschild to Lord Randolph Churchill to accompany the latter on his visit to South Africa and Mashonaland (Zimbabwe) in 1891 shortly after Cecil Rhodes' British South

Africa Company (BSA Co.) had expropriated all of Mashonaland. London was the principal centre for organizing and deploying vast sums of British mining capital accompanied by highly ranked and experienced American mining engineers to the many different mines of the world including South African mines. The other method whereby American mining engineers went to South Africa was through those already managing various properties on the Witwatersrand writing to friends, colleagues and former professors in the United States inquiring about and requesting the dispatch of men with specific qualifications and skills.

American mining engineers who went to South Africa through their colleagues in London, Kimberley and Johannesburg came from many different mines in and out of the United States. The most important mines in the United States from which some of these engineers graduated and gained valuable experience in managing mines and mills on a large scale were the North Star in Gras Valley, California; the Standard Consolidated at Bodie, also in California, known for pioneering work in the use of the cyanide process and electrical transmission; Bunker Hill and Sullivan in Idaho which produced John Hays Hammond, Victor M. Clement, and Fred W. Bradley; and the North Bloomfield in Nevada County, California, which turned out men like Hamilton Smith, Henry C. Perkins and James Hennen Jennings.[18] Outside the United States, the most pertinent mine was the El Callao gold mine in Venezuela whose superintendency had been under Henry C. Perkins, Hennen Jennings, George E. Webber and Barry Searls. Others who worked on or near the El Callao mine in other capacities were Thomas Mein who was Perkins' first mine-captain at El Callao before becoming a mine manager at the Nacupai mine nearby; Louis Seymour who was Perkins' assistant in mechanical engineering; Maurice Robeson who was mechanical engineer at Nacupai and El Callao mines; E.A. Blanton who was an expert on milling at the Union mine in the El Callao district; Richard Bowen, John Walsh, J. Klimke former surveyor at El Callao and F.H.P. Cresswell of the Chile mine.[19] All these men went to occupy mine management and specialist positions in some of South Africa's dominant mining groups of companies.

The Occupational Structure and Labor Processes on Gold Mines

The Mine Managers' Association of the Witwatersrand pioneered by American mining engineers in 1892 was characterized as being an intermediary between capital and labor and of important service as

(1) "an interchange of experiences upon such subjects as the relative advantage of employment of white or kaffir [black] labour in the various departments of mining work,
(2) the introduction of the contract [tribute] system [white skilled

miners commanding gangs of African laborers performing piece-work],
(3) the efficiency and economy of hand as opposed to machine drilling [by Africans]
(4) the numerous problems presented in mill management . . ."[20]

Apart from the obvious racial attitudes mine managers exhibited, they were also very anti-trade union even when the latter were exclusively white. Again, some of these mining engineers had achieved notoriety in the United States as mine managers who were totally and actively opposed to combinations by laborers and in some cases played leading roles in breaking up strikes before they went to the Witwatersrand.[21] These attitudes, roles and experiences of American mining engineers and their contributions to the state of the art in gold mining all helped in some ways shape the labor structure which evolved on the Witwatersrand gold mines between 1887 and 1914.

The exhaustion of both shallow diggings and many outcrop mines which concentrated on the oxidized zone, the increasing realization that the main reef series continued at greater depths into the pyritic zone, and the awareness of the low grade nature of the conglomerate beds in the main reef series meant that for gold mining to be profitable, it had to be on the basis of large-scale operations. Ernest P. Rathbone, a British mining engineer and former graduate of the Royal Saxony Mining Academy who wrote extensively for the growing mining technical and professional journals on the Witwatersrand, writing in the *Witwatersrand Mining and Metallurgy Journal* in 1890, said that

> "the greatest dividend paying mines in the world are known technically as 'low grade mines' — that is, where the product mined has either a low commercial value or where the percentage of the mineral contained in the rock is very low — but at the same time the amount of the mineral is remarkably constant, and the quantity of it is practically inexhaustible."[22]

In his informed opinion, the Witwatersrand gold mines' mineral content was low, constant and inexhaustible. To support his view he cited the relatively low mineral content of low grade gold mines of Dakota — the Homestake and Caledonian mines; the low grade silver mines of Nevada — the Consolidated and California and Virginia mines; the low grade copper mines in Michigan — the Calumet and Hecla mines; the low grade copper mines of Spain — the Rio Tinto Copper mines; and the low grade lead mines in Germany — the Mechernich and Commein mines near Cologne.[23] In concluding he advised that

> "in order to mine and mill profitably in the Witwatersrand district it is absolutely essential to do so on a large and generous scale, having the utmost regard for the actual cost of working each department."[24]

Mining on a large scale meant the development of large organizations with enormous capital, labor and material resources and extensive division of labor. Almost every mine was controlled by a board of directors who were themselves shareholders of the mine elected to the board by other shareholders. Of these directors, one was elected chairman of the board and another was often chosen as the managing director of the company. For administrative and control purposes, most boards of directors met in Johannesburg where some companies had their head offices. Where the latter were somewhere else, Johannesburg was represented by local boards of directors or committees. At the head offices were the secretaries of the companies reporting directly to the managing directors who represented the boards. Secretaries were assisted by staffs whose responsibilites were to keep records of board meetings and directives; register, issue and transfer shares; distribute dividends and pay company bills; keep mine managers' records and exercise strict control over the accounts covering costs of labor, machinery and stores used in operating the mines. In addition to the head office and perhaps the local board or committee, the company was represented wherever the number of shares bought warranted the presence of the company taking into account the cost of operating such an office. This resulted in the opening of offices in Berlin, Paris and London by the dominant mining finance houses located on the Witwatersrand.

Very often the board of directors was advised by a consulting mine engineer in conjunction with a resident or superintending mine engineer who usually was the mine manager. The advice of consulting engineer was sought in general or specific terms, such as in the areas of metallurgical and mechanical engineering, because mine managers were not experts in these fields of mining. A mine manager was generally a mining engineer by experience and or training rather than a metallurgical, mechanical or even an electrical engineer. By 1897, all mine managers on the Witwatersrand had to be certified by the government after passing examinations testing their knowledge of the mining laws of the South African Republic, mining practices, mechanics, mine surveying, geology, mineralogy and chemistry.[25] Remuneration covering the fees and salaries of the boards of directors, their secretaries and assisting staffs, consulting engineers and mine managers was as a rule recorded under "administration" or "general charges" accounts which were separate from "mine accounts" and others in which were entered costs and information on actual mining operations.

Immediately under the mine manager were the following employees who were directly engaged in actual mining activities and were crucial in their directing and supervisory roles: the mine overseer who was in charge of all underground works of a mine and worked under the direction of the mine

manager; the surface foreman who was responsible for the surface works of the mine and reported directly to the mine manager; the "shift boss" who was in charge during a shift in a section of or sometimes the entire underground operations of a mine acting under the instructions of a mine overseer; and the "ganger" who was the leader of a group of workmen in one or more working places during a shift[26] and was directly answerable to the shift boss. In addition to the foregoing jobs which were critical to actual mining operations, the following complement of occupations would round off what were commonly regarded as white men's jobs by 1890:[27]

Miners	Masons
Engine-drivers	Blacksmiths
Fitters	Amalgamators
Carpenters	Various [generally unskilled whites]

All the jobs mentioned above from mine manager down to generally unskilled white men both above and underground were occupied by white immigrants and white men from the Cape and Natal British colonies. These jobs constituted the white part of the racially and heirarchically divided labor structure in which white workers as a group dominated black workers also as a group with respect to pay, social position and political influence. The white component of this labor structure was itself sharply divided first into skilled and unskilled sections in which immigrant whites were predominant, better paid and held higher status than unskilled whites. Second, within the skilled white ranks there seems to have been further distinctions between real and experienced immigrant miners and immigrants, as well as whites from the Cape and Natal colonies who were skilled not in mining proper but in auxiliary skills such as masonry, carpentry, plumbing and blacksmithing which had become specialized functions as mining developed from "medium" scale operations which depended on Cornish-type artisanal miners to becoming large-scale factories dependent on scientific and technical skills as well as management. This differentiation within the white section of the labor structure on the basis of possessing real and auxiliary mining skills, as well as not having any particular skills, accounted for both the differentials in pay and social position within the white heirarchy.

The black section of this racially and hierarchically divided labor structure comprised African drillmen, shovellers, trammers and helpers attached to white miners, engine drivers, fitters, carpenters, masons, blacksmiths, amalgamators and any remaining skilled white workers. Bill Andrews, an English trade unionist, recalled his first day at work as a fitter on the Geldenhuis Estate mine in 1894 in the Witwatersrand district when the head of the workshop Jock Davidson, another Englishman, handed him the necessary tools and said "Here's your hammer, . . .,and here's your chisel,

shifting spanner, pliers, . . . and here's a nigger."[28] This racially abused and subjugated labor force was, in 1890 on the Witwatersrand, classified into three categories by the Chamber of Mines and the Mine Managers' Association on the basis of an agreement among members of the former to reduce African wages: third class African laborers or unskilled ordinary laborers were to comprise fifty percent of Africans employed by any company each paid the maximum rate of £2 per month excluding the customary rations; second class African laborers or partially skilled African workers were limited to thirty percent of Africans employed by any company with each earning a maximum wage of £2 10s per month not counting the rations; first class African laborers or highly skilled African workers were to consist of the remaining twenty percent and were to be remunerated at the discretion of each company.[29] The latter class of African labor presented mine managers with endless problems because it constantly threatened skilled white miners, engine drivers and all the other remaining skilled white workers referred to above. On many mines some Africans had acquired special skills despite their positions as helpers and not apprentices and managers generally found it desirable and economical to encourage and make special provisions for such cases.[30] Some mine managers went so far as arguing that all Africans who had worked a few months and had become "fair to good drillmen" should be considered skilled but paid less than white men doing or supervising the same job.

By 1896 the job structure of 1890 had expanded further in terms of larger numbers of blacks and whites employed and the greater differentiation of jobs necessitated by increased deep level mining and the numerous improvements in the treatment of ores on the surface at the stage where gold was recovered. There were thirty-one different mining occupations held by white men ranging in a descending hierarchy from mine managers to laborers. As of June 1, 1897, the Chamber of Mines listed forty-eight different mining jobs held by black men in five mining departments (underground, above ground, in the mill, cyanide division and general category). African labor was largely manual by design with certain kinds of skilled work performed by a few Africans. The types of work Africans were mainly engaged in underground were hand-drilling, shovelling, filling, tramming and assisting machine drillmen, track layers, timbermen and other white skilled underground workers.[31] On the surface, Africans were employed in landing, dumping and filling trucks, tramming, ore-sorting, stoking and assisting enginemen, carrying coal, lumber, and other items, pick and shovel work, assisting millmen, filling and emptying tailing vats, and generally all work carried on under strict supervision of whites.[32] In some cases, blacks learned a trade and worked as mechanics, blacksmiths, engine drivers and so forth. While some managers welcomed this class of labor, others rejected it and

preferred having all black labor remain unskilled or simply not having any black labor at all.

Conditions of Work and Labor Shortage

The attempt and failure of the Jameson Raid of 1896 seemed to have persuaded the South African Republican regime to set up the Industrial Commission of Enquiry into the mining industry on April 14, 1897. Its terms of reference were that it inquire into the conditions of the mining industry, its problems and make recommendations that would improve its operations, while its scope of inquiry was to examine issues pertaining to labor, tariff rates, taxation, dynamite, trade and agriculture as they affected the mining industry.[33] The testimony sought and taken by the Commission regarding these issues came from the mine-owners, consulting mining engineers and mine managers only. In dealing with the labor question a tacit acceptance permeated the witnesses' testimony and Commissioners' questions concerning the basic nature of the racially and hierarchically divided labor structure and the extent of differentiation found within it. The bulk of the testimony on labor focused on various aspects regarding its recruitment, utilization, remuneration, housing, how to differentiate, control and discipline it. Representative of mining capital was George Albu, Chairman of the Association of Mines[34] and director of several mines to whom the hierarchy of labor started with the consulting mining engineers at the top, then came mine managers who were in turn followed by various classes of white and black labor.[35] Albu viewed some parts of white and all black labor as areas where significant savings could be achieved by mining capital if wages were cut. His contention was that high wages for the ordinary laboring classes "whether it be in Africa, Europe, or America" made it unnecessary to work,[36] especially for extended periods. Therefore, some white miners' wages which were perceived as abnormally high and all black wages (both low and high) had to be reduced. Besides, he reasoned, cutting white miners' wages was a lesser evil than creating white unemployment by shutting down those mines which had become unprofitable due to high labor costs.[37] To buttress his argument for cutting some white miners' wages, he pointed out that the ordinary white man on the Witwatersrand mine earned from £18 to £22 per month while the average white miner in Europe was paid about £4 per month,[38] a fact corroborated by almost all other witnesses who followed his testimony before the Commission. He also preferred more African labor underground because white labor was too expensive and in any case he doubted that "white man can do considerably more than a skilled kaffir."[39]

Typifying the consulting mining engineers' views and providing the Commission with comprehensive evidence was Hennen Jennings, consulting

engineer to Hermann Eckstein and Company. Apart from all the evidence and data that he presented to the Commission, two sections of his testimony stood out, his experiences in Venezuela and in the United States. He found that the conditions prevailing in the Republic were similar to those he had encountered in Venezuela and the experience the United States had in marshalling its black populace was instructive for the Republic to consider emulating. In 1884, a new regime started in the El Callao mines using high grade machinery with increasing stamping power in conjunction with white skilled labor which was given a relatively free hand in managing the mine. By 1892, production and other operating costs were reduced from £6 2s. 6d. to £1 19s. 9d. per ton or by 308%. The primary factors responsible for this reduction were the importation of Black labor from the West Indies and the improvement in machinery and mining methods. The Venezuelan situation was in many other respects identical to the one prevailing in the South African Republic. Both Jennings and the Commission recognized the similarities but the Commission and the regime that created it simply sat on the report. The resolution of mining capital's frustrations with the South African Republican regime came to a head in the Anglo-Boer war of 1899 to 1902 in which the British empire's forces were despatched to crush the republican state and clear the way for more British and European capital as well as immigrants.

After the Anglo-Boer war in which a few leading American engineers such as the veteran Gardner F. Williams, Louis Seymour, George Labram and F.R. Burnham fought on the side of mining capital and Imperial Britain, the Witwatersrand gold mining industry experienced simultaneously an increase in European capital and a grave shortage of African labor. Alfred Milner, the British High Commissioner of South Africa, negotiated an agreement between his office and the Portuguese colonial administration of Mozambique whereby the gold mines in the Transvaal colony could recruit African laborers in Mozambique and transport them by railroad at preferential freight rates to the Transvaal. This agreeement called the *modus vivendi* was signed in December 1901 while the guerilla war was raging and resulted in two to four thousand Mozambicans arriving on the Witwatersrand per month. When the Transvaal Labor Commission Report of November 1903 estimated that there would be a deficiency of 129,000 Africans in the mines of the Witwatersrand excluding other industries, Milner's office inquired from the Colonial Office in London whether he could obtain the required labor from other British colonies including India. He was informed that this was not possible in light of labor needs in these colonies. He proceeded with some reluctance to more extreme measures involving importing Chinese laborers from China, 12,000 miles away.

As early as 1898, there were discussions in the Chamber of Mines of the South African Republic regarding the feasibility of securing laborers from

mining districts in India and China. Chinese laborers employed in Australian mines were found to be efficient and cheap but considered inappropriate for the South African Republic. Behind this conclusion was the general fear that the Chinese would over a short period threaten to take many skilled and semi-skilled jobs held by white men on the mines. Italian, Cypriote and Hungarian skilled and unskilled labor was also investigated and found expensive when transport costs, food rations and wages were taken into account. Besides, the potential of these immigrants joining local white unions that were slowly forming made them doubly unattractive to mining capital. In 1902, when the debate was heating up on whether or not to import Chinese labor to complement the existing and projected shortage of African laborers on the Witwatersrand gold mines, the Chamber of Mines commissioned H.R. Skinner, "a prominent and successful mine manager . . . whose sympathies with the white workman [were] well-known, and one who [had] no predilection towards Asiatic labour" to visit the United States and China.[40] In the United States, Skinner was "to find out what [were] the experiences and opinions of those who [could] calmly look back upon the experiment which they in their county made many years ago, and which the conditions of this country [South Africa] may . . . compel us to face."[41] In China, he was to obtain information for the Chamber concerning "the class of labourer engaged, his habits, wants, foods, pay, the districts from which the most suitable workmen [came], the class of work for which they [were] best adapted and which [could] be most properly entrusted to them,"[42] including numbers of available men, the cost of transporting them, and "every detail which could be of interest or importance to the work" of mining.[43]

Gold in the United States was discovered in a Spanish-Mexican trading village of San Francisco in 1848. Within months, tens of thousands of male adventurers had arrived on the digging sites. From the east came Europeans and American-born whites, from the south Mexicans and Chileans and from the west Australians and Chinese. The Mexican province in which San Francisco was situated became the thirty-first state of the Union in 1850. From 1848 to the late 1860's, mining expanded from alluvial, and shallow placer mines to deep level lodes yielding an increasing variety of minerals. During this period, the Chinese were more than welcome on both shallow and growing deep level mines as long as they did not compete with European and American-born labor. When hard times hit the west from the 1870's into the 1880's, the Chinese became targets of rabid discrimination and victimization. This anti-Chinese agitation resulted in the Chinese Exclusion Act of 1882 which prohibited immigration of Chinese laborers except merchants and students. Later amendments forbade wives from joining husbands thus fostering and perpetuating "bachelor dormitories." National, state and local laws

prohibited Chinese from becoming naturalized citizens, marrying whites, and testifying against whites in courts. These and other racist restrictions against the Chinese were carried over into the twentieth century. It was this experience in social engineering that H.R. Skinner had been sent and commissioned to study as the Transvaal Chamber of Mines and the British colonial state prepared themselves for importing Chinese laborers.

The Imperial British government had sanctioned this exercise by resuscitating a convention dating back to October 1860 between Queen Victoria and the Emperor of China allowing Chinese subjects to work in British colonies. The renewed convention was signed on May 13, 1904. A total of 63,695 Chinese were imported from southern and northern China into the Witwatersrand gold mines between June 1904 and June 1907 when their repatriation began. One major condition attached to their employment was that they be barred from holding fifty-five types of jobs which had come to be viewed as white miners' occupations. Issues surrounding Chinese laborers had a profound effect on the politics of Britain and the Transvaal colony. In Britain, the Chinese question helped return the Liberals to power in January 1906 with a comfortable majority over all other parties combined in the House of Commons. In the Transvaal, it assisted the republican Africaners, colonial whites from the Orange River, Natal and Cape British colonies, as well as many immigrant miners from Europe and the United States coalesce into the Afrikaner political party, Het Volk (The People) and win the February 1907 election which led to self-government.

The Chinese added one more category to the labor structure which had emerged on the Witwatersrand gold fields by the turn of the century. This labor structure was shaped like a pyramid whose apex was occupied by imported mining engineers; below this elite group were immigrant skilled miners from Europe, Australia and the United States; immediately under the skilled miners were colonial whites ranging from those who possessed skills that could be used in some mining task to those who simply had no skills; the bottom comprised the large mass of African skilled and unskilled miners. The wage rates and salaries earned by miners also reflected the foregoing hierarchy which was based on technical knowledge, skills and experience as well as race. When the Chinese were added to this labor structure, they were ranked immediately below the colonial whites and above the broad African base. Their wages also reflected this ranking. By 1910 when the Union of South Africa was formed, the shape of this labor structure had not changed. Only its constituent strata had changed because the skilled, semi-skilled and unskilled Chinese had come and gone between 1904 and 1910. The schedule comprising the fifty-five occupations from which they were excluded was applied to African mine-workers.

The new state, the Union of South Africa, enacted the Mines and Works Act No. 12 of 1911 which consolidated and amended all the laws in force in the former British colonies of the Transvaal, Natal, Orange River and Cape relating to the operations of mines, works, machinery and the issuance of certificates of competency for performing certain jobs such as blasting and driving engines. The Mining Regulations Commission of 1907–1910, especially its recommendations which set aside a number of key occupations in the mining industry for white men, were used as a model for similar prohibitions issued under the Mines and Works Act No. 12 of 1911. Article number four of this act was very important in that it empowered the British Governor-General of South Africa to make regulations applying to mines, works, and machinery particularly in granting, cancelling and suspending certificates of competency to mine managers, mine overseers, mine surveyors, mechanical engineers, engine-drivers, miners entitled to blast, and other classes of persons employed in, at or about the mines, works and machinery. The Governor-General exercised this power in continuing to effectively maintain the republican and colonial built racial and hierarchical labor structure which excluded African miners from filling any key jobs especially those perceived as befitting white miners.

Conclusion

The factors responsible for the hierarchic and racially divided labor structure in the Witwatersrand gold mining industry were the Chamber of Mines, the Mine Managers' Association, technical and professional mining organizations, white labor unions, low grade ore, deep level mining, white racism and the absence of a black miners' union. The Witwatersrand gold mining industry, like all other major industries in South Africa, was based on massive cheap African skilled and unskilled labor. Mining capitalists, their consulting engineers, mine managers, white miners both skilled and unskilled as well as the state shared, supported and labored in maintaining this job structure. Central to this common objective was that dividends of mining capital, the high salaries and wages of consulting engineers, mine managers, skilled and unskilled white miners as well as the state revenues from taxes levied on profitable mines depended on the rate and extent to which black labor was exploited. American consulting and mining engineers played a crucial role in helping consolidate this type of labor structure.

Footnotes

1. *The Engineering and Mining Journal*, Vol. XLIV, No. 23, December 3, 1887, p. 409.
2. George F. Becker, "The Witwatersrand and the revolt of the uitlanders," *The National Geographic Magazine*, Vol. VII, No. 11, November, 1896, pp. 349–367.
3. What South African historiography calls gold "discoveries" by European colonists, explorers and prospectors before 1886, when the main reef series was indeed discovered, were to a very large extent findings of ancient gold digging sites worked by Africans.

4. Thomas A. Rickard, *Interviews with Mining Engineers* (San Francisco: Mining and Scientific Press, 1922), pp. 263-4.
5. *Ibid.*, p. 264.
6. Becker, p. 364.
7. James E. Homans, Ed., *The Cyclopaedia American Biography*, Vol. VIII (New York: The Press Association Compilers, Inc., 1918), p. 59.
8. Clark C. Spence, *Mining Engineers and the American West* (New Haven: Yale University Press, 1970), p. 303.
9. "Interview with W.R. Grace," *South African Mining Journal*, Vol. IV, Part II, (April 27, 1907), p. 168.
10. He excluded underground operations with which he felt "incompetent to speak."
11. Theodore Gregory, *Ernest Oppenheimer and the economic development of Southern Africa* (Cape Town: Oxford University Press, 1962), pp. 81 – 90.
12. *Ibid.*
13. Spence, p. 4.
14. Herbert Clark Hoover, *The Memoirs of Herbert Hoover* (New York: MacMillan, 1951), Vol. I, p. 131.
15. John H. Curle, *The Gold Mines of the World* (London: George & Routledge & Sons, Ltd., 1905).
16. Spence, pp. 278 – 9.
17. Rickard, p. 414.
18. Spence, p. 143.
19. Rickard, pp. 229 – 230.
20. *South African Mining Journal*, Vol. II, No. 1 (Oct. 1, 1892), pp. 1 – 2.
21. Spence, pp. 303 – 5.
22. Ernest P. Rathbone, "Mine Management," *The Witwatersrand Mining and Metallurgical Review*, Vol. 1, No. 7 (July 1890), p. 2.
23. *Ibid.*
24. *Ibid.*
25. Samuel J. Truscott, *The Witwatersrand Goldfields, Banket and Mining Practice* (London: Macmillan & Co., Ltd., 1898), pp. 474 – 5.
26. *Ibid.*, p. 431.
27. Witwatersrand Chamber of Mines, *Second Annual Report for the Year Ending 31st December, 1890* (Johannesburg: Argus Printing and Publishing Co., Ltd., 1891), p. 95.
28. R.K. Cope, *Comrade Bill* (Cape Town: Stewart Printing Co., sponsored by W.H. Andrews Biography Fund, c. 1943), p. 27.
29. Witwatersrand Chamber of Mines, *Second Annual Report . . . 1890*, p. 68.
30. *Ibid.*, p. 67.
31. Hatch and Chalmers, pp. 454 – 5.
32. *Ibid.*
33. Witwatersrand Chamber of Mines, *The Mining Industry: Evidence and Report of the Industrial Commission of Enquiry* (Johannesburg, 1897), p. 1.
34. *Ibid.*, p. 14.
35. *Ibid.*, p. 25.
36. Transvaal Chamber of Mines, *Thirteenth Annual Report for the Year Ending 31st December, 1902* (Johannesburg, 1903), p. xlvii.
37. *Ibid.*
38. *Ibid.*, p. xlviii.
39. Great Britain. *Parliamentary Papers*, Cd. 2026 (1904), Vol. LXI, pp. 21, 29 "Transvaal Labour Importation Ordinance."
40. G.B. Pyrah, *Imperial Policy and South Africa, 1902 – 1910* (Rept. Westport, Conn.: Greenwood Press, 1975), p. xiv.
41. Union of South Africa. Statutes. *Mines and Works Act*, Act No. 12 (1911), p. 374.
42. Transvaal. Mining Regulations Commission, *Report of the Mining Regulations Commission, 1910*, pp. 144 – 219.

43. Union of South Africa. Statutes. *Mines and Works Act*, Act No. 12 (1911), Article 4 Part N of 1(a) to (b).