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The Wasted Years

A history of mine waste rehabilitation methodology in the South African mining industry from its origins to 1991

A thesis submitted to the School of Animal, Plant and Environmental Sciences (APES), University of the Witwatersrand, Johannesburg, South Africa, by

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Abstract

Decades after the commencement of modern mining in the 1870s, the South African mining industry addressed the impacts associated with its mine waste deposits. In this, it followed the pattern its international peers had set. This study aims at chronicling, for the first time, the mining industry's efforts to develop scientifically sound and replicable methods of mine waste rehabilitation. Mindful of the limitations in accessing official and public written sources for such an applied science, the study seeks to take a broader approach: It considers factors beyond pure experimental results (of which only patchy records exist), and considers the socio-economic context or the role of certain personalities, in an effort to understand the evolution of the applied technology between the 1930s until the passage of the Minerals Act in 1991. The bulk of this mine waste rehabilitation work during this period was done by the Chamber of Mines of South Africa and its members, the gold and (later) coal miners. The focus will therefore be on these sectors, although other mining sectors such as platinum will be covered when relevant.

Following decades of ad hoc experimentation, concern about impending legal pollution control requirements in the 1950s spurred key gold industry players to get ahead of the curve to head off further regulation. Their individual efforts, primarily aimed at dust suppression, were quickly combined into an industry initiative located within the Chamber of Mines. This initiative became known as the Vegetation Unit. Well resourced and managed by a dynamic leader with horticultural training – William Cook – the Unit conducted large-scale and diverse experiments between 1959 and 1963 to come up with a planting and soil amelioration methodology. The initial results of this work were almost immediately published in an effort to publicise the industry's efforts, although Cook cautioned that this was not a mature methodology and that continued research was required. The Chamber of Mines, however, was trying to head off pending air quality legislation and in 1964/65, the organisation publicly proclaimed the methodology as mature and ready for widespread application. With this decision, the Unit's focus shifted to widespread application while its ability to advance the methodology scientifically effectively collapsed in the 1960s and early 1970s.

In addition to this shift of focus and resources to application rather than continued refinement, the Unit was constrained by non-technical and non-scientific factors: Key among them was the industry's implicit belief, and hope, that a walk-away solution had been found. The Unit's manager Cook stood alone in driving its application and refinement for most of his time in that position. In his day-to-day work, he lacked an industry peer with whom to discuss rehabilitation results and he compounded this isolation

through limited interaction with academia until very late in his career. This isolation was amplified by the lack of relevant technical knowledge among the company representatives on the committee tasked with the oversight of the Vegetation Unit: As engineers, all of them lacked not only technical understanding of the botanical and ecological challenge, some even questioned the legitimacy of the Unit's existence into the 1980s. In addition, the concentration of all rehabilitation efforts in this single entity structurally curtailed the individual mining companies' interest in the advancement of the methodology, creating a further bottleneck. Indeed, as late as 1973, the key metallurgy handbook covered mine waste rehabilitation only for information purposes, specifically stating that this was the responsibility of the Chamber's Vegetation Unit alone.

To some extent, the presence of a champion within the Chamber – H. Claussen – obscured some of these challenges until the early 1970s. Indeed, the Unit had acquired additional scientific capacity by this stage, which gave it the ability to renew its research and to advance its methodology. That it failed to do so was mainly due to three factors coinciding: the retirement of its internal champion Claussen, a lack of succession planning for Cook, which left the Unit on 'auto-pilot' when he retired, and a rising gold price, which turned industry attention away from rehabilitation towards re-treatment of gold dumps.

During this period of transition in the mid 1970s, the Chamber's approach was thus somewhat half-hearted and vulnerable to alternative, potentially cheaper, rehabilitation proposals such as physical surface sealing advanced by Cook's eventual successor – Fred Cartwright. Though not grounded in any science, Cartwright's proposal gained ascendance due to his forceful personality as well as the industry's desire for an alternative to the seemingly open-ended costs associated with the existing rehabilitation methodology. During this time, the Chamber's structures singularly failed to protect the industry's long-term interests: The oversight committee for the Vegetation Unit, remained largely staffed by somewhat disinterested engineers, and relied heavily on a single individual to manage the Unit. Not only did the oversight committee passively acquiesce to Cartwright's virtual destruction of the Unit's grassing capacity, it also allowed him to stake the Chamber's reputation with the regulator by championing an unproven technology for about five years. Only Cartwright's eventual failure to gain regulator approval for his – still un-proven – technique led to a reluctant abandonment by the Chamber in the early 1980s.

Cartwright's departure in 1983 left the Unit (and the industry) without the capacity to address mine waste rehabilitation, at a time when emerging environmental concerns were gaining importance in social and political spheres in South Africa and across the world. The Unit sought, unsuccessfully, to build alliances with nascent rehabilitation

practitioners from the University of Potchefstroom. It furthermore failed to build mechanisms for sharing technical rehabilitation knowledge with fellow southern African or international mining chambers, leading to further stagnation of its method. At the same time, up-and-coming South African competitors such as the University of Potchefstroom seized the opportunity to enter the mine waste rehabilitation field as commercial players during the mid 1980s, at a time when the Unit had been reduced to grassing dumps for a single customer, the Department of Minerals and Energy Affairs (DMEA).

Using its status as a part of the Chamber of Mines, the Unit gradually regained its position of prominence through the development of industry guidelines for rehabilitation. Yet, it would never again occupy a position of pre-eminence in practical fieldwork, as industry players, academic capacities and commercial players entered the field in the mid-1980s in response to a growing environmental movement worldwide. When the passage of the Minerals Act in 1991 formally enshrined not merely rehabilitation but environmentally responsible mine closure in law, the Unit had been reduced to a prominent but no longer dominant player in this sector. This lack of pre-eminence ultimately caused the Unit to be among the first Chamber entities to be privatised when the Chamber began to restructure. This ended its role as a central driver of applied rehabilitation techniques for the South African mining sector once and for all. As this privatisation coincided with the broader opening up of South Africa's society and economy after the unbanning of the ANC, there would never again be an entity (commercial or otherwise) that would dominate the rehabilitation sector as the Chamber's Vegetation Unit had done in its day.

Keywords

Chamber of Mines of South Africa, mine waste, rehabilitation, slimes dams, tailings storage facilities (TSF), technology advancement, South African gold mining, South African coal mining, South African environmental legislation.