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Geology, Uranium, and Apartheid: South Africa's Nuclear Program and the International Politics of the Cold War

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Geology, Uranium, and Apartheid: South Africa's Nuclear Program and the International Politics of the Cold War

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Abstract

This paper examines the history of mining and uranium and its importance in South Africa's nuclear history. It begins with the development of minable mineral deposits in South Africa through geologic processes and ends with the South African signing of the Non-Proliferation Treaty (NPT). The paper explores the intermittent period between creating the Atomic Energy Board and developing South Africa's energy program through assistance from the United States and France. As the apartheid government brought sanctions to South Africa, the government began considering nuclear weapons through a different lens to project power. South Africa slid towards isolation under sanctions from the West. The study draws on the personal archive of E.S Reddy, government memos from the United States and South Africa, anti-apartheid publications, and more to understand the implications of South Africa's "geologic luck" and how the early mining history in South Africa has longer-term consequences for the development of a South African nuclear program.

Keywords: *Uranium, Apartheid, Cold War, Geology, Nuclear Weapons, Neocolonialism*

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Table of Contents

List of Figures

Chapter 1: Introduction and Historiography

Introduction

In November 2007 a group of four armed men broke into the Pelindaba Nuclear Facility located outside of Pretoria and managed by the South African Nuclear Energy Corporation. Armed men breached the perimeter during the night of November 8th. They deactivated several layers of security and went undetected by security officers. Once inside the men spent nearly forty-five minutes before they broke into a control center in the middle of facility and nearly stole a computer. An off-duty security guard spotted the men and was shot, but quickly triggered a security alarm. The men quickly escaped out the same way they entered and fled the scene before the South African authorities arrived. Simultaneously another team of intruders attempted to enter the nuclear facility from the western edge but failed to gain entry. The police never identified any suspects, but questions raised by domestic and international diplomats put a spotlight on the motives of the intruders. The South African government diminished the importance of these the events as a routine burglary. The South African Nuclear Corporation wrote a report after the break in that was never published in a public forum.[1] This seemingly minor break in conjured new questions about whether South Africa invested enough to protect one of the most vulnerable stockpiles of weapons grade uranium in the world.

Since South Africa dismantled its military nuclear program in 1991, following the signing of the Non-Proliferation Agreement, the state stored enriched nuclear material from the retired weapons at the Pelindaba Nuclear Facility. When South Africa shut down its nuclear weapons program the Pelindaba Nuclear Facility remained out of the spotlight, but the events of

[1] Birch, Douglas, and Jeffrey Smith. "How Armed Intruders Stormed Their Way into a South African Nuclear Plant." The Washington Post. WP Company, March 14, 2015. https://www.washingtonpost.com/world/how-armed-intruders-stormed-their-way-into-a-south-african-nuclear-plant/2015/03/13/470fc8ba-579d-4dba-a0c0-f0a1ed332503_story.html.

November 8th, 2007, placed a new focus on how South Africa stored weapons grade uranium. When President Barack Obama visited South Africa in 2013, the material located at the Pelindaba Facility was a topic of diplomacy discussed during the summit.[2] Since the break in South Africa made no changes the storage of these materials, but the South African Nuclear Energy Corporation fired six security personal following indications that the intruders received inside information on security systems.

After it introduced uranium mining South Africa ascended to a leader in uranium production and remains the eleventh top producer in the world. Metals mining started as a primary industry in South Africa in the late 19th century when the country was still a British Colony. South Africa discovered uranium in the 1940s after gaining independence and subsequently increased mining output during the Cold War. The government also developed relationships with France, Israel, and West Germany over uranium trade. For much of its history transnational corporations managed metallic mining in South Africa. British owned mining companies operated in South Africa as a form of neocolonialism. These corporations exploited both the land and the workers of South Africa, but the government managed uranium mining without corporations' involvement. The South African government used the same practices on its own citizens in uranium mines after it nationalized uranium in 1949. This project will look at the long-term influence of South Africa's mining history beginning with the formation of uranium and other deposits in the deep geological past. These deposits influenced South Africa's diplomatic relationships, nuclear program, and apartheid labor programs. I collected information

[2] Birch, Douglas, and Jeffrey Smith. "U.S. Unease about Nuclear-Weapons Fuel Takes Aim at a South African Vault." The Washington Post. WP Company, March 14, 2015. https://www.washingtonpost.com/world/africa/us-unease-about-nuclear-weapons-fuel-takes-aim-at-a-south-african-vault/2015/03/13/b17389f6-2bc1-4515-962d-03c655d0e62d_story.html.

from an array of sources all to tell the story of 20th century South Africa through the lens of its geologic history and its nuclear program.

Maps, geography, and geology all play enormous roles in how humans considered the history of the globe and the interpretations we make surrounding natural resources and their trade. David Christian's book *Maps of Time* introduced a new way for historians to consider these movements of people and goods, but also the larger field of big history. Christian argued that eight threshold moments defined the development of the Earth, life, and humanity. He claimed that moments like the formation of chemical elements, the creation of life, the agricultural revolution, and the industrial revolution are all moments that fundamentally changed the path of our world.[3] Christian's work invoked a new way of thinking about history and the challenges of associating the natural world with human interactions, specifically when considering more modern events. His point of view applied to many of the themes that will emerge from examining South Africa's 20th century history. Another similar position looks at the history from the geologic past. *A Most Improbable Journey: A Big History of Our Planet and Ourselves* by Walter Alvarez looks at the field of big history from the perspective of geology. Alvarez aimed to explain why events in human history took place He presented them through the geology of the region in question as a context for understanding human interactions and the natural world.[4] I used both authors as a framework to understand how in the case of South Africa the geology influenced the events of the 20th century.

The essay presents three case studies of twentieth-century South Africa. The first explores the development of South Africa's nuclear program. This will also examine the agency of South Africa's government as they developed a nuclear program. The next portion explores

[3] David Christian, *Maps of Time* (Berkley, California: University of California Press, 2004). pg. 15
[4] Walter Alvarez, *A Most Improbable Journey: A Big History of Our Planet and Ourselves*, 2017. pg. 8

the South Africa's international diplomacy in relation to the nuclear program. It considers South Africa's role in the Cold War, and how the nuclear program impacted South Africa's diplomatic relationships during a period of economic uncertainty fueled by sanctions over the apartheid South African government. The final portion explores the role of South Africa's racialized labor policies in the mines and the far-reaching impacts these had on the longevity of the apartheid government.

Gabrielle Hecht's book *Being Nuclear: Africans and the Global Uranium Trade* inspired this project. In this work, Hecht uncovered what it meant for a state to be nuclear and how society handpicked states across history to be nuclear. She explored the relationships between former colonies and nuclear powers, who, in many cases, are former colonizers.[5] This project expands on her theoretical framework to focus more on the natural history and how it is set up the events she covered in her research These included the colonization and decolonization of South Africa. While Hecht addressed many of the human interactions that lead to a nuclear power, she ignored the broader geologic history that explaines how valuable geologic minerals became a catalyst for growth in the South African economy. Hecht's work is the most complete research into the history of nuclearity, specifically in Africa. Before the release of her book *Being Nuclear*, Hecht published articles that covered themes of the book but also looked deeply at techno-politics during the Cold War, nuclearity, labor and uranium production, and French national policy on nuclear reactors after the second world war. Many of Hecht's historical arguments focus on using nuclear material to project political power with new technologies. This

[5] Gabrielle Hecht, *Being Nuclear: Africans and the Global Uranium Trade*, 2014. pg. 20.

framework was specifically applicable to South Africa where the government used nuclear energy and weapons to ascend the world order.[6]

Historiography

The research into nuclearity in South Africa has a few major scholars who define the ideas of the last twenty years. Gabrielle Hecht is one of the few scholars who focused research on the production of uranium and the Cold War through the lens of the natural resources used to build bombs, rather than on the diplomacy around the bombs themselves. Hecht unraveled the interconnectedness of themes of decolonization, labor rights, public health issues, race, and nuclearity. The framework Hecht built across her research is the inspiration for this project, but there is one part that she missed which will play a major role in the argument of this essay. While Hecht's research is groundbreaking in its topic, she also ignored an enormous part of the narrative. The human interactions over uranium remained important, however it's also crucial to consider how uranium gained to a place of value in the global order. Also, the value of lands with access to the valuable minerals including much of South Africa. Hecht's research techniques are unique to those of more traditional historical studies based purely on archival research. Hecht looked at this project differently. She researched significantly in archives in France, the U.K., South Africa, the United States, but she also relied heavily on interviews with people who lived through decolonization, the rise of uranium, and who worked in the mines. She acknowledged that when looking at the histories of nuclearity much of the best information remained classified, and likely will not be available for scholars or public consumption for years to come as it is closely related to issues of national security. While some documentation over national security is available, Hecht took a different route and explained other topics through interviews. The

[6] Van Wyk, Martha. "Sunset over atomic apartheid: United States–South African nuclear relations, 1981–93." *Cold War History* 10, no. 1 (2010): pg. 55.

perspective from interviews is missing from my work but Hecht's framework and themes built on what she extracted from interviews provided context for my research.[7] Throughout the book, she interviewed mine workers at sites in Gabon, Madagascar, South Africa, and Namibia.[8] In addition, she spoke with people in the surrounding areas of the mine, including managers, engineers, doctors, and residents. These interviews still cannot make up for the questions of national security in the research, but they add a new dimension to Hecht's analysis. The elements of humanity in people she described being subjected to the horrific conditions of uranium mining. While my project cannot rely on Hecht's interview methodology, I use her theoretical framework as a model while focusing more on the natural processes which make uranium an industry with enormous potential for the South African state during the 20th century.

The role of France in South Africa's nuclear development is also pivotal. Some of Hecht's arguments look at the prevalence of nuclear material around the globe and illustrated the importance they would eventually have in South Africa. One of her earliest publications titled "Political designs: nuclear reactors and the national policy in postwar France" examined the early nuclear advancement. The article looked at how the study of technological innovation and development can be used to shape political, social, economic, and cultural considerations in broader society. Hecht examined how technology can be a lens through which we can view broader historical questions. This technique remains applicable to South Africa's nuclear rise. In this case, the main questions revolved around how the world can be viewed through the lens of nuclear power and weapons. Hecht argued that two individual reactors located in France are more than just technological artifacts of that age; they represented a shifting tide in international

[7] Gabrielle Hecht, *Being Nuclear: Africans and the Global Uranium Trade*, 2014. pg. 341.
[8] Ibid, 342.

politics and are as involved in politics as in technology.[9] This research remained relevant when studying South African nuclear policy as France provided South Africa with technology, financial assistance, and relationships with French corporations as they developed the beginning of South Africa's nuclear power infrastructure, a plant constructed outside of Cape Town in 1976.

Colonization and race remain relevant to the study of uranium even in the post-colonial era. Hecht also researched colonization, a reoccurring theme wherever uranium is considered. Her article "Rupture-talk in the nuclear age: conjugating colonial power in Africa" examined two former French colonial holdings Madagascar and Gabon. In this colonies the French mined uranium ore and later processed it. This began in the 1950s and paper examines how the discussions of decolonization and nuclearity are deeply intertwined. The paper examined the relationship between indigenous labor.[10] This framework provided valuable context for how labor interacted with uranium outside of South Africa. Overall, the paper argued that uranium mining in Africa revealed the power structures that created and maintained the categorizations of countries in the nuclear age as a stalwart of colonization.

The Cold War and related patterns of colonization and decolonization define a sphere of research. Hecht looked at how decolonization movements led to the formation of global governing bodies of nuclear material in her paper "Negotiating global nuclearities: apartheid, decolonization, and the Cold War in the making of the I.A.E.A." She investigated the International Atomic Energy Agency (I.A.E.A.) as an agency where geopolitics was irreverent to its work. The chapter argued that the separation between technology and politics never took

[9] Gabrielle Hecht, "Political Designs: Nuclear Reactors and National Policy in Postwar France," *Technology and Culture* 35, no. 4 (October 1994): pg. 657, https://doi.org/10.2307/3106502.
[10] Gabrielle Hecht, "Rupture-Talk in the Nuclear Age: Conjugating Colonial Power in Africa," *Social Studies of Science*, Oct-Dec 2002., pg. 691.

place in practice. The research focused on the role of South Africa in the agency's early years to understand the technopolitical regime that negotiated the visions of a global world order.[11] These narratives describe the complex relationships between apartheid South Africa, decolonizing states, the United States, and the meanings of nuclear within the context of politics. Hecht used these frameworks to explain nuclearity as a spectrum that is not a condition of duality where a nation is either nuclear or not nuclear. The implications of this are further defined by the Cold War and the postcolonial visions of the 20th century. While this paper looked at relationships between South Africa and its rise in the international order it also leaves out a major portion. Topics in this paper make up a significant part of my argument. South Africa showed intention to start its nuclear program and industry early notably with the nationalization of uranium in 1949. They also created a prominent system through outside assistance from countries like France, the United States, Israel, Great Britain, and West Germany. I explore the influence of these relationships will be explored in the international relations chapter which situates South Africa's role in the new atomic world order.

Hecht also investigated the dangers of working in uranium mines for miners. In "Africa and the nuclear world: labor occupational health, and the transnational production of uranium" This paper, looked at the entire continent of Africa to try and discover Africa's place in the nuclear world. U.S. government reports claimed that "countries like Gabon, Namibia, and Niger did not have any nuclear activities," Hecht argued that although these nations did not have any atomic weapons or nuclear energy sources, they are in a different sense part of the atomic world. Transnational cooperation's acted as a modern form of neocolonialism. At the time of this report in 1995, these nations accounted for 25% of the world's uranium production; additionally,

[11] Gabrielle Hecht, "Negotiating Global Nuclearities: Apartheid, Decolonization, and the Cold War in the Making of the IAEA," Jan 2006, pg. 26.

exposed themselves to a higher amount of radiation than any other workers in the nuclear energy industry.[12] While the nuclearity of bombs and reactors is not up for debate Hecht argued that other aspects of the atomic world give nations legitimacy as nuclear nations, including uranium mining. These mining stages place African countries on the spectrum of nuclearity that Hecht described where they have access to the raw materials, but often did not have access to technology to use the raw materials.

Research into the topics of Africa, nuclearity, decolonization, workplace health, and beyond provide essential background for the 20th century, especially from the point of view of uranium and its importance in the global economy during the tensions of the Cold War. Engaging with other scholars who have also researched uranium's role historically will be valuable. Hecht provided valuable context for how mine workers and ordinary individuals, often ignored in more traditional government documents played a role on the rise of South Africa's nuclear program, but her work largely ignored the negotiations between South Africa and western leaders over nuclear technology. Very broadly in her work, Hecht argued that South Africa's Black majority is heavily exploited by a type of nuclear neocolonialism from western leaders. What it ignored is the immense bargaining power the South African government had as a major producer of uranium, as well as considering the geologic background which led to South Africa having an immense amount of uranium. While apartheid South Africa did take advantage of the Black working class it also used these raw materials to bargain for a nuclear future. While parts of South Africa were victimized in this process, the whole society was not. The only reason that South Africa can bargain for this future is because the government was run by the white

[12] Gabrielle Hecht, "Africa and the Nuclear World: Labor, Occupational Health, and the Transnational Production of Uranium," *Comparative Studies in Society and History* 51, no. 4 (October 2009): pg. 897, https://doi.org/10.1017/S001041750999017X.

minority. Patterns across Africa during decolonization show that is South Africa was under a Black ruled government likely they would not have received the same kind of support from western powers.

There are multiple ways to examine this history of South Africa from, including the perspective of politics and international relations. Anna-Mart Van Wyk takes a different perspective from Gabrielle Hecht. Van Wyk spent much of her career researching the South African nuclear program and its impacts on global diplomacy. Much of her research is focused on South African nuclear history and the proliferation of South Africa's nuclear weapons. Over her career she has examined the relationship between the United States and South Africa beginning in the 1960s, more recently her research has focused on the non-proliferation of nuclear weapons and the Cold War more broadly in the context of South Africa. Van Wykes research provides context on how South Africa's position in the global system changed over time, as well as a look at how the South African relationship with western leaders changed across the twentieth century. While Hecht provided a glance on the influence of South African nuclearity on the micro level, Van Wyk zoomed out to examine South Africa's role more broadly in the global system.

The relationship between the United States and South Africa over nuclear material defined the development of South Africa's nuclear program into the 1970s. One of Van Wky's earliest articles, published in 2010, investigated the relationship between the United States and South Africa and the role of the United States as an ally of the South African State but also a critic of the apartheid government. The article overviewed how South Africa began to develop a nuclear program as early as 1965. Still, the relationship with the United States remained unchanged as it continued to cooperate with the trade of nuclear material with South Africa. This

suddenly shifted in 1976 under the Ford administration, as the United States began to purchase uranium less frequently from the international market. Van Wyk argued that it was already too late to stem any buildup of South Africa's nuclear arsenal and weapons program at this stage even as investment from trade decreased.[13] This research looked at one of the major challenges of the U.S South African partnership. As South Africa continued to rely on the United States and vice versa South Africa fell under embargos and sanctions from much of the west over apartheid policies, forcing the U.S and others to reconsider their relationship over access to uranium. South Africa still held bargaining power when it comes to uranium. Across the 20th century South Africa was able to use access to uranium as bargaining power to ensure they had the intelligence and technology to start their own nuclear programs.

The Cold War shifted to become a larger topic of Van Wyk's research. She focused more on the broader Cold War conflicts and the role of the South African nuclear program in the global conflict. She published the first of a series of articles that focused on the role of South African weapons. "Apartheid's Atomic Bomb: Cold War Perspectives" used a variety of archives in both the U.S. and South Africa to analyze the South African government's development of nuclear weapons and their perceived capability in the framework of the Cold War. The paper looks at the reasoning behind the decision to develop nuclear weapons as an ongoing safeguard against the spread of communist influence in South Africa.[14] For South Africa it was important to protect against the Soviet ideals of decolonization which could have been dangerous for the South African apartheid government. As part of this, the article discussed the complex relationship between anticommunist movements and the apartheid government, which played a

[13] Martha S. van Wyk, "Ally or Critic? The United States' Response to South African Nuclear Development, 1949–1980," *Cold War History* 7, no. 2 (May 2007): pg. 196, https://doi.org/10.1080/14682740701284124.
[14] Anna-Mart Van Wyk, "Apartheid's Atomic Bomb: Cold War Perspectives," *South African Historical Journal* 62, no. 1 (March 2010): pg. 102, https://doi.org/10.1080/02582471003778367.

pivotal role in developing the South African program. The article concluded with a discussion of the destruction of the South African nuclear arsenal and the methodology behind why South Africa joined the Treaty for non-proliferation.

Van Wyk's research also looked at South Africa's entrance to the Non-Proliferation treaty which brought an end to the nuclear weapons program. In 2015 she published an article "From the Nuclear Laager to the Non-Proliferation Club: South Africa and the N.P.T." which discussed the termination of the South African nuclear program in the 1980s after South Africa refused to succumb to pressure to sign the Treaty on the Non-Proliferation of Nuclear Weapons for twenty-one years. Throughout this period, South Africa felt pressure from embargos and sanctions, but this did not stop the country from building six nuclear devices as a deterrent strategy. This paper analyzed the reasoning behind the refusal to participate in the Non-Proliferation Treaty and the motives and intentions behind these decisions, which stayed away for many years.[15] This paper is crucial for understanding the reasoning behind the building and continuing to possess nuclear weapons in the 1970s and 80s, as a deterrent intended to project power from South Africa's white apartheid government. It also investigated the reasoning to undergo non-Proliferation in 1991 as it became clear that South Africa would soon be ruled by a Black majority government. In 2018 Van Wyk published an article, "South African nuclear development in the 1970s: a non-proliferation conundrum." This article examined the 1970s in great detail and argued South Africa's challenging of the nuclear order in the 1970s was against the grain of the rest of the world at the time. The 1970s were a decade of transformation where diplomats reconsidered the international system through the eyes of the new nuclear order, a

[15] Jo-Ansie van Wyk and Anna-Mart van Wyk, "From the Nuclear Laager to the Non-Proliferation Club: South Africa and the NPT," *South African Historical Journal* 67, no. 1 (January 2, 2015): pg. 34, https://doi.org/10.1080/02582473.2014.977337.

process expedited by the conflict or lack of conflict in the cold war. The international system had become a system of haves and have-nots of nuclear power. Not the spectrum that Hecht argued exists. The South African state felt pressure from Soviet expansionism, so the state elected to build its first nuclear device. South Africa also felt pressure from international condemnation over the apartheid regime and the relevant isolation. Additionally, South Africa was actively involved in a conflict in Angola, fighting against Soviet and Cuban-backed forces.[16] Similarly to Hecht's arguments on technopolitics, Van Wyk argued that the construction of a nuclear device was an act of techno nationalism that was also supported by western collaboration in nuclear technology in the 1960s with relationships with the west and countries like the United States, clearly signaling the departure from the nuclear non-proliferation regime that the five nuclear powers of the non-proliferation powers were attempting to establish.

This section examined some more recent research on the 20th century concerning uranium and South Africa's nuclear program. Comparing and contrasting the ideas of two leading scholars on South Africa's nuclear past. Throughout the 20th century, other significant publications investigated South Africa through many of these lenses, but with different focuses including the role that Black mineworker under apartheid policies played in the development of a nuclear South Africa.

An important piece of the development of nuclear weapons arrived from western allies in France, West Germany, Israel, the United States, and Britain. During the 20th century, one famous publication looked at South Africa's nuclear potential based on the country's relationship with West Germany. This was not the only relationship that the apartheid government had with

[16] Anna-Mart van Wyk, "South African Nuclear Development in the 1970s: A Non-Proliferation Conundrum?," *The International History Review* 40, no. 5 (October 20, 2018): pg. 1155, https://doi.org/10.1080/07075332.2018.1428212.

another western power over uranium and nuclear material. Still, this book, *The Nuclear Axis: Secret Collaboration between West Germany and South Africa*, was published in 1978 by Zdenek Cervenka and Barbara Rodgers. This is the most famous example of a 20th-century scholarly publication that covered the relationship between South Africa and European countries in its aim to gain nuclear weaponry.

The Nuclear Axis argued international efforts aimed at thwarting the proliferation of nuclear weapons can be overtaken, and commercial considerations are often given priority over global security. The book lays out why South Africa is of more considerable concern because of the conflict between independent African countries and the white minority regimes in Southern Africa, like the apartheid government. The book looked at how a South African nuclear force would alter the political situation on the African continent, which previously had been a nuclear-free zone, which many experts saw as a necessity to remain that way. Overall, the book argued that all existing nuclear weapons must be destroyed as the survival of humanity is at stake. It claims that while the work of West Germany intended to spread, the technology was used to build reactors peacefully.[17] While this was with good intentions, it was later discovered that the South African were using West German technology developed by the Karlsruhe Nuclear Center to enrich South African uranium to weapons-grade quality in exchange for South African uranium.[18] This book laid the groundwork for the South African nuclear program, international relations, and uranium.

While South Africa had relationships with West Germany, they also had secret deals with France, which were used to build the Koeberg Nuclear Power Station just north of Cape Town.

[17] Zdenek Cervenka and Barbara Rogers, *The Nuclear Axis: Secret Collaboration between West Germany and South Africa* (New York: Jullian Friedmann Books Ltd., 1978): pg. 6.
[18] Väyrynen, Raimo. "SOUTH AFRICA: A COMING NUCLEAR-WEAPON POWER?" *Instant Research on Peace and Violence* 7, no. 1 (1977): pg. 39

An article published in 2021 by Anna Konieczna looks at the strategic French nuclear assistance to South Africa between 1964 and 1979. The research for this article was conducted in archives in both South Africa and France; later, this project will examine U.N. documents focused on the relationship. While many believe this relationship was very one-sided, with only the South Africans receiving a benefit, this article uncovers how both countries benefitted from the relationship, which shared not only knowledge but also military and nuclear technologies. The article argued that while the French leaders were fully aware of proliferation risks, they maintained a relationship with the apartheid government. The paper also looked at Cold War history broadly and examines how to write the global history of the cold war as a narrative in which this type of diplomacy is not invisible.[19] In the same vein, it examined South Africa's relationship with France as a form of neocolonialism, but this diversifies itself from my argument that because South Africa was a white government it had benefits that other countries did not have, including access to French technology and capitol for the Koeberg nuclear power plant.

Some research indicated that South Africa gained nuclear infrastructure because of the failures of non-proliferation internationally. J. D. L Moore's book titled, *South Africa and Nuclear Proliferation: South Africa's Nuclear Capabilities and Intentions in the Context of International Non-Proliferation Policies*, looked at the buildup and later the de-escalation of the nuclear program as South Africa neared the signing of the Treaty on for Non-Proliferation. Moore's book examined how South Africa was one of the world's largest producers of natural uranium and, later, a significant producer of enriched uranium. Moore argued that western non-proliferation policies were less effective in South Africa for a variety of reasons, including the

[19] Anna Konieczna, "Nuclear Twins: French-South African Strategic Cooperation (1964–79)," *Cold War History* 21, no. 3 (July 3, 2021): pg. 285, https://doi.org/10.1080/14682745.2020.1823968.

lack of application of non-proliferation from western powers as it appeared more and more likely that more and more countries would gain nuclear capabilities in the coming years, this along with the access to natural and enriched uranium in South Africa made the process even faster. Moore built this argument on a survey of human, financial, and material resources in South Africa, which quickly proves construction of a weapon was well within South Africa's capabilities. Moore then looked at the incentives and disincentives of having the nuclear capability for a country with the resources like South Africa. The book broadly discussed international relationships, predominately with the west and nations aligned with the United States during the cold war.[20] Culminating with a discussion of the 1977 Kalahari incident, where South Africa's nuclear capabilities were fully realized by a Soviet satellite, leading to one of the few instances of east-west cooperation during the Cold War. While Moore's research looked substantially at international diplomacy, it only looks a little at the factors domestically and the impact of uranium mining on South Africa.

In addition to international relationships regarding uranium in South Africa, there is significant research into mining and workers' rights, concerning the policies of the apartheid regime. Francis Wilson's book, *Labour in the South African Gold Mines 1911-1969*, observed conditions in South African gold mines, which in many cases were located adjacent to uranium mines as they mined the same deposits for different material. This is just one of many publications on the issues, but this book examined the economic conditions that fueled these economies. Francis Wilson was a professor of economics at the University of Cape Town where much of his research focused on the exploitation of migrant workers in South Africa, particularly in the mines. His book opened with the argument that the development of the gold mining

[20] J.D.L. Moore, *South Africa and Nuclear Proliferation* (New York: St. Martin's Press, 1987): pg. 12.

industry in South Africa has done more than any other industry in shaping the structures that still exist in South African labor markets today. From this argument, the assumption could be made that the influence on the uranium mining industry was even more significant, as the uranium mining industry in part grew directly out of the gold mines carrying over many relevant structures. The study was collected from three primary sources; published statistical reports, government reports, publications from the gold mine industry, and data published in books, journals, and newspapers. Secondly, Francis looked at direct observation in working mines. He visited six of these sites and observed all parts of the mining process, from stope face to smelting. Lastly, Francis talked with people in the mining industry to gain more insight into his observations at mining sites. He spoke with administrative officials at the Chamber of Mines and gained access to speak with mining finance houses and the management running the mines. This included white managers, shift bosses, miners, and their Black counterparts, including clerical workers and migrant workers.[21] Overall, this book provided a great perspective on the economics behind the labor in South Africa's mines and the structures that carried through to other industries, but perhaps most strongly in the uranium mining industry.

Across all this research, there is one theme that connects them all, whether it was intentional or not. The paradox identified by Gabrielle Hecht as her main argument in *Being Nuclear* considered the challenges of describing South Africa and other African nations as nuclear even though they often have lacked a nuclear weapon across history, with South Africa being the exception.[22] Hecht claimed that a country does not need one of these weapons to be considered a nuclear nation. Instead, the presence of nuclear material, uranium, and the workers

[21] Francis Wilson, *Labour in the South African Gold Mines 1911-1969* (London: Cambridge University Press, 1972): pg 17.
[22] Gabrielle Hecht, *Being Nuclear: Africans and the Global Uranium Trade*, 2014: pg 46.

who mine uranium is often enough to consider the nation to be nuclear, especially in cases where beyond just the natural resource of uranium, colonial powers are exploiting the nation and people.

Hecht painted South Africa as the victim across the development of this history other research which looks broadly at global relationships shows that South Africa was not a victim. Instead, as an instigator which created its own path to nuclear relevance through a bargaining system that used South African natural resources as a point of leverage towards western powers who had larger intelligence and technology which South Africa needed to build the nuclear program which became a symbol of racial power over the Black South Africans who labored for its success. This leads to questions of why colonial powers saw these regions of Africa as essential to the growth of their colonial empires before the discovery and use of uranium. The crucial piece of this is natural resources available in these regions but also looking at why these resources are there in the first place and what makes them accessible. For this reason, it is vital to turn to geology to understand how these resources originated in this location and how they became more accessible to colonists across history.

I completed archival research at the Yale University Manuscripts and Archives collection with the E.S Reddy papers, the Woodrow Wilson Center's digital archive on South Africa's nuclear history, and the Forward to Freedom Anti-Apartheid Movement archive. From these resources I am building on the preexisting body of scholarly work to argue that firstly, the geologic history of South Africa and the prevalent natural resources including uranium have a profound impact on South Africa's position in the global order. Yet this connection is not automatic. South Africa gained its global position because of the agency of its government to capture the power of uranium for political gain. Secondly, race also aided South Africa's nuclear

program development. A white apartheid government ruled the county which gave South Africa more access to technology and intelligence that other Black governments in southern Africa did not have access to. Additionally, race played a role in the broader domestic systems. South Africa's Black rural population played a pivotal part in the extraction of materials used for the South Africa's nuclear program. Lastly, the nuclear program gave South Africa's a better position in the global order. Yet, this also further perpetuated themes of race and colonialism in the history of South Africa until the Black government took control in 1994. This essay explores relationships between geology, race, uranium, labor, and nuclearity. To gain a grasp of the interconnected nature it is essential to begin with the geology that shaped South Africa.

Chapter 2: Geologic Luck: The Groundwork of South Africa's Mineral Fueled Economy

The geology of South Africa is deeply linked with many of the events and themes of the twentieth century, especially those in relation to Cold War politics of nuclearity. This chapter uses South Africa's geology to set a framework that explains how uranium and other mined minerals provided the riches that power South Africa's economy. Not only did the existence of uranium help and hinder relationships abroad, it they also created divisions in South Africa through the development of the country's nuclear program. This program built on the backs of rural Black South African's and migrant workers. These themes remain reflected in modern South African society. This leads questions of the importance of geology and mining which created a platform for the apartheid government. To explain these realities this chapter describes South Africa's natural history to understand the development of physiography, geologic history, the formation of valuable minerals, and the history of mining these minerals.

Physiography

The diversity of South Africa's geology and subsequent geography stand out as they are also specific locations pivotal to the mining industries in South Africa. One of the most well-known landforms is the Great Escarpment, which divides the lowland coastal area from the high plateau in the center of the county. This escarpment creates a physical barrier between the shoreline and the inland highlands that not only changes the environmental conditions, but also creates two distinct regions of South Africa. These regions impact the movements of people, goods, and ideas between the coastal lowlands and the interior highlands. Strictly speaking, the escarpment formed from differential erosion of volcanic rocks and the softer Karoo Supergroup.

The erosional pattern created a roughly 1500-meter basaltic cap exposed along the escarpment. Erosion of the Karoo Supergroup over millions of years created the escarpment dominated by 300-600-meter-high cliffs exposing the harder volcanic rocks. This landform provides a great example of how the geology and geography of South Africa divides the inlands and coastal areas of the region which impacted early human history and still had an impact on the early mining infrastructure in the country.[23]

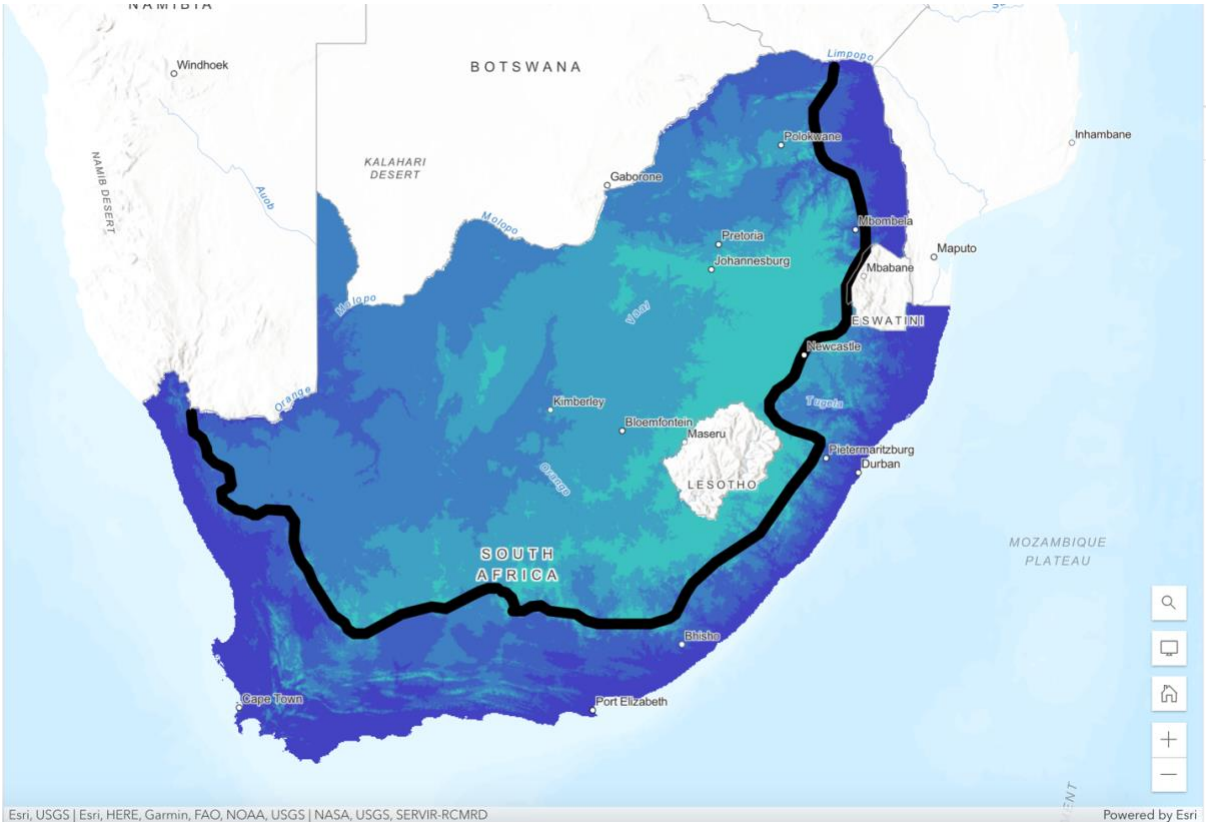
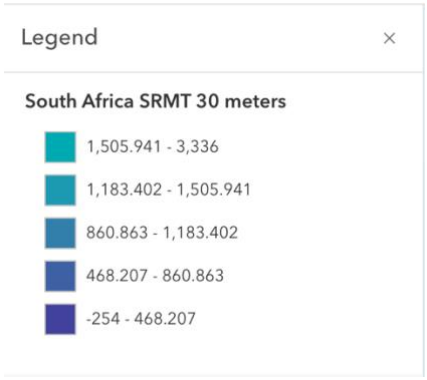


Figure 1: South Africa's Physiography and the Great Escarpment

[23] Grab, Stefan. *Landscapes and Landforms of South Africa*. New York City, NY: Springer International Publishing, 2016. Pg. 47



Since the 1830s, European geologists and geomorphologists studied the landforms across South Africa. Geomorphology, the study of the Earth's surfaces looks at how the present surface relates to the structures that created it. In 1830 Charles Darwin visited South Africa's Western Cape, which left a lasting impact on Darwin in the years leading up to his publication of *The Origin of Species*. Both he and other scientists looked at the diverse landscapes of South Africa to understand the geological history and geomorphological processes that led to today's landforms. The topography of the region describes the irregularity of the Southern African Plateau, which extends past modern South African borders into parts of eastern Africa. This structure is known as the African superswell and is responsible for the high relief terrains along the eastern coastline of the African continent. This region of southern Africa sits at an elevation of 1000 meters above sea level but formed through the rise of cratons. A craton is an old, stable part of continental lithosphere consisting of the crust and upper sections of the mantle. Generally, cratons like these only rise to an elevation of 400 to 500 meters, yet research shows how unusually hot rocks deep in the Earth's mantle beneath the African Plate produced the excess elevation in the African superswell of the southern African cratons.

Topography and the erosional history, as well as the relationship between the two tell the story of the formation of current landscapes. Plumes are bodies of hot rock at the core-mantle boundary that subsequently rise through the mantle increasing the volume of rock beneath the crust. Modeled mantle densities and viscosities assume that uplift in southern Africa is plume related and this topographic anomaly is attributed to the persistence of a Large Low Shear

Velocity Province at the Core-Mantle boundary. Large Low Sheer Velocity Provinces are characteristic structures of the lower mantle. These represent thermal irregularities that became hot, upwelling regions of mantle, partially responsible for the high plateau in central South Africa by increasing the volume of rock beneath the Earth's surface and subsequently increasing elevation at the surface. The observed topography of Southern Africa does not correlate with the predicted dynamic topography based on plume models. Plumes models predict the topographic changes that develop when plumes reach the base of the lithosphere. Because these models do not match the present landforms in southern Africa it suggests the modern topography reflects stresses from plate tectonics instead of mantle plumes. Plate tectonics refers to how the motion of oceanic lithosphere and continental lithosphere crafts the landscapes as these pieces move together and apart from one another. The modern topography of southern Africa originates from episodes where plate boundaries reorganized which suggests that the most dominant influence on modern topography is the relationship between the stresses associated with plate movements. Not as much those that previously associated with mantle plumes.[24]

Geologic Evolution of African Continent

To understand the geologic evolution of southern Africa there are a few essential terms used to describe the development of geologic history. Kimberlites are igneous intrusions sourced from the mantle and vertically integrated into the crust. They play a role in explaining the geological developments of southern Africa. Kimberlites indicate different geologic processes took place beneath the surface. These intrusions are responsible for the presence of diamonds

[24] Moore, Andy, Tom Blenkinsop, and Fenton (Woody) Cotterill. "Southern African Topography and Erosion History: Plumes or Plate Tectonics?" *Terra Nova* 21, no. 4 (2009): pg. 310. https://doi.org/10.1111/j.1365-3121.2009.00887.x.

near the surface as they act as transport from the high-pressure and temperature environment inside the Earth. The term kimberlite originated from Kimberly, South Africa a diamond mining city in the center of the country.

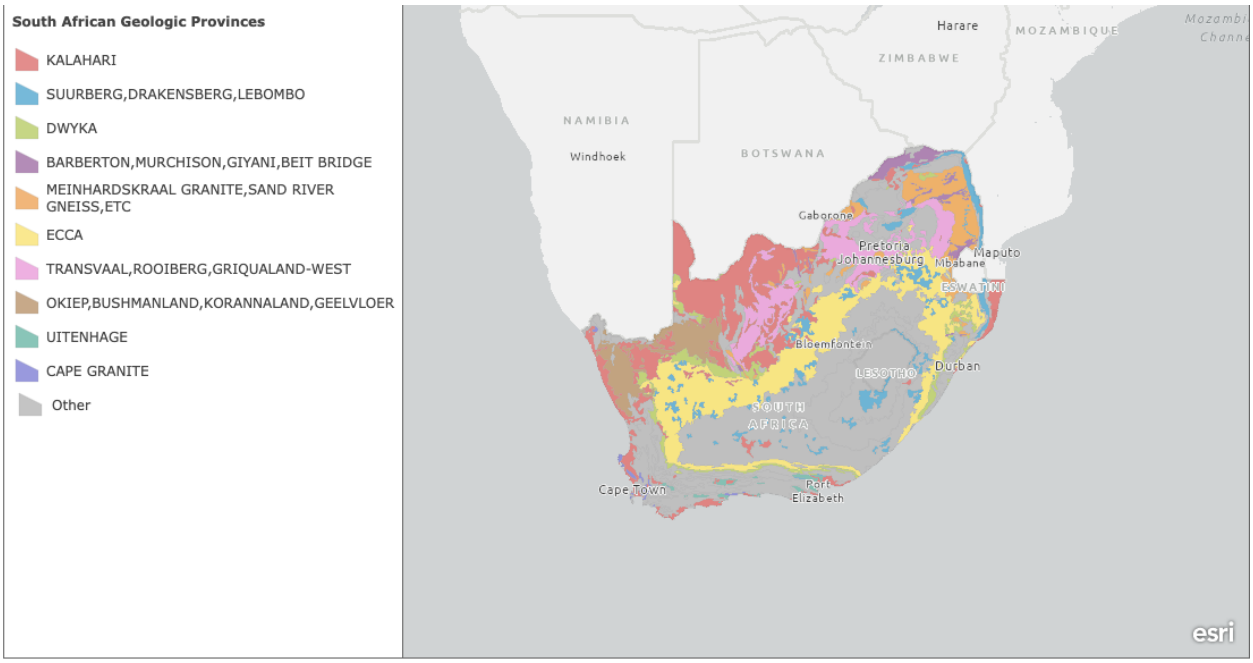


Figure 2: South African Geologic Provinces

South Africa's geology is broadly understood through its geologic groups. Some of the most important include into the Kalahari Group, Karoo Supergroup, Beaufort Group, Bushveld Complex, Transvaal Supergroup, and Drakensberg Group. Some of these are relevant to the story of South Africa's mining wealth. Others are not relevant for minerals but play a significant role in the geologic history.

South Africa contains some of the oldest rocks in the world. It is also a location of complex geologic processes that drove the formation of the geography and the geologic resources which continue to propel the South African economy. The process of building the

continent began in the Archaean Eon, between 4,000 million years ago and 2,500 million years ago. In this age the mantle was much more active than it is today resulting in an everchanging global structure of continents as plates shifted across the Earth's surface. Even with the ongoing changes in the African continent, the continent recorded much of the Earth's geologic history beginning with the formation of continental crust in the Archean (4,000-2,500 million years ago) and extending into the Neoproterozoic Era (1 billion years ago-541 million years ago) with the Pan-African orogeny. Orogenies are periods of mountain building often resulting from the convergence of tectonic plates.[25]

The supercontinent Gondwana formed between 800 and 650 million years ago as Rodinia pulled apart in the northern portion of the Earth. The Gondwana landmass ultimately consisted of the present-day Africa, South America, India, Madagascar, Australia, and New Zealand. The collisions to build the Gondwana took place during the Neoproterozoic (1 billion years ago-541.8 million years ago) into the Paleozoic (541 million years ago-252 million years ago) during the formation events of the Pan-African Orogeny. This orogeny is responsible for the collisions that created much of the metamorphism still visible in rocks within Earth's crust in southern Africa. Collisional metamorphism takes place as an ocean basin closes and two pieces of continental crust come together. The first of these orogenic events known as the East African Orogeny took place as the Mozambique Belt (north of Kalahari and Kaapvaal cratons) formed from the collision of Madagascar, Sri Lanka and East Africa. The second and third orogenic events took place between 600-530 million years ago. The Brasiliano Orogeny brought together much of South America and Africa, while the Kuunga orogeny comprised of the collision of

[25] Kroner, A. "Proterozoic Crustal Evolution in Parts of Southern Africa and Evidence for Extensive Sialic Crust Since the End of the Archaean." *Philosophical Transactions of the Royal Society of London. Series A, Mathematical and Physical Sciences* 280, no. 1298 (1976): pg. 541. http://www.jstor.org/stable/74577.

Australia and Antarctica. These three orogenies assembled Gondwana.[26] Africa formed as the Kalahari plate collided with the Congo and the Rio de Plata to close an ocean around 540 Ma. The formation of this supercontinent built a framework for the landmass that became Africa when Gondwana later broke apart.

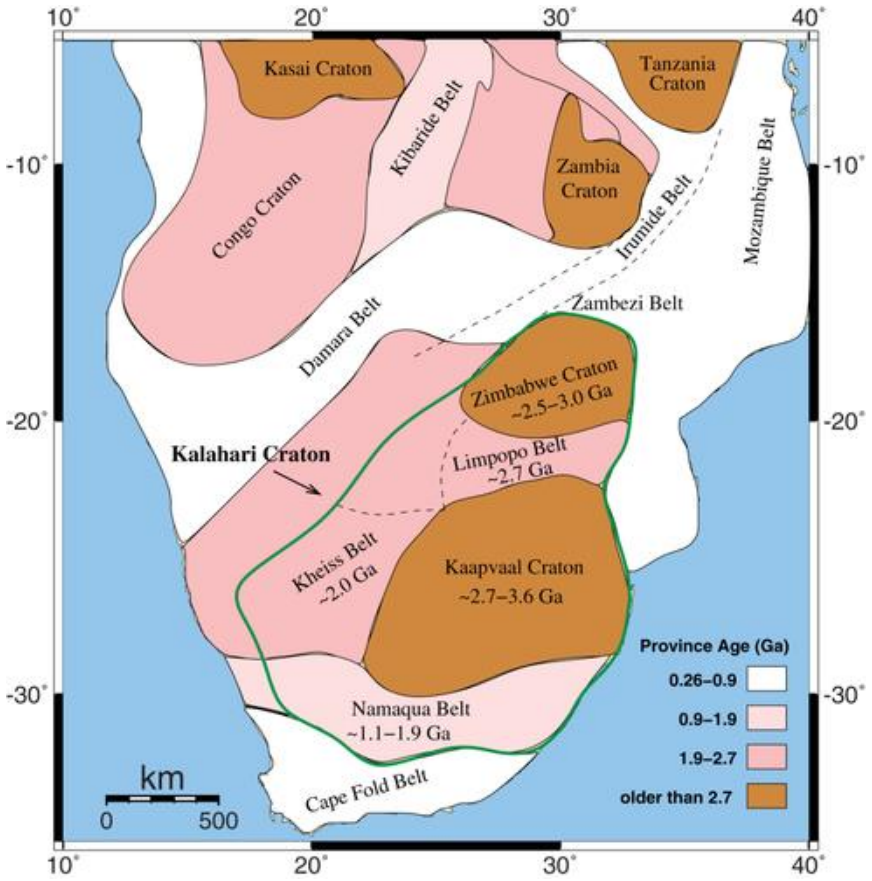


Figure 3: Tectonic map of southern Africa and distribution of Archean and Proterozoic terranes. In above image belts aged to 0.26-0.9 billion years mostly result from the Pan-African Orogeny. The green line denotes the location of the Kalahari Craton. From (Ashwal and Burke, 1989).

The collision of these cratons led to the larger formation of the continent. The oldest portion of African continental crust known today formed in the Kaapvaal region. Today the Kaapvaal region of South Africa is also one of the most productive mining regions. These pieces

[26] Meert, Joseph G., Van Der Voo Rob, The assembly of Gondwana 800-550 Ma, Journal of Geodynamics, Volume 23, Issues 3–4, 1997, Pg. 232, ISSN 0264-3707, https://doi.org/10.1016/S0264-3707(96)00046-4.

of crust contain some of the most pristine mid-Archaean rocks which underwent extensive metamorphism losing many of their original characteristics. This metamorphism is likely responsible for much of the mineral deposit formation in this region of South Africa.[27]

The supercontinent Pangea formed following the combination of Laurasia and Gondwana which combined in the Carboniferous Period (335 million years ago). The breakup of Pangea about 180 million years ago took place as southern Africa began to separate from the Falkland Plateau. The Falkland Plateau now sits to the east of Argentina in the Atlantic Ocean. This rift formed the which later opened into the Indian Ocean. The Falkland Mountains, situated on top of the plateau eventually eroded to a flatter plateau surface.

Cape Mountains formed under compression as the Falklands plateau moved northward and folded the Cape Supergroup into the Cape Fold Mountains during the formation of Pangea. The Cape Supergroup was later covered with Karoo sediments during the Permian period (298 Ma-251 Ma). The Karoo sediments make up the Karoo Supergroup which stretches from the Kalahari Desert to the southernmost edges of the continent and South Africa's southern coastline. This deposition took place after igneous intrusions and these sedimentary rocks now cover two thirds of southern Africa. These rocks are made up of shales and sandstones deposited in the marine glacial environments to river settings from the Late Carboniferous (359.2-299 million years ago) to the Early Jurassic (201.3 -174.1 million years ago) Periods during an ice age. They also hold vast mineral wealth.

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[27] de Wit, Maarten J., Cornel E. de Ronde, Marian Tredoux, Chris Roering, Rodger J. Hart, Richard A. Armstrong, Rod W. Green, Ellie Peberdy, and Roger A. Hart. "Formation of an Archaean Continent." *Nature* 357, no. 6379 (1992): pg. 553. https://doi.org/10.1038/357553a0.

These older blocks of crust make up large portions of the supercontinent Gondwana. The sediments from these cratons account most of the present-day African continent's landmass (see figure 2) which spans two billion years of the continent's history.[28] The areas the cratons span when compared with surface geology exposes the impacts of these cratons' movements on modern geologic structures and surfaces. Both the Kaapvaal and Zimbabwe cratons, located in the northern parts of South Africa exhibit a relatively thick upper portion of the mantle which was impacted by plume activity and volcanism over the past 2,000-million years. This region indicates that the mantle was depleted by extractions from a major melting event. The Kaapvaal craton indicates that there were multiple episodes of plume activity. This is implied by the presence of dome structures including the Johannesburg Dome.[29] Plume activity remains important because plumes act as transportation for kimberlites to bring minerals to the surface. Plumes impacted the buoyancy of the Western Gondwana craton because of the interactions between the plumes and lithosphere. These interactions led to Cretaceous (145.5-65.5 Ma) uplift and interaction between hotspots and kimberlites.[30]

Formation of deposits

To understand the distribution of deposits in South Africa it is essential to understand the geologic provinces where they are present. South Africa is broken up into distinct geologic provinces, which are dictated by the dominant rock types and structural elements in each region.

[28] Guerer, Derya, Roi Granot, and Douwe van Hinsbergen. "Noise in the Cretaceous Quiet Zone Uncovers Plate Tectonic Chain Reaction," 2021. Pg. 12 https://doi.org/10.31223/x5j626.
[29] Afonso, Juan C., Walid Ben-Mansour, Suzanne Y. O'Reilly, William L. Griffin, Farshad Salajegheh, Stephen Foley, Graham Begg et al. "Thermochemical structure and evolution of cratonic lithosphere in central and southern Africa." *Nature Geoscience* 15, no. 5 (2022): pg. 407.
[30] Hu, Jiashun, Lijun Liu, Manuele Faccenda, Quan Zhou, Karen M. Fischer, Stephen Marshak, and Craig Lundstrom. "Modification of the Western Gondwana craton by plume–lithosphere interaction." *Nature Geoscience* 11, no. 3 (2018): pg. 206.

The Bushveld Complex, Witwatersrand Basin, Kaapvaal Craton, and Transvaal Supergroup all host important mineral deposits in South Africa.[31]

The Witswatersrand Basin is responsible for just over 93% of South Africa's gold output and it also produces large volumes of uranium, silver, pyrite, and osmiridium. Other nearby formations such as the Bushveld Complex (igneous) and Transvaal Supergroup (sedimentary) contain vast amounts of chromium and vanadium as well as other industrial metal deposits. These complexes are much older than the Karoo Supergroup sedimentary units which sit directly on top of them.[32]

The Kaapvaal Craton sits beneath parts of northern South Africa, just south of the Zimbabwe craton. The oldest rocks of this craton lie along the southeastern, eastern and northern margins. At these locations the oldest metamorphic rocks are stitched together by intrusions which occurred steadily between 3.25 and 2.8 billion years ago. By 3.0 billion years ago a global change in Earth's systems meant the lithosphere had become significantly more rigid and was able to support the development of Dominion, Pongola, and Witwatersrand sedimentary basins on top of the older igneous and metamorphic rocks. Through the Archean the cooling of the Earth's crust allowed continents to form as the lithosphere stabilized. Prior to this progress early Archean lithosphere could not support these basins because it was not yet rigid enough. After the formation of these basins there was extensive volcanism and granitoid activity across the craton as the mantle remained active while more material deposited into the basins.[33]

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[31] Singh, Mayshree, Andrzej Kijko, and Ray Durrheim. "Seismotectonic models for South Africa: Synthesis of geoscientific information, problems, and the way forward." *Seismological research letters* 80, no. 1 (2009): pg 75.
[32] Ahiakwo, N. I., A. C. Egwuonwu, and O. C. Okeke. "A review of the geology and mineral resources of South Africa." *International Journal of Advanced Academic Research* 4 (2018): pg. 91.
[33] Eglington, B. M. "The Kaapvaal Craton and Adjacent Orogens, Southern Africa: A Geochronological Database and Overview of the Geological Development of the Craton." *South African Journal of Geology* 107, no. 1-2 (2004): pg. 24. https://doi.org/10.2113/107.1-2.13.

Because of the extensive erosion in the region, it is still debated how the Witswatersrand Basin formed, whether from a meteor or as a basin caused by the formation of a nearby mountain belt, known as a foreland basin. The Witwatersrand uranium and gold deposit is one of the most researched geologic features of South Africa. A foreland basin formed the central uplift known as Vredefort in Witwatersrand as crustal plates moved from the north and the west to construct the foreland basin. Other theories for the formation of the Witwatersrand Basin postulate that it may have formed from a meteor impact. This hypothesis is complicated by the absence of meteorite substance in the basin.[34]

The Witwatersrand Basin's ore-bearing reefs are confined to the depression, which began to fill 3,074 million years ago. Sedimentary rocks deposited in the basin are divided into horizons of gold quartz and sulfide ores. The Witwatersrand deposit is a leader among the Precambrian gold deposits on the global scale only challenged by Kalgoorlie, located in Australia. The Kalgoorlie formed over a much longer period leading to a larger deposit of gold. Because the uranium and gold deposits originated from a melt that took place inside the earth with energy emanating from inside the Earth the conditions indicate the occurrence of uranium and gold deposits. This interior melting process is responsible for the vast spreads of uranium and gold bearing structures in the depression of the Kaapvaal craton, as well as the presence of diamonds, platinum, and chromium minerals in ores.[35]

Another aspect that plays an important role in the formation of mineral wealth in the region is the diamond bearing kimberlite formation that lies below modern-day South Africa. Earth's oldest cratons are also the most productive in terms of their diamond production.

[34] Marakushev, A. A., L. I. Glazovskaya, N. A. Paneyakh, and S. A. Marakushev. "The Problem of the Origin of the Witwatersrand Uranium-Gold Deposit." *Moscow University Geology Bulletin* 67, no. 3 (2012): pg. 143. https://doi.org/10.3103/s0145875212030052.
[35] Ibid, 149

Diamonds form up to 150 kilometers inside the Earth in volcanic rocks called kimberlites which originate by melting deep in the mantle. These volcanic kimberlites are brought to the surface by rising craton eruptions. Kimberlites tend to form along the edges of cratonic blocks, meaning the margins of cratons are the most productive regions. This is examined using plate reconstructions and tomographic images which outline the edges where cratons are more likely to penetrate the upper sections of the crust.

Banded iron formations are sedimentary rocks that consist of two alternating layers of iron rich and iron poor rocks. These two rocks are often iron oxides (iron rich) and cherts (iron poor). Gold mineralization processes takes place within banded iron formations of the Kalahari Goldridge deposit, located at the Kraaipan Greenstone Belt. Greenstone belts are packages of variably metamorphosed volcanic sequences and sedimentary rocks within Archaean aged cratons. Located in the northwest province of South Africa, the Kraaipan Greenstone Belt contains gold ore deposits. Typically, greenstone belts are interpreted as forming at ancient oceanic spreading centers where plates pull apart and magma cools forming new crust along the ocean floor. The hydrothermal activity of the greenstone was the main episode in gold formation in this environment when these belts sat on the ocean floor.[36] Hydrothermal vents are areas where a fissure on the seabed such as a mid ocean ridge that can lead to deposits of gold and silver. The past existence of these hydrothermal vents during the formation of the greenstone belts is responsible for the prevalence of gold in the region which forms along these vents with other minerals including cobalt, zinc, and silver. Gold accumulates in the vents from hot water circulating into the Earth's crust through fractures. The circulation creates metallic rich fluids

[36] Hammond, Napoleon Q., and John M. Moore. "Archaean Lode Gold Mineralisation in Banded Iron Formation at the Kalahari Goldridge Deposit, Kraaipan Greenstone Belt, South Africa." *Mineralium Deposita* 41, no. 5 (2006): pg. 492. https://doi.org/10.1007/s00126-006-0074-6.

that group on a specific rock. Once the rock becomes oversaturated the metal ore solidifies into ore minerals.

The structural characteristics of Free State, Klerksdorp, West Wits Line, West Rand, Central Rand, East Rand, and South Rand goldfields within the Witwatersrand Basin further support this assumption that the basin formed from an impact event roughly 2 billion years ago. Based on this there are two distinct deposition events that could be used to mark the end of deposition in Witwatersrand Basin and Transvaal Supergroup. These are the Umzawami (2.7 billion years ago) and Ukubambana (2.2-2 billion years ago) events. Thrust belts in the basin between 2.2.-3.0 billion years ago align with the super continent cycles. The period between these two events was dominated by four large scale basin forming events that ended with the deposition of the volcanic-sedimentary sequences of the Klipriviersberg group in the basin. This completed the formation of the basin. After these depositional events the metamorphism that took place within the basin prepared the system to precipitate gold through metamorphic and hydrothermal fluids.[37]

The two most well-known uranium deposits are located at the Rössing uranium mine in present day Namibia (colonized by South Africa for much of the 20th century) and Witwatersrand, located just outside of Johannesburg, and a very important location for gold mining in South Africa. The Rössing uranium deposit is in central Namibia. It is hosted in a granite body that formed in the central zone of the Pan-African Damara Orogen. This granite is part of a group of granites in the surrounding areas which contributed to the formation of the

[37] Dankert, Bjinse T., and Kim A.A. Hein. "Evaluating the Structural Character and Tectonic History of the Witwatersrand Basin." *Precambrian Research* 177, no. 1-2 (2010): pg. 7. https://doi.org/10.1016/j.precamres.2009.10.007.

uranium deposits in Rössing. The Rössing Dome is a near perfect example of a granite dome that is surrounded by metasedimentary rocks.[38] Uranium mineralization and a high fluid flux rate are also confined to the curved zone to the south and southeast of the dome. Uranium deposits formed in the granite near the ends of its crystallization as tectonic forces from the Pan-African collision fractured rocks allowing hot, mineral rich fluids and magma to percolate through the new fractures. This altered the granites and left behind high concentrations of uranium bearing minerals. Fault modeling is used as an indicator that the shear area underwent deformation and metamorphism which produced a large network of faults that were exploited and filled by the fluids. These leucogranites which filled the fractures contain uranium. The development of the Rössing formation in the rim of the dome was pivotal in the crystallization of the uranium-enriched granites within a highly fractured area.[39]

The granites at the Rössing mine in Swakopmund, Namibia contains higher than average concentrations of uranium and thorium. The overview of the tectonic setting looks at the Damara Orogen to begin. The common view is that the relationship in the Central Zone of the orogeny between the Neoproterozoic metasedimentary rocks and the underlying red granite gneiss is that during the Damara orogeny the red granite intruded and later deformed. Conflicting research claims that the red granite gneiss could be Grenville in age, roughly 1.5-1 billion years in age. The Etusis Formation and the granite gneiss beneath it made up of metamorphic rocks and illustrates the strain nearby rocks during the orogen in the ductile shear zone.[40] A ductile shear

[38] Oliver, Grahame J. H. and Judith Ann Kinnaird. "The Rössing-SJ Dome, Central Zone, Damara Belt, Namibia: an example of mid-crustal extensional ramping." (1996) pg. 59.
[39] Basson, I.J, and G Greenway. "The Rössing Uranium Deposit: A Product of Late-Kinematic Localization of Uraniferous Granites in the Central Zone of the Damara Orogen, Namibia." *Journal of African Earth Sciences* 38, no. 5 (2004): pg. 413. https://doi.org/10.1016/j.jafrearsci.2004.04.004.
[40] Bowden, P., D. Herd, and J. A. Kinnaird. "The Significance of Uranium and Thorium Concentrations in Pegmatitic Leucogranites (Alaskites), Rössing Mine, Swakopmund, Namibia." *Communs geol. Surv. Namibia* 10 (1995): pg. 43.

zone is a long and narrow zone of relative displacement. They are like faults but without the fracture planes because the rock is ductile and causes concentrations of large strain across the whole shear zone.

The development of uranium resources at Witwatersrand and Rössing developed in two distinct ways, but the result is still a plentiful high density of uranium. In the case of the Witwatersrand Basin uranium precipitated during deposition of material when the Witwatersrand Basin was underneath the Witwatersrand Sea. Alternatively, the development of resources in Rössing stems from pan African collisions which fractured preexisting rocks allowing mineral rich magmas to flow into the fractures. These magmas ultimately became the resource for uranium.

History of Mining

The story of mining in South Africa stretches from the precolonial mining of pigments in stones which began around 40,000 years ago. Humans mined the first metal ores about 2,000 years ago and the industry rapidly developed following the arrival of colonists.[41] Even with the arrival of colonists who mined the lands as early as 1681, movements into the more central parts of the country did not occur until the 19th century. Prior to this most of the mining operations took place in the Northern Cape between the coastline and the Great Escarpment. Early mining operations by indigenous peoples focused on collecting iron, copper, tin, and gold for artisanal use. With the arrival of colonists, the utilitarian commodities of iron, copper, and tin became most important until they discovered larger quantities of gold. These processes began in 1852 once an export port was identified along the coast at Hondeklip Bay about five hundred

[41] Hammel, Dipl.-Ing. Christian, White, Pfeiffer and S. Miller. "Pre-colonial mining in southern Africa." *Journal of The South African Institute of Mining and Metallurgy* 100 (2000): pg. 49.

kilometers northwest Cape Town. The discovery of diamonds in kimberlites near Kimberly, South Africa in 1870 and gold from the Witswaterand Basin in 1886 shifted the focus of mining as systems began to move inland to Kimberly for diamonds and Witwatersrand for gold. Both areas remain some of South Africa's most productive mining regions. This laid the early groundwork for South Africa's more modern reliance on mining as a major industry, but the delay between the earliest mining practices and the modern inland mining by colonial powers was driven by the existence the Great Escarpment.[42]

The geography of South Africa shaped its human history from the precolonial eras into the more modern history. It also dictated policy and politics throughout the apartheid regime and is partially responsible for the longevity of these policies aided by the systems of labor and mining industries in South Africa. The importance of mining in South Africa's economy developed an economic structure across the country which led to the formation of a small, white ruling class especially in areas with a need for industrial labor. The mining industry formed a new racial order where Black migrant labor from rural South Africa and beyond South Africa's border completed the deepest, most dangerous mining for the least profitable ore. The white ruling class managed these workers with brutal control. Geography dictated the movements of peoples but also the politics and economics of mining.[43] These movements of people had one main goal. Locate these poor Black workers in the most resource rich areas with large potential for mineral wealth to exploit.

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[42] Knight, Jasper, and Christian M. Rogerson. *The Geography of South Africa: Contemporary Changes and New Directions*. New York City, NY: Springer International Publishing, 2019. pg. 47

[43] Lester, Alan. *From colonisation to democracy: A new historical geography of South Africa*. Vol. 8. IB Tauris, 1998. pg. 3

The Kaapvaal craton and its relationship with the accessibility of precious minerals in the Watwatersrand Basin were pivotal to the movement of mining to more inland locations in South Africa. Initially, colonial mining practices began towards the exterior regions of the country to avoid traversing the Great Escarpment that protected the interior of the country. Following more exploration of the mining possibilities there was a move to begin mining in the interior of the region. This was only done because the mineral deposits were very close to the surface and therefore easy to access. The rise of the Kaapvaal Craton and the subsequent eruption of lavas from the mantle carried precious minerals to the surface in granite dikes is responsible for the economic viability of the mining in the Witwatersrand and other adjacent basins along the interior of South Africa.

The presence of these valuable minerals like diamonds, gold, and heavy metals positioned South Africa for intensive industrial mining operations from relatively early in its history. This leads to the argument that mining materials and technology were quite well developed in South Africa. As a result, this chapter argues that the production and exploitation of uranium was simplified after its discovery in South Africa because of the past mining history of the country. The infrastructure already in place pushed South Africa's uranium mining to new levels.

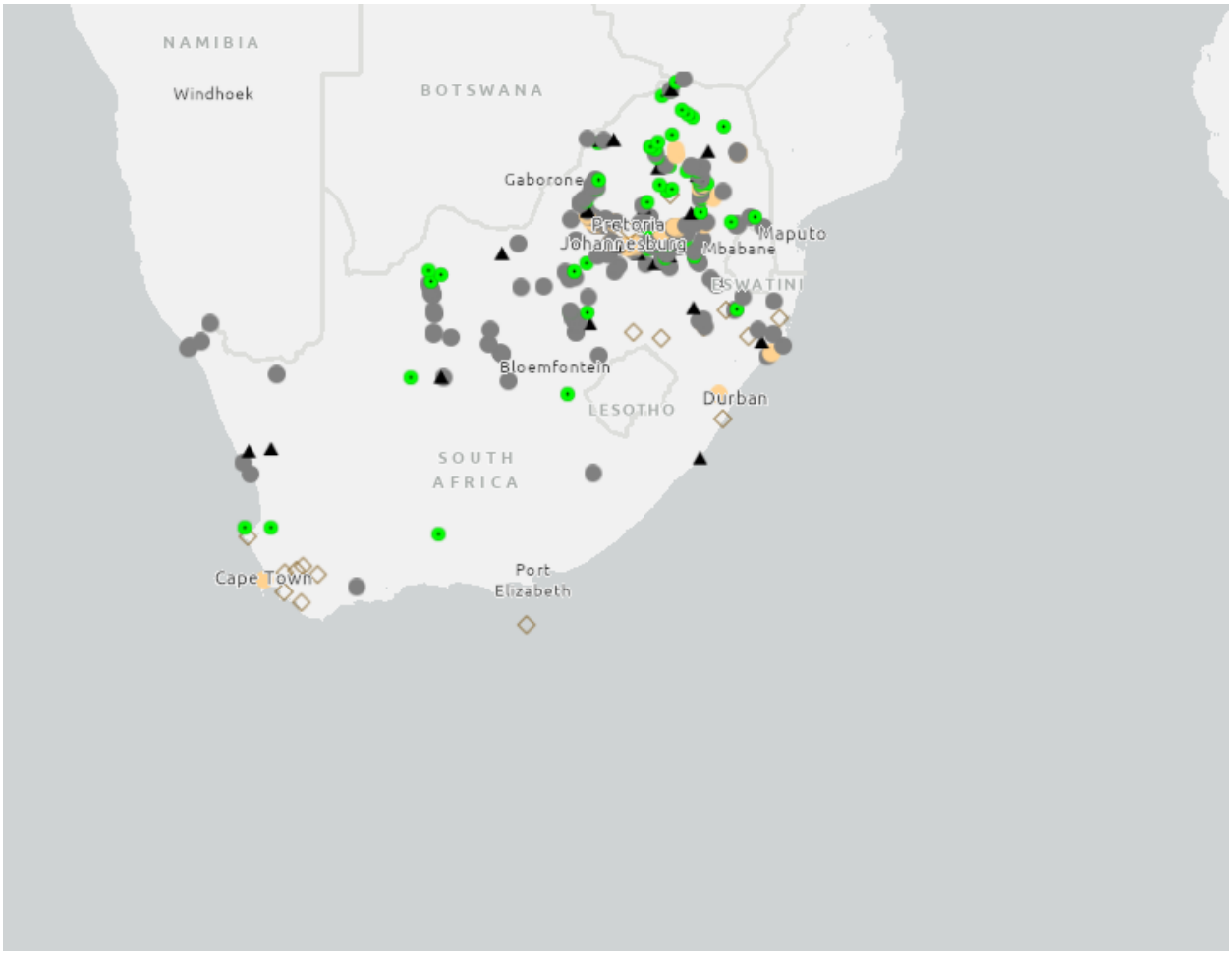

Figure 4: South African Mining Infrastructure

Much of the mining is in the Pretoria and Johannesburg region of the country. Locations where exploration identified future mining locations are prevalent nearby the preexisting mines. Processing facilities refineries are located nearby to preexisting mines or coastal export cities.

In addition to Witwatersrand, another major location for uranium and gold mining in southern Africa is the Rössing mine located in west central Namibia. The mine opened in 1976

under the Rio Tinto mining company. Prior to the opening of the Rössing mine, deposits of uranium were discovered in Namibia in 1928. South Africa colonized Namibia until 1989 when Namibia declared independence, but throughout this whole period Rio Tinto, a British company, ran the mine a which extracted much of the wealth from Namibia often using Namibian and migrant labor under apartheid policies. To this day, the Rössing mine is one of the largest mining complexes in the world for uranium. While the results of the uranium mining are very similar to those located at Witwatersrand a unique set of processes led to the formation of deposits at Rössing which differentiate it from the deposits located in the Witwatersrand Basin.

The Rössing Uranium mine and the Witwatersrand Basin are more similar than most realize. While Witwatersrand is very remote from the trade ports along the coast of South Africa the ease of mining in terms of the quality of ores and its proximity to Earth's surface is a main reason why it is so productive in gold and uranium. While Witswatersrand was mined earlier because of colonial enterprises in what became South Africa in 1886 the German mining in Namibia was delayed and began in 1908. Larger scale mining across Namibia did not occur until South Africa took control of Namibia as a colony under the apartheid government. It was after this that South African officials explored Rössing more deeply, which ultimately became the largest open pit uranium mine in the world. While they are not very different geologic settings there are parallels that can be drawn between the two to understand the accessibility of minerals.

Diamonds are responsible for most of the early mining industry in South Africa. Diamond mining also developed infrastructure for further mining exploration for other minerals. The intrusions and tectonic relationships that took place between two pieces of the African Plate

(Somali and Nubian) during previous supercontinents are part of what is responsible for the formation of South Africa's mineralogical luck.

The natural history of South Africa does far more than just explain how the ground beneath the country formed including the landscapes and resources. It also helps reveal how present-day South Africa gained its position in the global order. Geology informed all of these aspects. It dictated where people work, who does what jobs, and how wealthy a country is. The presence of minerals including gold, diamonds, and uranium in South Africa brought immense wealth to the country's economy. As a result, the white apartheid government built the economy on these minerals. The presence of uranium was even more important for South Africa's attempt to ascend the global order through its technopolitical projection of new nuclear technologies. South Africa's large, easily minable uranium deposits gave the country a head start to become a nuclear power. The agency the apartheid government captured its natural resources towards a nuclear South Africa.

Chapter 3: South Africa's Nuclear Program

When contemplating the Cold War and the rise of nuclear programs across the globe, many scholars focused on the rise of programs in western Europe and other global powers like the United States and Britain. South Africa is far from the first country to come to mind, yet with its easy access to uranium it was already closer than many of its competitors. South Africa had the potential to quickly start an energy program and later a military program. Geologic luck shaped the countries policies and opportunities. The deep connections between South Africa's geology and domestic policies influenced the rise of South Africa's nuclear program. South Africa's program improved through international relationships that propped up this program. South Africa's domestic policies held agency which propelled the country into a position of nuclear power. Still, South Africa's relationships with the United States, Israel, France, and even West Germany benefitted the rise of the South African program. These relationships were not one-sided; countries also significantly benefitted from the relationship they shared with the South African State.

South Africa was not content only sourcing uranium. It wanted its own nuclear program. The primary focus of the program was energy. While weapons are the first thing that comes to mind when deliberating the nuclear options of a country, one of the most imperative parts of the rise of the South African nuclear program was the construction of the Safari-I experimental reactor in 1965 and the Koeberg Nuclear Plant in 1976. This was pivotal for the program's rise but also laid the groundwork for the atomic weapons that South Africa developed a few decades later. One essential aspect to consider when discussing the South African nuclear program is the ruling leadership of the South African government during the 20th century. The white minority apartheid government ruled South Africa, taking advantage of Black Africans across all parts of

society. Economic sanctions resulting from the government shaped South Africa's relationship with other countries, especially in the 1980s and 90s.

South Africa relied on the financial, intelligence, and technological help from other countries to build its nuclear program. Beginning in the 1960s, South Africa received assistance from the United States enriching uranium mined in South Africa. South Africa sent this uranium to the United States where American scientists enriched it then used or sold it back to South Africa.[44] The United States slowed amount of South African uranium it enriched at the end of the 1960s to ensure South Africa did not stockpile enriched uranium for weaponry. South African Atomic Agency developed technologies to allow the country to enrich uranium on its own accord. In 1969 South Africa constructed a plant to enrich uranium; this move ended their reliance on the United States as South Africa even developed a covert weapons program as it publicly planned for building its first major nuclear power project. The independency of this plant from the weapons program created many options for the future of South Africa's nuclear potential. Uranium provided South Africa with leverage on other nations, but also set the country up with a conundrum. South Africa needed to remain independent, and the government acted to free itself from reliance on the West throughout the Cold War.

Nuclear Beginnings: South Africa and Uranium Nationalization

The 1940s changed how major world powers considered uranium and its value as a mineral. Modern scholarship, including Gabrielle Hecht's book *Being Nuclear*, focuses on the nuclear nature of uranium and whether possessing the material makes a country "nuclear." She also discussed where this nuclearity lies on a spectrum, meaning that countries are just nuclear or

[44] Levin, S. A., and S. Blumkin. *Enrichment supply and technology outside the United States*. No. K/OA--3094. Oak Ridge Gaseous Diffusion Plant, 1977. Pg. 4

not nuclear. They can lie in between these two extremes and can evolve as a nation acquires material and technology. Hecht's argument left out a more significant part of the geology that created uranium for African nations. Issues surrounding nuclearity in South Africa began as early as 1949, as the Soviet Union began to weaponize. The House of Assembly in Parliament debated on the Atomic Energy Bill which outlined the Union's earliest legislation over uranium. South Africa's legislators understood the country had a large volume of usable uranium at this time. The discussion in Parliament focused on nationalizing the mining and ownership of uranium so that the South African state held control over mining. In the years following the U.S bombing of Hiroshima and Nagasaki, South Africa made an intentional effort that ensured their uranium was under the control of the state. This decision by South African officials ensured that countries like the United States depended on rather than controlled South Africa for raw materials.

South Africa's existing infrastructure gave the government a head start in building policy dictating how the state would manage uranium mining. At the same time a movement in international politics intended to gain a greater understanding of what nuclear weapons meant for the world order. This was particularly important for South Africa, which had immense natural potential for a uranium industry. Ultimately this industry became a leading part of the economy later in the century.[45].

In March of 1949 there was already meaningful research at multiple South African gold mines to understand the potential for nuclear resources in the country. As explained in the previous chapter the environments for gold and uranium are frequently associated with one another. The South African government gave gold mining companies the right to conduct exploratory miner as they held the mining rights for much of the resource-laden land in South

[45] Kornprobst, Markus. "African agency and global orders: the demanding case of nuclear arms control." *Third World Quarterly* 41, no. 5 (2020): pg. 913.

Africa which had sources of both gold and uranium. This ensured that South Africa remained in control of the minerals and did not become a victim of neocolonialism as they did in 1886 when transnational corporations managed the gold rush at Witwatersrand.

These discussions outlined some of the earliest public intentions by the South African government to become a nuclear power once they had a clearer idea of the value of uranium. The nationalization bill was the beginning of South Africa setting a course to protect the countries' uranium reserves to build a nationalized mining and uranium trade system. The national system ensured that South Africa remained free from neocolonial advances by the west.

The 1949 bill that nationalized uranium and constructed the Atomic Energy Board was an essential first step by the South African government to ensure that the government kept the wealth that may stem from these findings. Ownership of the resources needed to remain within South Africa. Furthermore, the Atomic Energy Bill prioritized uranium mining within the country. If the Minister of the Atomic Energy Board saw any reason to enter a plot of land that they believed contained uranium, they had the right to explore the potential of the land for the government. This was further reinforced to the point that as the government discovered uranium and mined it, it became property of the state. The reasonings for this were the potential damage that the material could cause, but also so that the state held control of the material and could use and sell it as it deemed acceptable.[46]

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[46] "House of Assembly Debates, Union of South Africa, on Atomic Energy Bill, First Session, Tenth Parliament", March 28, 1949, Wilson Center Digital Archive, National Archives at College Park, 21.79 South Africa d. General, 1947-1950, Special Assistant to the Secretary for Energy and Outer Space, Records Relating to Atomic Energy Matters, 1944-1963; General Records of the State Department, RG 59. Contributed by Mara Drogan. https://digitalarchive.wilsoncenter.org/document/117461

The irony of the Atomic Energy Bill discussions in Parliament was that many politicians did not fundamentally understand nuclear weapons or nuclear energy. While they understood that uranium was the raw material that powered the atrocities at Hiroshima and Nagasaki, they did not comprehend how the material went from this natural form to something that could be used as civilian energy or military strength. At this stage, only a few people understood the power of uranium, but the symbolism of nuclear material already gave the state agency to nationalize its nuclear future. Throughout the debates in Parliament, politicians admitted their naivety but also addressed the importance of passing the bills to nationalize South Africa's supply. What was clear following these debates was that uranium was a potentially powerful resource that required immediate government attention because control of uranium changed how other countries perceived South Africa on the global stage.[47]

To conclude the discussion on the atomic nature of South Africa in Parliament, the Minister of the Mines, Jan Smuts, disclosed that South Africa hired one former Manhattan Project scientist and another expert in the field to research and develop an atomic energy industry. Smuts discussed how one of these workers has previously worked with the Manhattan Project in the United States the program that developed some of the earliest nuclear weapons.[48] In the 1950s, South Africa made a more intentional effort to understand its role as a "nuclear nation" with one of the world's most plentiful and easy-to-extract uranium sources in the world. Around this time, South Africa changed focus from a country solely invested in producing uranium to one that maintained its newfound devoted position in the world order due to access to uranium. South Africa's previous experience with gold was crucial to the success of its uranium

[47] Ibid
[48] Ibid

mining industry as they already developed mining infrastructure and technology.[49] The present gold mining infrastructure at many mines later evolved to also work as uranium mines.

Trade and Development: International Relations Through Investments

South Africa developed relationships with some of the world's most powerful countries, specifically those aligned with the United States during the Cold War. These countries negotiated directly with the South African government to trade for its uranium rather than working with private corporations because of the nationalization of South African in 1949.[50] While South Africa strengthened its international standing the government authorities also realized to cement this newfound influence, it was crucial for South Africa to develop nuclear infrastructure of its own. South Africa began to outwardly project the significance of relationships with foreign countries, including the United States. This ambition required intelligence from outside of South Africa. The government leveraged its uranium deposits for technology and knowledge from the U.S to start the beginnings of its own program.

The South African- American relationship was not one sided. The countries exchanged technology and materials in both directions. After the United States passed the Atomic Energy Act, they could assist South Africa in building its program. Still, for the relationship United States and South Africa needed to reach a formal agreement before any exchange of material.[51] According to a South African cabinet memorandum titled "Research in the field of Nuclear Energy and Exchanging Information with Friendly Nations." South Africa agreed as early as

[49] Moore, J. D. L. "Uranium Mining in Southern Africa." In *South Africa and Nuclear Proliferation: South Africa's Nuclear Capabilities and Intentions in the Context of International Non-Proliferation Policies*, pp. 77. London: Palgrave Macmillan UK, 1987.
[50] Coetzee, Clive, and Thomas J. Trebat. "The proposed nationalization of mines in South Africa–a critical assessment." *Province of KwaZulu-Natal Provincial Treasury IGR Unit–306*(2010).
[51] Buck, Alice L. *A history of the atomic energy commission*. No. DOE/ES-0003/1. USDOE Assistant Secretary for Management and Administration, Washington, DC. Office of the Executive Secretary, 1983.

1956 to provide the United States and Great Britain with around 5000 tons of uranium oxide each year for the next ten years at an average price of forty million Great British Pounds per year. In exchange, the United States agreed to fund an experimental nuclear reactor in South Africa. The American Government told South African officials that the United States would support up to $350,000 for this experimental reactor. The British government reached another agreement with the South African government in exchange for access to nuclear material. In return, Britain agreed to provide confidential information regarding peacetime uses of nuclear energy and the production of heavy water, a crucial ingredient in both nuclear power and nuclear weaponry. For the South African Government to acquire this information, they needed to enter a friendship treaty with Britain This ensured that both countries had intelligence on the others' nuclear exchanges and technological developments and programs.[52] To start their program, South Africa's Atomic Energy Board depended on exchanges with foreign powers. These were some of the first exchanges of both intelligence and physical materials from which South Africa gained momentum towards developing a program of their own.[53] Arguably this was the most critical step, as South Africa possessed all the raw materials necessary to capture uranium effectively.

However, they still needed exposure to some of the technologies necessary to develop nuclear energy. South Africa, in the public eye still focused on using its uranium as a civilian power source but did not yet have a functioning reactor. After this, South Africa fundamentally focused on solidifying its place in the new world order, showing a new ambition for South Africa

[52] "South African Cabinet Memorandum, Research in the Field of Nuclear Energy and Exchanging Information with Friendly Nations", 1956, Wilson Center Digital Archive, South African Foreign Affairs Archives, Atomic Research Union of South Africa.137.11.23.Vol. 1.Atomic Energy.3.5.56-1.6.57. Obtained and contributed by Anna-Mart van Wyk, Monash South Africa. https://digitalarchive.wilsoncenter.org/document/116048
[53] Ibid

to become a geopolitical power though nuclearity. After climbing the ranks because of their willingness to trade with the rest of the globe, they also began to solidify their position by making deals with the United States to build an experimental reactor. The deal placed them incredibly close to developing a larger scale energy program according to South African state memos on exchanged with friendly nations.[54]

South Africa's government became more involved in the technological uses for uranium more than just the production of raw materials from the mines during the 1960s. In 1960 South Africa's government negotiated with the United States to gain access to both funding and information for construction of an experimental nuclear reactor to be built in the country's western province. An extension on their prior exchange with the Americans a few years earlier. Previously South Africa provided the United States with raw uranium and now aimed to use this previous exchange as leverage for funding. According to the proposed application to the American government from the South African Department of Foreign Affairs the proposed application covered the costs for a research reactor. The Atomic Energy Board submitted the application in May of 1960. This was South Africa's attempt to take advantage of President Eisenhower's Atoms for Peace program. The Atoms for Peace Program was President Eisenhower's plan aimed at sharing nonmilitary nuclear technology with common allies. The program provided funding for nuclear research reactors.[55] The South African Atomic Energy Board saw this program as the last chance to take advantage of funding before it expired on June 30th, 1960. The research reactor proposed by universities in the Western Cape province was a significant step for South Africa's nuclear endeavors. Unfortunately, before the submission of the

[54] Ibid
[55] Krige, John. "Atoms for peace, scientific internationalism, and scientific intelligence." *Osiris* 21, no. 1 (2006): pg. 166.

official application to the United States officials The Atomic Energy Board received notification from the United States Atomic Energy Commission informally that they would not receive a grant. The United States Atomic Energy Commission did not consider South African as an "underdeveloped country" and as a result they could not receive the grant.[56]

This raised issues over the question of how race and power played a role in this decision. Domestically South Africa was ruled by a white government with a wealthy ruling class, yet much of the country lived under very different circumstances. Black South Africans worked harsh jobs for very little pay and lived in segregated townships under inhumane conditions. Questions of race played a role in how the United States looked at this application as a project to benefit the well-educated white university students in the Western Cape rather than a project that would serve the whole country and potentially lift a working class out of poverty. In that sense, it did not fulfill the goals of the Atoms for Peace program because the United States saw South Africa as a prosperous peer nation, rather than as a poor country in need of American aid. While the United States turned down the proposal, the application for the program stated they would offer to help with the project outside the framework of Atoms for Peace by leasing the South African State reactor fuel or funding similar proposals to reduce the significant upfront capital investment. [57] This draft of the application questioned what South Africans should request from these cost-reducing measures offered by American officials.

Negotiations between both the United States and South Africa over their nuclear futures continued. A South African report titled “Union-United States cooperation in the Nuclear Field:

[56] "South Africa Department of Foreign Affairs, 'Proposed Application to United States for Assistance in Meeting Costs of Research Reactor in Western Province'", May 4, 1960, Wilson Center Digital Archive, South African Foreign Affairs Archives, Brand Fourie Personal Papers, Atomic Research in the Union of South Africa, 137.11.23, Vol 3, 24.3.58-13.5.60. Obtained and contributed by Anna-Mart van Wyk, Monash South Africa
[57] Ibid

Financial Assistance," summarized the telegram exchange between the United States and South Africa regarding negotiations for a formal request for nuclear materials. These interactions reinforced the potential for other forms of aid, once again giving the lease of nuclear fuel as an option and providing assurance that this would fall within an agreement already confirmed between the two countries.[58] This correspondence between the two negotiating parties showed that while South Africa had an ongoing relationship with the United States, they also, had to fend for themselves in funding nuclear projects and understanding the role they played in the greater global nuclear system. At the same time, it also illustrated how South Africa's leverage against the United States was limited and the Union was still reliant on American aid. External sources would not bring all the programs' pieces to them. Instead, they needed to choose their path to build a program they were proud of.

Nuclear Transitions: From Energy to Weaponry

South Africa began to feel the isolation that resulted from economic sanctions placed on the Union over the racial policies of the white apartheid government. Nuclear weapons worked to give South Africa a role in the global order even much of the globe cut off the Union. Before 1963 South Africa kept the façade that most nuclear work and agreements in the public domain aimed at building a civilian energy program that to power the country's energy grid over the coming century.[59] In 1963 those ambitions changed as South Africa's Department of Foreign Affairs considered the potential for nuclear weapons. South African Foreign Affairs documents

[58] "South African Report, 'Union-United States Cooperation in Nuclear Field: Financial Assistance'", April 28, 1960, Wilson Center Digital Archive, South African Foreign Affairs Archives, Atomic Research SA137.11.23.Vol 3.24.3.58-13.5.60. Obtained and contributed by Anna-Mart van Wyk, Monash South Africa. https://digitalarchive.wilsoncenter.org/document/116036

[59] Moukambi, Victor. "Relations between South Africa and France with special reference to military matters, 1960-1990." PhD diss., Stellenbosch: Stellenbosch University, 2008.

titled “Information on ARMSCOR and Armaments Development and Production” illustrated a coming of age for South Africa’s nuclear future. In 1960 the formation of ARMSCOR aimed to counteract the apartheid weapons embargos. The creation of ARMSCOR gave South Africa a viable source for weapons while these embargos continued.

South African officials began to move towards the formation of ARMSCOR in 1960 prior to United Nations Sanctions implemented in 1964. The Armaments Production and Development Act Passed in 1968 and completed the creation of ARMSCOR. South Africa faced these sanctions over the racially motivated, discriminatory, and oppressive policies of the apartheid government. The first was a sanction on exporting arms and other military equipment to South Africa. ARMSCOR allowed the military to purchase weapons under sanctions because they came from a domestic source. The Armaments Production and Development Act stated that the mission of ARMSCOR was to supply the needs of armaments and related products to South Africa and maintain critical industries and technologies in the country during the time of embargo.[60] A primary goal of the company was to abide internationally by Non-Proliferation treaties to avoid further sanctions and embargoes from the international community.[61] At the same time, authorities explored developing South Africa’s own weapons program. The report also stated that ARMSCOR cooperated closely with the national governing body regarding all weapons of mass destruction. The formation of this corporation focused on supporting South Africa's military throughout the embargo. Still, it also focused on maintaining the image of South Africa as a responsible supplier of arms to South Africa and the international audience. This

[60] "South African, Information on Armscor and Armaments Development and Production Act", 1968, Wilson Center Digital Archive, South African Foreign Affairs Archives, BTS, 32.2, Vol 1, Vol 2, AI 1994, Vol 3, Armscor, Krygkor Vol. 1, 1 April 93 - 30 Jul 1994. Obtained and contributed by Anna-Mart van Wyk, Monash South Africa. https://digitalarchive.wilsoncenter.org/document/116083

[61] Batchelor, Peter, and Paul Dunne. "The restructuring of South Africa's defence industry." *African Security Review* 7, no. 6 (1998): pg. 36.

essay's next chapter will explore this relationship with Israel. Once again, the South African state focused on maintaining its position in the global world order.[62] With the forthcoming developments of the 1970s, it was imperative that South Africa become less reliant on other nations as their nuclear weapons program became more well-known internationally during the events of the 1970s.

Enriching South Africa's Future: Uranium Enrichment Technology

The South African government began to further itself from dependency on western partners in the 1970s with the introduction of its own enrichment technology. On July 20th, 1970, South African Prime Minister John Vorster gave a speech announcing the country's new approach to marketing and selling enriched uranium. A Department of Foreign Affairs document titled "Announcement by South African Prime Minister Vorster" included a transcript of Vorster's speech days earlier. The speech illustrated South Africa's growing self-awareness as a nuclear power especially of its development of their own nuclear enrichment technology. The announcement marked a significant step in South Africa's nuclear capacity as they no longer depended on the United States uranium enrichment. Instead, they enriched their own uranium by using a technology developed by South African scientists. This was one of the larger objectives defined in 1959 by the Atomic Energy Board.[63] In the speech, Vorster emphasized the ability to enrich uranium in South Africa as it offered financial and geopolitical benefits. Most countries preferred to purchase enriched uranium, so the ability to enrich it themselves was crucial for the nation's economic success and international stature. This technology was essential and ensured that South Africa was not dependent on western nations for enrichment. Vorster had greater

[62] Ibid, 39
[63] Roehrlich, Elisabeth. "The Cold War, the developing world, and the creation of the International Atomic Energy Agency (IAEA), 1953–1957." *Cold War History* 16, no. 2 (2016): pg. 199.

ambitions then enriching uranium, he claimed that South Africa could develop its own nuclear power program. For a program of this scale, it was crucial for South Africa to have the ability to enrich uranium at a faster rate within the country to keep reactors powered and push the energy grid forward. This was a point of national pride for Vorster and the South African government. He mentioned the United States, Great Britain, and France as the only countries in the west with uranium-enriching plants. The main barrier to developing such programs was the high cost. The most recent plant built in France cost roughly $3.5 billion. The financing of this technology came from partners including the United States and France. Vorster talked about the uniqueness of the South African process that allowed it to be competitive with existing plants located in the west while allowing for further development as technology improved in the coming years. Vorster concluded his speech by assuring the world that South Africa would only enrich and use uranium for nuclear energy and peaceful purposes. He also promised to collaborate with other non-communist countries who wished to build a civilian energy program, yet only after they completed an agreement to safeguard the South African process and technology.[64] In hindsight, it is worth noting that at the time of this speech, South Africa is just seven years from the discovery of its secret atomic testing site. To this day, the South African government denies any nuclear weapons testing but this technological advancement was a catalyst for the program's progression.[65] The CIA examined Vorster's speech and used additional intelligence before it authored a report on the concern that South Africa may weaponize.

[64] "South African Department of Foreign Affairs, Announcement by South African Prime Minister Vorster", July 20, 1970, Wilson Center Digital Archive, South African Foreign Affairs Archives, Brand Fourie, Atomic Energy, File 2/5/2/1, Vol 1, Vol 2. Obtained and contributed by Anna-Mart van Wyk, Monash South Africa. https://digitalarchive.wilsoncenter.org/document/114143
[65] Ibid

The American intelligence needed to quickly understand South Africa's intentions. In response to the speech from the South African Prime Minister, the CIA published a report on the scientific intel they had gathered by August 1977. The report titled "Central Intelligence Agency Directorate of Intelligence, Office of Scientific Intelligence, 'South African Uranium Enrichment Program.'" The American intelligence overviewed some of the new infrastructure needed by the South African Government for the new enrichment technology. Initially, South Africa constructed a small enrichment plant that became operational in the months following the announcement. This plant expected to produce between 25 and 70 tons of reactor-grade uranium per year, yet South Africa expected to complete a larger second plant which would open for operation in the mid-1980s. Following the completion of these projects, South Africa could potentially capture up to 10 percent global market for enrichment, but the country needed foreign investments and technical assistance. The CIA speculated that the enrichment process used by South African authorities was a slightly modified version of the German method, which used a higher-pressure process gas to enrich the uranium. The heavily redacted report concluded that the uranium enriched using South Africa's new process could be used to create nuclear weapons. The South African government continued to claim its nuclear technology is only for civilian energy. This history demonstrated the challenges South Africa faced in developing its nuclear program. South Africa focused on energy publicly in the 1970s, but foreign powers still questioned whether a nuclear weapons program was in the realm of possibility.[66]

[66] "Central Intelligence Agency, Directorate of Intelligence, Office of Scientific Intelligence, 'South African Uranium Enrichment Program'", August 1977, Wilson Center Digital Archive, Obtained and contributed by William Burr and included in NPIHP Research Update #11.
https://digitalarchive.wilsoncenter.org/document/116904

While South Africa no longer needed the United States to enrich uranium, it continued to collaborate with the United States' nuclear programs for intelligence and technological advantages. For instance, a U.S intelligence memo from August 24, 1970, titled "United States Department of State, Memorandum from Martin Jacobs to Mr. Nelson on South African Nuclear Scientist's Visit US Nuclear Testing Facilities" outlined the South African request for its scientists to visit American nuclear facilities. This request resulted in a visit in August of 1970 for South African scientist Dr. J.V. Retief to American Scientist Martin Jacobs at a United States U.S Nuclear explosion facility. The same U.S. government memo discussed inviting a South African scientist into American labs and raised questions over the perceived risk from political and nuclear security perspective. Dr. Retief received the same briefing that other international scientists received. Yet, American officials worried that the visit could have political repercussions if it appeared that the United States assisted South Africa in developing its nuclear weapons program.

The memo suggested how goals of the South African government sought to deepen its relationship with the United States to expand its own nuclearity. Interestingly, the memo recommended that the U.S. still had zero evidence that South Africa had any intention to develop nuclear weapons. There were concerns what could happen if the United States refused to aid South Africa. However, the Americans also considered what it might look like if they denied Dr. Retief access to this visit. American officials worried this might be a new irritant in the U.S-South African relationship, which the South Africans could interpret as a breach of the agreement on peaceful uses of atomic energy, agreed to in the 1950s or worse drive South Africa into communist hands. Ultimately, the state department gave Dr. Retief clearance to complete the

lab visit.[67] South Africa's access to American labs symbolized a new age and indicated that further intellectual property transactions occurred following this visit. Exchanges like this between South Africa and the United States showed how the South African Union still relied on the United States with some dependency for intelligence to further build its nuclear infrastructure. This illustrated how uranium empowered South Africa on the global stage to a point of tense negotiation with the United States.

Powering a Modern South Africa

From the South African government's perspective, the subsequent years were the most critical and complex in its nuclear ambitions. As South Africa edged closer to building a nuclear reactor plant outside Cape Town, they also developed a testing site in the Kalahari Desert for its secretive nuclear weapons testing program. South Africa balanced on a tightrope of publicly developing a nuclear power station while secretively developing weapons as well. As far as the world was concerned South Africa proudly became the first African State with nuclear power due to the Koeberg Nuclear Power Station. Construction began in 1976 following years of negotiations with the French government and French corporations and banks. These negotiations took place between French banks and corporations who provided the credit. The French government over negotiated over the technology needed to build the nuclear reactors at Koeberg Nuclear Power Station. The agreement between South Africa and France made on January 5th, 1977, solidified the relationship between the two countries and provided the South African

[67] "United States Department of State, Memorandum from Martin Jacobs to Mr. Nelson on South African Nuclear Scientist's Visit US Nuclear Testing Facilities", August 25, 1970, Wilson Center Digital Archive, NARA RG 59, Subject Numeric Files, 1970-1973, Science, Box 2870, File AE6 SAFR. Obtained and contributed by Or Rabinowitz. https://digitalarchive.wilsoncenter.org/document/116593

government with the capability to build its nuclear infrastructure. International Atomic Energy Agency (IAEA) documentation titled "Text of the Agreement of 5 January 1977 Between the Agency, France and South Africa for the Application of Safeguards in Respect of Koeberg Nuclear Power Station" offered an overview of this history.[68]

The construction of the Koeberg Nuclear Power Station began in 1976 and finished in 1984. Since then, the plant acted as a significant power source for the Western Cape, a region of South Africa that is home to the second-largest city in the country, Cape Town. Before and throughout this project, South Africa held a strong relationship with France, which assisted the government in capturing the geologic energy potential of South Africa's uranium mines. According to the document titled "The Urgent Need for Immediate Cessation of all Nuclear Collaboration with South Africa." South Africa and France officially reached an agreement on May 29, 1976. This agreement resulted in the construction of the Koeberg Power Station. The deal was widely criticized as supporting the white ruling apartheid government. This was reinforced by France – a former colonial power – who provided support in the form of $2 billion, most of which went to the French industrial corporations of Framatome, SPIE-Batignolles, and Alsthom. French corporations provided much of the technology and engineering behind the project. While the French bank Credit Lyonnais provided 85% of the capital that backed the project. [69] This was the beginning of the South African involvement with a civilian energy program, behind the scenes, the South African government covertly developed a nuclear weapons program. The Soviets discovered the existence of the program in 1977 which resulted

[68] The Text of the Agreement of 5 January 1977 Between the Agency, France and South Africa for the Application of Safeguards in Respect of Koeberg Nuclear Power Station, 23 February 1977, MS 1499, Box 16, International Atomic Energy Agency 1976-1977, E.S Reddy Papers, Yale University Manuscripts and Archives, New Haven CT.
[69] The Urgent Need For Immediate Cessation of all Nuclear Collaboration with South Africa, 24-25 February 1979, MS149 Box 20, United Nations Seminar on Nuclear Collaboration with South Africa, London, 1979 February 24-25, E.S Reddy Papers, Yale University Manuscripts and Archives, New Haven CT.

in a rare moment of agreement between the Cold War antagonists the United States and the Soviet Union.

Leveraging Uranium: South African Power Politics of the 1970s

South Africa's involvement with civilian energy reactors preceded the challenges following the discovery of the testing site. In 1977, a Soviet satellite discovered the Kalahari test site. The site, made up of two 200-hundred-meter-deep test shafts, was located at Valstrap in the Kalahari Desert. The facility was ready for a "cold test," typically to check the explosive devices' non-nuclear components and logistics.[70] Following the discovery, the Soviets alarmed the United States who later confirmed the existence of the site with its own reconnaissance mission. This discovery swiftly changed how international players perceived South Africa, especially as they continued to claim they only planned to develop a nuclear power program. In the diplomatic frenzy that followed, South Africa sought to leverage its nuclear ambitions to bolster its status. Throughout the following year, the South African government negotiated with the Americans, to ensure that they still had access to necessary fuel for its up-and-coming energy program. South Africa continued developing a nuclear weapon, still shrouded in secrecy.

South Africa quickly responded to the international pressure following the discovery of its test site. On August 26, 1977, the South African Department of Foreign Affairs sent a telegram to all heads of embassies in response to the Soviet claim that South Africa was on the verge of developing a nuclear weapon. The telegram titled "The Urgent Need for Immediate Cessation of all Nuclear Collaboration with South Africa" attempted to control the narrative following the discovery of the test site. The notification denied of the existence of the South

[70] de Villiers, John W., Roger Jardine, and Mitchell Reiss. "Why South Africa gave up the bomb." *Foreign Aff.* 72 (1992): 98.

African nuclear weapons program. It laid out three main points; that South Africa did not have or intend to develop nuclear explosive devices for any reason, that the Kalahari Facility was not a testing facility: and that there would not be any nuclear explosive testing of any kind within South Africa.[71] The foreign affairs office included passages from Prime Minister John Vorster's speech from August 24, 1977, which echoed these sentiments. He reinforced the South African government's focus on developing nuclear energy to be used for peaceful purposes. Vorster provided more context on why South Africa is not focused on weaponry, claiming that South Africa voluntarily undertook to supply its uranium to non-nuclear weapon states only under agency or equivalent safeguards. At the same time, Vorster acknowledged that South Africa had not joined the Non-Proliferation Treaty but argued this did not mean South Africa did not cooperate in the worldwide goal of preventing proliferation. Vorster pointed fingers at larger nations like the United States for the larger-scale failures of the Non-Proliferation Treaty. He cited the terms of Article IV of the Non-Proliferation Treaty "all parties undertake to facilitate the fullest possible exchange of equipment, materials, and scientific and technological information for the peaceful uses of nuclear energy."[72] At this stage in the relationship with the United States the South African government no longer held a great relationship with the United States and their dependency on the United States for nuclear assistance whittled to an all-time low. While the government still leveraged uranium in its relationship with France the dependency on the United States was less necessary now that South Africa had uranium enrichment technology.

[71]"Cable, South African Department of Foreign Affairs, 'South Africa: Nuclear Bomb Charges'", August 26, 1977, Wilson Center Digital Archive, South African Foreign Affairs Archives, Brand Fourie, Atomic Energy, File 2/5/2/1, Vol 1, Vol 2. Obtained and contributed by Anna-Mart van Wyk, Monash South Africa. https://digitalarchive.wilsoncenter.org/document/114180
[72] Ibid

Vorster argued that the United States continued to take advantage of South Africa. According to Vorster, the United States ignored many of these commitments regarding the supply of materials and equipment. He cited this as the main reason South Africa had not joined the treaty. Other countries like the United States took advantage of the South African government. Vorster questioned the failure of the United States to follow through on agreements over the delivery of reactor fuel to South Africa. As an example, he referred to the U.S. refusal to deliver reactor fuel for the research reactor Safari I. The United States made the agreements in 1956, yet in the two years preceding this speech, the United States government delivered no fuel even though South Africa made payments at the time of the agreement.

At this point, Vorster continued to play hardball with the United States. He offered to renegotiate to enter the Non-Proliferation Treaty, but under harsher guidelines set by South Africa, including the "discriminatory actions" that he raised earlier in the speech.[73] He argued that these needed to be addressed for South Africa to join. Still, Vorster pushed the envelope further and questioned why the United States, Britain, and the Soviet Union were permitted large nuclear arsenals further adding to the argument that South Africa may join a non-alignment movement. Essentially Vorster called out the hypocrisy of the Soviet Union as they prepared nuclear tests but would not let the South Africans organize a test of their own. Vorster questioned why these double standards existed and promises that if these continued, South Africa would take matters into its own hands, and do as it saw fit.[74] These advancements all resulted from South Africa's geologic luck which gave the country the ability to be the only African

[73] Ibid
[74] Ibid

country to possess nuclear infrastructure. In this speech Vorster announced himself on the global stage as a leader with the influence to disrupt the more traditional global powers.

South African officials continued these dialogues in international government settings. A few weeks later, on September 19, 1977, at the General Conference of the International Atomic Energy Agency, South African representatives spoke on the twentieth anniversary of the agency and what it meant for the country to be a member of the IAEA. Mr. Kurt von Schirding, South African Ambassador to the United Nations, continued to project the message purveyed by Prime Minister Vorster weeks earlier. Von Schirding discussed why South Africa's government joined the agency in the first place, flexing its muscles as one of the largest producers of uranium in the world. He argued that the South Africa Union did not join because of the benefits they would gain but rather because of the benefits that other countries would benefit from due to the membership of a leading uranium producer. Von Shirding discussed some significant developments in South Africa's nuclear program, including the creation of their enrichment technology and the construction of the 20-megavolt research reactor known as Safari I. He also revisited the allegations that South Africa developed a nuclear weapon but associated this with accusations of highly suspect sources seeking political advantages.[75] While the speech sets out and congratulated the IAEA on its 20th anniversary, Mr. von Schirding echoed the speech that Prime Minister Vorster gave just a few weeks earlier. The speech spread a unified government message to the domestic and international political stage. The South African Union at this time tried to paint the image that other countries took advantage of them in recent years as a country

[75] "One Hundred and Ninety-Eighth Plenary Meeting of the Twenty First International Atomic Energy Agency General Conference in Vienna (Statement by South African Rep. to the IAEA von Schirnding)", September 29, 1977, Wilson Center Digital Archive, IAEA Archives, 1977 General Conference Records, GC(XXI)/OR.198. Obtained and contributed by Jo-Anie van Wyk and Elisabeth Roehrlich. https://digitalarchive.wilsoncenter.org/document/116630

with incredible raw material wealth. When they try to use this wealth for their benefit, they face the traditional global powers that South Africa officials claimed set a robust double standard to keep South Africa far removed from the nuclear arena.

The United States remained one of South Africa's most vital allies. Prime Minister Vorster sent a letter to President Jimmy Carter in the wake of South Africa's enrichment program announcement and the discovery of the Kalahari Desert testing site. The letter was a response to correspondence from the United States Secretary of State Cyrus Vance. The letter opened by reinforcing the South African stance of the past few months, which stated that South Africa will not develop a nuclear device and that the Kalahari site is not associated with the nuclear program. Vorster further echoed the statements of Von Schirding at the General Conference of the IAEA. Prime Minister Vorster called out the United States for its discriminatory policies towards South African government, including the unwillingness to supply fuel for the Safari I research reactor and the continued ignored commitments by nuclear powers on the exchange of equipment, materials, and technical information.[76] One of the new points he made that was not in his speech in August 1977 or at the IAEA speech was that IAEA removed the South African delegation from the Board of Governors. He argued this is a flagrant violation of the agency's statutes.[77] Vorster provided an example of how the agency did not take the same steps on India, which also had an instance of non-alignment with the Non-Proliferation Treaty (NPT). Yet, the agency decided to keep India within the governors while removing the South African delegation.

These realities remained part of the problem that South Africa saw as they were under more pressure to join the NPT. The other non-governor members were not under the same strain;

[76] "Letter from South African Prime Minister Vorster to US President Carter on US-South Africa Relations", October 1977, Wilson Center Digital Archive, South African Foreign Affairs Archives. Obtained and contributed by Anna-Mart van Wyk. https://digitalarchive.wilsoncenter.org/document/116634
[77] Ibid

as part of this pressure, the United States threated to withhold reactor fuel for the Koeberg Nuclear Reactors until South Africa's government join the NPT. Prime Minister Vorster's final also addressed the continued exclusion of South Africa from International Fuel Cycle Evaluations. South Africa was one of the most significant suppliers of uranium and one of the exporters with the most substantial potential to export enrichment equipment. Vorster closed this portion of the letter by quelling the American anxiety over the Valindaba enrichment plant, further setting the intentions for using the plants' uranium to remain peaceful and claimed that South Africa will share technology with interested parties. This letter showed South Africa's agency due to its position in the global world order, which resulted from the development of its nuclear program. South Africa's government was now in a situation where it could exert its power on its allies and enemies, a consequence of the past 30 years that did not exist in the 1940s before South Africa's nationalization of the uranium mining industry.

The exchange between Prime Minister Vorster and President Carter assumed a lot about South Africa's new role in the world order. The South African government found itself in a position where they could put pressure on some of the world leaders through nuclearity. In the early days of its uranium exploration, South Africa aimed to use the uranium to make the country more relevant on the global stage. Now with the development of a domestic nuclear energy program and their own technology for uranium enrichment; South Africa edged closer to the negotiating table with some of the most significant western powers. South Africa's economy did not only benefit from the economic and technological growth associated with its uranium programs but also grew in political power.[78] This raised questions over whether western powers would have paid a Black-ruled South Africa the same respect. South Africa set itself apart from

[78] Spence, Jack E. "South Africa: the nuclear option." *African Affairs* 80, no. 321 (1981): pg. 443.

other African states because of its access to uranium and its white minority government. Because of these combined factors South Africa was able to grow as an increasing relevant country in the global world order.

South Africa continued to rise in nuclear power to the point that in 1978 the CIA published a report that defined the organization of South Africa's nuclear options and decision-making structure. The report titled "Interagency Intelligence Memorandum, US Director of Central Intelligence, 'South Africa's Nuclear Options and Decision-making Structure'." predicted that the South African government held out on signing the NPT until they had built up large enough a stockpile of highly enriched uranium to construct weapons. The CIA expected South Africa to continue to test, design, and develop nuclear weapons. Once they have built up a stockpile of enriched uranium intelligence predicted that South Africa would continue to play hardball with the United States to ensure U.S. commitments to supply reactor fuel. Even if the international safeguards of the NPT applied to this stockpile once South Africa acceded to the agreement. In addition to support through nuclear infrastructure, South Africa expected to seek broad American political support and greater acceptance of South Africa's perceptions of long-term security needs.[79] Throughout all this, it was doubtful that South Africa planned to detonate a nuclear device in the following months unless the "playing field" changed significantly.

The CIA report looked at the internal thinking of the South African government. It outlined how in the early years of the South African program; American intelligence predicted the decisions of the South African government. South Africa did not have the same resources in terms of intelligence as many of its allies and enemies in the nuclear order. While they openly

[79] "Interagency Intelligence Memorandum, US Director of Central Intelligence, 'South Africa's Nuclear Options and Decision making Structure'", July 1978, Wilson Center Digital Archive, CIA Freedom of Information Act Release. Obtained and contributed by William Burr for NPIHP Research Update No. 25. https://digitalarchive.wilsoncenter.org/document/119213

communicated with many of these countries, they did not develop enough infrastructure to run their own intelligence missions. They openly communicated with scientists as they did at the beginning of the 1970s.[80] The downside was that with these visits, they were only at the mercy of what the U.S. government would show them, which in most cases was already public knowledge. Of course, there were also likely intelligence documents from both sides of this issue that are not public. If and when they release these the narratives of the relationship between the United States and South Africa may have a very different tone and tell the stories differently.

Conclusion

The development of South Africa's nuclear program from the civilian energy and the military point of view looked at the challenges of a smaller African nation strived to use its national resources to ascend the world order. South African officials had the wherewithal to nationalize the countries uranium resources very early. Although because of its vast uranium resources, South Africa was taken advantage of by more powerful countries and international governing bodies. This does not tell the complete story. Throughout all the technological developments that South Africa made, they still built a nuclear weapons program away from the watchful eye of countries like the United States and the Soviet Union. At the same time, when the United States used its political position to attempt and take privileges away from South Africa, the country snapped back to protect its government and its people. It is worth noting that during the development period of nuclear infrastructure a white minority government ran south Africa and kept the country's majority, indigenous Black African, out of the positions of power. This leads to questions of how the narratives of this history might have been different if South

[80] Ibid

Africa was under a majority-Black government. To answer these questions is easy to look at the non-proliferation process in South Africa in 1991. Many theories still exist about why South Africa chose to join the non-proliferation treaty at this time. Many scholars point to the rise of Black political leaders in South Africa like Nelson Mandela.[81] Once it became apparent that the movement would take control of the government through a democratically elected process, current South African leadership underwent the non-proliferation process to keep nuclear weapons out of the hands of the new South African state.[82] While scholars still debate the realities of this, it indicated how predominately white western countries may have reacted if Black South African government had a nuclear arsenal at its disposal.

When considering the development of the South African nuclear program, it is crucial to consider the role of South Africa's alignment with the United States and the west during the Cold War. Although the country clashed with the Soviet Union over the Kalahari testing location, South Africa broadly communicated with other western powers who hoped to benefit from South Africa's access to the natural resources. At the same time, South Africa gained insight into the technology needed to harness this uranium from other western countries. The following chapter will focus on how South Africa built relationships with many Western powers interested in creating a nuclear program in a similar era. The next chapter will focus on how the development of relationships with Israel, the United States, and France propelled South Africa into a stronger position of global relevance in the 20th century as they developed technology to harness the vast potential of their uranium resources.

[81] Liberman, Peter. "The rise and fall of the South African bomb." *International Security* 26, no. 2 (2001): 71.
[82] Ibid, 77

Chapter 4: South African Nuclear Diplomacy

On September 22nd, 1979, the American satellite Vela Hotel picked up a double light flash between the coast of South Africa and Antarctica. This kind of flash meant one thing: a nuclear weapons test. However, no country claimed responsibility for the explosion that caused the light reaction seen by American satellite. Many speculated that the countries involved were likely South Africa and Israel. Historians and scholars debated the cause of the flash and concluded that a joint atomic test between South Africa and Israel was a likely cause.[83] After the test, Israel's nuclear program acquired weapons deliverable by land, sea, and Israel remains a nuclear power. For South Africa the test showed it continued to use its nuclear program to establish itself as a global power. Its geopolitical location at the end of the 1970s as a country that developed nuclear infrastructure could not be disregarded. The relationships that helped it reach this role in the global nuclear system were even more critical. Without the relationship with South Africa, Israel would not have the location where such a test was possible. Still, South Africa would not have the infrastructure it developed without its partnerships with countries like the United States, Britain, and Israel. [84]

South Africa developed a nuclear program backed by the state very early compared its peer countries. With foreign assistance, the program reached a new level in the global order. To gain these relationships, South Africa used natural resources to build a program including the raw uranium; what they lacked, at least initially, was the technology to enrich uranium. Uranium enrichment was crucial to the relationships with foreign powers for South Africa's government. In many cases, nuclear allies already possessed the technology needed to harness South Africa's

[83] Burr, William, Avner Cohen, Lars-Erik De Geer, Victor Gilinsky, Sasha Polakow-Suransky, Henry Sokolski, Leonard Weiss, and Christopher Wright. "Blast from the Past." Foreign Policy, September 22, 2019. https://foreignpolicy.com/2019/09/22/blast-from-the-past-vela-satellite-israel-nuclear-double-flash-1979-ptbt-south-atlantic-south-africa/.

[84] Liberman, Peter. "Israel and the South African bomb." *The Nonproliferation Review* 11, no. 2 (2004): 49.

uranium. Through negotiations and allegiances, South Africa traded its raw uranium for intelligence, which was critical to the success of the upstarted South African nuclear program. The system of exchanges between countries explained much of the nuclear development in the 20th century. Without the export of uranium from South Africa, countries like the United States and Britain did not have access to uranium. In the same vein, without the import of western technology into South Africa, the South African nuclear program would fall short. These exchanges were essential to the development of South Africa's position in the global order. The potential to ascend the global order came from South Africa's access to uranium which put them in the position to have these interactions.

Across the history of nuclearity in South Africa, the country held relationships with many countries aligned with the west during the Cold War. Although some of the most well-documented relationships existed between the United States, Israel, and even Germany, South Africa did share relations with France, Britain, Japan, and the Netherlands. South Africa's relationship with France developed relatively late but was critical to developing South Africa's nuclear energy program as discussed in the previous chapter. France offered South Africa access to the reactors and financial resources to construct the Koeberg Nuclear Power Plant. South Africa negotiated with the French government, banks and corporations to gain access to the necessary credit and technology. In return, France gained access to South African uranium.[85]

South Africa engaged in many smaller deals with the United States and Britain beginning in the 1950s. In turn, Britain cautiously exported arms and planes to South Africa during the arms embargo which caused immense controversy domestically in Britain. While South Africa

[85] "Reply, French Minister of Foreign Affairs, 'Sale of Two Nuclear Plants to South Africa'", June 2, 1976, Wilson Center Digital Archive, Ford Presidential Library, White House Central Files, Subject File, CO 135, South Africa, 3.1.76-7.31.76, Box 46. Obtained and contributed by Anna-Mart van Wyk, Monash South Africa. https://digitalarchive.wilsoncenter.org/document/114149

maintained strong relationships with American allies like France and Britain, they also partnered with other countries like Japan which involved the export of Namibian uranium to Japan for civilian energy use. South Africa diversified its relations, trying not to solely depend on one international partner.

Japan's short relationship with South Africa involved the purchased of uranium mined in the South African colony of Namibia, in the 1970s. A report by Japanese professor Yoko Kitazama titled "Japan's Nuclear Deals with South Africa" overviewed the relationship in 1974.[86] The deal between the two countries brought 8,200 tons of uranium into Japan and led to long-term contracts between Japanese corporations like Mitsubishi Corp and the Rössing Uranium mine. In exchange for uranium, Japan provided South Africa with uranium-enriching technology. This technology fit South African mining because South African system mined in the waste product of gold mines in very remote regions of South Africa. The Japanese technique allowed enrichment to be done on the spot, removing the expensive transportation of ore from the supply chain. Additionally, the Japanese saw this as a chance to remove themselves from the monopoly that the United States held on uranium enrichment until the 1970s when countries like South Africa and Japan began to develop their techniques. Japan saw South Africa as a partner not only as a uranium resource, but also in counteracting the United States monopoly.

South Africa's government held relationships with smaller European nations in addition to its larger partners. Another less well documented relationship between Netherlands and South Africa illustrated more transactions of raw uranium. A South African government memo from 1956 titled, "South African Cabinet Memorandum, Research in the Field of Nuclear Energy and Exchanging Information with Friendly Nations" outlined a relationship with the Dutch. The

[86] Japan's Nuclear Deals with South Africa. 24 June 1977. Group 1499 Box 1, E.S Reddy Papers. Yale University Manuscripts and Archives. New Haven CT.

Netherlands enquired with South Africa whether the country would be interested in cooperation between the two countries on the development of peaceful uses for nuclear energy. The Netherlands did not produce uranium themselves, but they established an extensive research program focused on the generation of nuclear power through the suspension of uranium in heavy water. At the time, the Atomic Energy Board recommended that South Africa enter this partnership as it saw long-term benefits from the exchange.[87] South African officials saw this relationship with the Netherlands as another opportunity to use its natural resources as leverage, and more intelligence on the generation of nuclear power, an important step towards building its own civilian energy program. This chapter explores these relationships that South Africa held with other western powers to understand how South Africa developed a system prominent enough to disrupt the Cold War relationship between the United States and the Soviet Union.

South Africa and the United States: The Groundwork of Nuclear Development

Since the beginning of South Africa's involvement in the global nuclear order South Africa associated with the United States and the relationship remained crucial to South Africa's success. The United States was the first country South Africa worked with in the 1950s. South Africa started to work with the United States during President Eisenhower's "Atoms for Peace" campaign which provided funding to third world nations for nuclear power plants. Both countries understood the benefits of collaboration. The South African government's earliest benefit from this relationship was funding for a research reactor in South Africa. [88] The early intention by both the United States and South African governments illustrated how important they saw this

[87] "South African Cabinet Memorandum, Research in the Field of Nuclear Energy and Exchanging Information with Friendly Nations", 1956.

[88] Ibid

relationship. South Africa's international relationships laid out the three steps of international relations crucial to the development of South Africa's nuclear program. First after it nationalized uranium mining the South African government needed these relationships to enrich uranium, a process the government relied on the United States for. Secondly, they also needed to develop their own enrichment technology which the United States was essential in assisting. [89] The last step was holding relationships to develop both a civilian energy program and a few years later a secretive nuclear weapons program. For the energy program South African officials relied immensely on the French, while the Israeli's played a crucial role in developing weapons and a weapons test.

The development of the research reactor meant that South Africa needed a constant source of enriched uranium. In 1960 South African documents sent to the ambassador to the United States illustrated the evolution of the relationship between the two countries. The document, a letter titled "South African Department of Foreign Affairs, Informing the United States of South Africa's Intent to Request Nuclear Materials" overviewed South African Officials' requests for enriched uranium. As South Africa edged closer to building a research reactor, it was crucial for the government to have access to enriched uranium used to power the reactor. The letter explained how the South African Atomic Energy Board formally applied to purchase nuclear materials enriched up to 90% in U-235 from the United States Government. 90% enrichment is widely regarded as weapons grade.

[89] "Letter, South African Department of Foreign Affairs, Informing the United States of South Africa's Intent to Request Nuclear Materials", March 30, 1960, Wilson Center Digital Archive, South African Foreign Affairs Archives, Atomic Research in the Union of South Africa.137.11.23.Vol 3.24.3.58-13.5.60. Obtained and contributed by Anna-Mart van Wyk, Monash South Africa.
https://digitalarchive.wilsoncenter.org/document/116042

In 1977 Soviet discovery of a nuclear testing facility in the Kalahari Desert drastically damaged the relationship with the United States. The American government began a new string of correspondence with the South Africans to understand the South African government's goal for this site.[90] A draft of a letter from the American government to the Soviet leader Leonid Brezhnev in August 1977 followed the Soviet intelligence's discovery of the site outlined steps that the American government took to understand South African intentions. The Americans sent a letter titled "Response to Soviet Message on South Africa" to the Soviets as Americans had a greater ability to use diplomatic pressure on the South African. The American response aimed to quell any suspicion that the Soviets had about South African weapon development. United States authorities wanted to obtain intelligence and requested the geographic coordinates and other specific details that the Soviets collected following their primary intelligence of the South African test site. [91] This letter had two main goals, to diminish the worries of the Soviets of any possible developments in South Africa but also to keep the innocence of the South Africans, who the American previously held a strong relationship. For both South Africa and the United States, this event tested their relationship which stayed intact following these events but in a more strained manner.

While the official American government reaction to the discovery of the test site was subdued and focused on gathering more intelligence, the response by U.S media illustrated a very different level of trust between the American public and the South African government. A

[90] Pabian, Frank, G. Renda, R. Jungwirth, L. K. Kim, E. Wolfart, and G. G. M. Cojazzi. "Open source analysis in support to non-proliferation monitoring and verification activities: Using the new media to derive unknown new information." In *Proceedings Symposium on International Safeguards: Linking Strategy, Implementation and People, vol. IAEA-CN-220, paper*, vol. 312. 2014.

[91] "Letter, Warren Christopher to William Hyland, 'Response to Soviet Message on South Africa'", August 10, 1977, Wilson Center Digital Archive, National Archives, Record Group 59, Department of State Records, Records of Warren Christopher, box 16, Memos to White House 1977. Obtained and contributed by William Burr for NPIHP Research Update No. 25. https://digitalarchive.wilsoncenter.org/document/119249

telegram sent from the South African embassy in Washington D.C to South Africa on September 19, 1977, overviewed the media response in Washington to the discovery that South Africa prepared to test a nuclear weapon. *The Washington Star* published an article titled "South Africa and the Bomb" on September 19, 1977. The telegram overviewed the article which claimed that four weeks after the Soviet discovery of the testing site, the site is still active to the point where the United States worried about a potential test. As the United States intelligence watched the site through surveillance, they communicated with other countries about restricting South Africa's access to equipment and materials necessary for nuclear weapons. The article looked at an angle that few sources mentioned. The author questioned South Africa's motives to gain access to a nuclear weapon, asking whether they are motivated by atomic weapons as a desperate last attempt to guarantee the minority white government cannot be overwhelmed by the Black majority in the coming years.[92] This article projects the instability over nuclearity in South African and United States diplomacy for the first time in recent history. It also foreshadowed the national public opinion Americans held towards South Africa which slowly became worse as a result of racialized apartheid policies in the late 1970s and 80s as the United States could no longer turn a blind eye. While South Africa and the United States cautiously supported one another with intelligence, materials, and technology, the new reality of a potential nuclear weapon showed a new side of American diplomacy. The country focused on intelligence and global reach to keep a weapon out of the hands of the South African government.

[92] "Telegram from South African Embassy in Washington to the Department of Foreign Affairs Summarizing a Washington Star Newspaper Article on 'South Africa and the Bomb'", September 19, 1977, Wilson Center Digital Archive, South African Foreign Affairs Archives. Obtained and contributed by Anna-Mart van Wyk. https://digitalarchive.wilsoncenter.org/document/116637

From the American government's perspective, there is a slightly different response to the potential for a nuclear weapon. A CIA report published on South Africa in July of 1978 looked at information gathered by the CIA and the possibility that South Africa developed a nuclear weapon after the recent activity just six months earlier at the suspected testing site. The CIA report titled "South Africa's Nuclear Option and Decision-Making Structure" looked more closely. In the report, the CIA saw no indication that South Africa would go beyond developing nuclear weapons, meaning there was no hint that South Africa produced and stockpiled these weapons. While high-ranked political leaders in South Africa made statements that included vague references to nuclear weapons, still no one had referred to an intention to exploit their new capability. While this intelligence was essential to consider, it's also worth noting that open statements by the South African military denied any military goals in South Africa's nuclear program.[93] The CIA redacted the remaining relevant information in this report when the government declassified this report. However, it still provided valuable context for how the United States considered the potential for South African nuclear weapons during this tense period.[94]

The relationship between the United States and South Africa slowly eroded under the tension of the Cold War. The American government provided immense support to the South African program in the past. They forced South African officials to make decisions around whether they still needed American support. The end of the 1970s indicated that the American government turned on their longtime allies. South Africa's relationship with the United States

[93] de Villiers, John W., Roger Jardine, and Mitchell Reiss. "Why South Africa gave up the bomb." *Foreign Aff.* 72 (1992): 98.
[94] "Interagency Intelligence Memorandum, US Director of Central Intelligence, 'South Africa's Nuclear Options and Decisionmaking Structure'", July 1978, Wilson Center Digital Archive, CIA Freedom of Information Act Release. Obtained and contributed by William Burr for NPIHP Research Update No. 25. https://digitalarchive.wilsoncenter.org/document/119213

was mainly built on the early years, improving South Africa's nuclear foundation through enrichment technology. The end of the 1970s illustrated the point where South Africa no longer needed to the American support and the leverage of uranium from the 1950s and 60s was no longer as effective. South African officials braced to enter a period of isolation where nuclear weapons took up a new role in the South African government's position globally. Now more than ever South Africa relied on its nuclear arsenal to keep its position in the global order as its relations abroad fell apart over the racial policies of the apartheid government.

Unlikely Partners: South Africa and Israel 1960-1985

As relations with the United States and South Africa strained, archived research suggested a surprisingly new partner for South Africa: Israel. An unlikely ally for South Africa, yet Israel shared more with South Africa than most people realize when they first think about the realities of the 20th century. South Africa's apartheid government racial policies removed Blacks from much of society. In a similar vein many of Israel's policies had the same impact on Arabs.

Across the Cold War, Israel's foreign policy mainly concerned the Arab Israeli conflict. The Arab Israeli conflict was like many other proxy conflicts during the Cold War. The Israelis sided with the Americans, and the Arabs sided with the Soviet Union. Part of this relationship was a long history of close intelligence cooperation between the United States and Israel.[95] As a part of the global order at the time, South Africa aligned with the United States. Israel and South Africa built their relationship on South Africa's need for intelligence and technology and Israel's need for the raw materials to build nuclear weapons and energy systems. This relationship not

[95]Ofek, Raphael. "Israel's Intelligence Contribution to US Security: The Cold War Years." Begin-Sadat Center for Strategic Studies, 2018. http://www.jstor.org/stable/resrep16888.

only contrasted the countries with their nuclear needs, but also placed the two racial policies of Israel and South Africa side by side.

The relationship between South Africa and Israel shared incredibly similar roots to the relationship that South Africa built with the United States in the 1950s, but at a much smaller scale. Beginning in 1960, South Africa began to sell uranium to Israel. The first sales recorded in confidential telegrams titled "M. I. Botha to South African Ambassador to Vienna D.B. Sole on sale of Uranium to Israel." According to these documents, the negotiations between the two countries began in 1958 and 1959; ultimately, these initial negotiations failed because of the unsuccessful assurance that Israel only used uranium for peaceful purposes. At the same time, the Israelis were under the impression that the talks stopped because of their actions in the United Nations. A telegram on July 7th, 1960, claimed that talks between the two sides restarted. These negotiations started with the guarantee that South Africa provideed Israel with uranium under the guarantee that that would use it for peaceful purposes, as previous deals with Japan and others ensured. Israel refused to enter any bilateral agreements with South Africa over the issue if South Africa enforced inspection measures limited Israel's sovereignty in the nuclear arena.[96] This telegram profiled the rough start that South Africa and Israel's nuclear relationship had from its start in 1959. Still, it also outlined how desperate both nations were to create this alliance that they would rely on for the next few decades for exchanges of uranium and technology.

Five years later, South Africa and Israel finally made an agreement that led to their long-term success as a nuclear alliance. Israel sent a request to the South African Parliament on

[96] "Confidential Telegram from South African Department of Foreign Affairs M. I. Botha to South African Ambassador to Vienna D.B. Sole on sale of Uranium to Israel", July 7, 1960, Wilson Center Digital Archive, South African National Archive, BLO 353, PS17/109/12 vol. 2. Obtained and contributed by Sasha Polakow-Suransky. https://digitalarchive.wilsoncenter.org/document/116579

February 1st, 1965, to purchase uranium. A document titled “Request from Department of the Prime Minister for Presidential Approval for a Bilateral Agreement on the Sale of South African Uranium to Israel” notified the parliament of the agreement. The document informed of the intent for the Israeli government to acquire uranium oxide through the Atomic Energy Board of South Africa. This notification from South African Prime Minister Hendrik Verwoerd concluded the bilateral agreement between South Africa and Israel, which allowed Israel to purchase uranium for peaceful purposes.[97] This document indicated the desire of the South African Parliament to enter this agreement as the exchange will benefit the Union of South Africa. This agreement expressed a new age for South Africa's nuclear trade, a deal with a power of similar global stature to that of South Africa in which they benefited immensely and continued to use their access to uranium as a leverage point against other countries to gain intelligence and technology.

As a part of the agreement in 1965, South Africa and Israel agreed to a series of safeguards to protect the two countries in a guarantee for the peaceful use of uranium. South African and Israeli officials wrote the draft to the South African Parliament on February 1st, 1965. The draft titled “Draft Agreement Between South Africa and Israel on the Application of Safeguards to the Sale of Uranium" outlined South Africa's expectations to protect itself from the Israelis using the uranium for military purposes. The first safeguard stated that Israel may only use this material within reactors, other equipment, and devices that the South Africa Review Board saw as relevant to the project. The protections also gave South Africa access to all

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[97] "Request from Department of the Prime Minister for Presidential Approval for a Bilateral Agreement on the Sale of South African Uranium to Israel", February 1, 1965, Wilson Center Digital Archive, South African National Archives, URU vol. 4835, ref. 134, 37-38. Obtained and contributed by Sasha Polakow-Suransky. https://digitalarchive.wilsoncenter.org/document/116589

locations and data necessary to source unique nuclear materials. This ensured compliance with this agreement. The agreement also allowed South Africa to end the deal if there is an event of non-compliance from the Israelis.

To reach the agreement with South Africa, Israel pledged to maintain all safeguards. Israeli officials stated they would use all material from this agreement to research or develop nuclear weapons. The deal does allow the Israelis to stockpile material, but it must be stored in a secure location and notify the South Africans of any intentions to remove material from these sealed storage facilities. Additionally, the South African authorities had the power to perform routine inspections of these seal storage facilities each year.[98]

This agreement between the two states gave South Africa immense power to not only hold the Israelis responsible, but it also gave South Africa's government power to collect intelligence on the Israeli program to use themselves. South Africa used its power of raw uranium as leverage to potentially withhold material from Israel and keep the Israelis from making strides in nuclear development. The South African government also needed the technology for themselves. Overall, this agreement kept South Africa from surpassing Israel in its nuclear relevance. It also benefitted South African officials in terms of economic gain from uranium sales. Financial benefit is less important than the gain in nuclear stance in the global order for South Africa.

The long road to a uranium trade agreement came to a close in 1965. South Africa completed an agreement with Israel to trade uranium. The stressed nature of the Cold War era meant that this agreement was more flexible due to instability around the globe. Throughout

[98] "Draft Agreement Between South Africa and Israel on the Application of Safeguards to the Sale of Uranium", February 1, 1965, Wilson Center Digital Archive, South African National Archive, URU vol. 4835 ref. 134, 39-44. Obtained and contributed by Sasha Polakow-Suransky. https://digitalarchive.wilsoncenter.org/document/116590

much of the Cold War the Middle East was one of the more tense regions in the world. This meant that agreements with Israel needed to remain thoughtfully negotiated to ensure that a level of peace remained between Israel and the Arab world.

While the partnership between the two nations was smooth, there were moments of negotiations where both countries needed to consider their own goals. The South African Department of Foreign Affairs published a report titled "'Items of Interest in the Field of Atomic Energy: Developments During March-April-May 1967" in May 1967. Earlier in the year South Africa notified the Israelis that they could supply 100 tons of uranium oxide at $5.38 per pound, but Israel responded that they were under the impression that the sale would take place for $4.60 per pound. The Israelis accepted the price of $5.35 following an extension of the period to accept the offer. Still, the Israeli government also requested that did not delivery material for another year due to the anxious situation in the Middle East and the ongoing challenges between Israel and Palestine.[99]

This report raised a few questions about why South Africa saw this relationship with Israel as so vital during this time. The Middle East was one of the most unstable regions in the world, with Israel caught up in many disputes, but South Africa still was quick to send uranium to the country regardless of the potential risks. This action by the South African government led to questions of what South Africa received in return. Earlier documents outlined how rough the initial relationship between the two countries was over issues of nuclearity. Documents provided context for why Israel sweetened the deal with additional exchanges in technology or

[99] "Report, South African Department of Foreign Affairs, 'Items of Interest in the Field of Atomic Energy: Developments During March-April-May 1967'", May 1967, Wilson Center Digital Archive, South African Foreign Affairs Archives, Brand Fourie, Developments in the Atomic Energy Field, F 2190. Obtained and contributed by Anna-Mart van Wyk. https://digitalarchive.wilsoncenter.org/document/116591

intelligence that provided South Africa unfettered access to Israeli nuclear facilities as part of the safeguards implemented to protect the South Africa from Israel developing atomic weapons using South African uranium.

While the relationship between South Africa and Israel benefited both countries, the repayments South African officials gave differed from those that larger global powers received. The United States, Britain, and France could all purchase nuclear material from South Africa in unrestricted amounts, yet the South African government enforced a quota of 100 tons of uranium on Israel. South Africa could use these relationships with other countries to gain the most advantageous deal when they wanted to purchase enriched uranium for use in their experimental reactor.[100] Initially, when working with Israel, this was different as the United States was still the main source of enriched uranium until South Africa created its own enrichment technology in 1970.

South Africa and Israel's trade relationship expanded beyond the nuclear field. As part of its affiliation with Israel, South Africa purchased aircraft from Mirage, a leading aircraft company that barred Israel from purchasing the planes. Instead, South Africa purchased its planes plus additional units. South Africa exported these supplementary planes to Israel, and the country had access to planes it otherwise would not. A memo titled "Memorandum from South African Department of Foreign Affairs Regarding Mirage Aircraft" sent in January of 1970 outlined the details behind the deal. The South African Ambassador in Cologne sent the memo after meetings with Dornier Aircraft Company to set a plan for South Africa to purchase mirage aircraft. The mirage aircraft was a light attack jet first sold in 1970.[101] Surprisingly, no sanctions

[100] Ibid
[101] LeRoy, Francois Jean-Michel. *The elusive pursuit of grandeur and independence: Mirage diplomacy, French foreign policy and international affairs, 1958-1970*. University of Kentucky, 1997.

blocked Israel from purchasing these aircraft, but the company was worried about the optics of selling planes directly to Israel.[102] South Africa gave Israel and favor as they exported planes for the Israelis. The South African government gained bargaining power in the years to come over issues of nuclear material from this exchange. This is especially important as both South Africa and Israel edged towards a point where they could develop nuclear weapons.

South Africa and Israel still changed their relationship into the 1970s. By 1975 the relationship between the two countries needed updated to ensure that it fit the changing times. A copy of the agreement sent to the Minister of Defense of South Africa outlined the updates in the relationship. The government redacted many of the diminutive details as the government made the report public. The earliest of these details was that all parties reduced mutually agreed security procedures to writings that will be kept top secret by both parties.[103] After this agreement between the two countries, their interactions changed dramatically and shifted more towards developing potential weapons.

Later in 1975, the Israeli and South African defense ministers met in Zurich to discuss the development and production of military equipment. A document with notes from the meeting titled “Notes on Meeting between Israeli and South African Ministers of Defense Shimon Peres and P.W. Botha in Zurich" described the meeting. These negotiations began earlier but stalled when the two sides could not agree. The notes outlined the challenges of the collaboration, which were primarily rooted in the required funding from both sides. Israel believed that South Africa

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[102] "Memorandum from South African Department of Foreign Affairs Regarding Mirage Aircraft", January 28, 1970, Wilson Center Digital Archive, South African Foreign Affairs archive, 1/8/5, vol. 2. Obtained and contributed by Sasha Polakow-Suransky. https://digitalarchive.wilsoncenter.org/document/116592

[103] "Israel-South Africa Agreement (ISSA)", April 3, 1975, Wilson Center Digital Archive, South African History Archive, The Freedom of Information Programme Collection, Nuclear Weapons History, Department of Defence. Obtained and contributed by Anna-Mart van Wyk, Monash South Africa. https://digitalarchive.wilsoncenter.org/document/114147

needed to contribute more investment from their side. In response, the South African Defense Minister, Minister Botha, requested that the project must be completed in phases to ensure that the South Africans could pull out of the project if they saw it as necessary.[104] Botha's thinking ensured that the South Africans were not taken advantage of but also created tension between the two groups as they negotiated a sensitive topic.

These meetings continued as Israel and South Africa edged closer to a final agreement. The two countries met again a few months later, on July 2nd, 1975, in Lisbon, Portugal, to further discuss security measures between the two parties. Notes from this meeting illustrated the further challenges in the relationship. A main takeaway from this meeting is the presence of a South African Naval team stationed in Israel; at the same time, the notes don't provide context on why they stationed a team in Israel. The deployment of a naval team showed the depth of the alliance and the security measures between the two parties.[105] At this meeting, the two countries also discussed the arms deal, which would send Israeli tanks to South Africa. The discussion mainly focused on building up security measures so that information exchanged by the two countries was not at risk of leaks.

South Africa and Israel's government relationships remained strong, and meetings continued between the two nations. South African Minister of Labor and Mines S.P. Botha visited Israel in July of 1976 as Israel and South Africa lifted safeguards previously implemented on South African yellowcake reserves. Yellowcake refers to the stage in-between raw uranium and fully enriched uranium. The agenda for Minister Botha's visit illustrated the details of his

[104] "Notes on Meeting between Israeli and South African Ministers of Defense Shimon Peres and P.W. Botha in Zurich", June 4, 1975, Wilson Center Digital Archive, South African National Defence Force Archive, HSI/AMI Z/23/6/1, Vol. 3. Obtained and contributed by Sasha Polakow-Suransky. https://digitalarchive.wilsoncenter.org/document/116597

[105] "Notes and Agenda Related to Israel-South Africa Meeting in Lisbon", July 1, 1975, Wilson Center Digital Archive, South African National Defence Force Archive, HSI/AMI Z/23/6/1, Vol. 3. Obtained and contributed by Sasha Polakow-Suransky. https://digitalarchive.wilsoncenter.org/document/116600

trip. Within the agenda the connections are clear between Israel and South Africa's nuclear agreements. On the first day of his visit, Minister Botha spent nearly six hours at the Israeli Soreq Nuclear Research Center. Two days later, Botha visited a tank repair facility, the Israeli Aircraft industry building, and an operational aircraft base. The trip signified a new age for South Africa as they publicly gained access to Israel's Nuclear Research Center.[106] Prior to this exchange South African scientists only visited an American research center during the 1950s. The visit indicated a new frontier in the relationship between the two countries in which the intelligence and technology they shared more secretive information than previously.

In November of 1977, South Africa was under new international pressure from the United Nations for the injustices placed on Black South Africans by the minority apartheid government. A significant part of this international pressure was an international arms embargo put in place by the United Nations. The embargo restricted the export of weaponry to South Africa.[107] This resolution put a noticeable strain on the South Africa-Israel relationship, primarily propped up by the trade of weapons and the exchange of information on nuclear energy and weapons. After the implementation of the embargo, the South African Ambassador to Israel sent a telegram to South Africa that outlined the reaction to the embargo in Israel in the public media.[108]

Shortly after the announcement, Israeli Prime Minister Moshe Dayan completed a radio interview where he stated that Israel would act in accord with the restrictions decided on by the

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[106] "Agenda of South African Minister of Labor S. P. Botha's Visit to Israel", July 31, 1976, Wilson Center Digital Archive, Personal collection of Sasha Polakow-Suransky. Obtained and contributed by Sasha Polakow-Suransky. https://digitalarchive.wilsoncenter.org/document/116604

[107] United Nations Security Council (UNSC) Res 418 (4 Novermber 1977) UN Doc S/RES/418(1977)

[108] "Telegram from South African Ambassador to Israel, 'Israeli Reaction to the UN Arms Embargo Against South Africa'", November 17, 1977, Wilson Center Digital Archive, South African National Defence Forces Archive, AMI/MI 204/3/17, 19. Obtained and contributed by Sasha Polakow-Suransky. https://digitalarchive.wilsoncenter.org/document/116654

Security Council. The South African Ambassador to Israel sent a telegram to South African National Defense Forces which overviewed the details. Prime Minister Dayan denied that Israel had any under-the-table dealings with South Africa. When asked to elaborate on the question of apartheid, Dayan claimed that South Africa does not differ from any other nation. He appealed that Israel would continue to vote alongside the United States when internal suppression from the apartheid government was an issue. While South Africa waited to receive official notice on Israeli tactics surrounding these questions, it appeared that they would attempt to subterfuge and circumvent as much as possible to avoid the embargo by following three steps: publicly professing to uphold the embargo, placing a restrictive interpretation on the security council resolution, and continuing as long as reasonably possible to disregard the embargo. The telegram acknowledged the potential challenges in continuing the relationship with Israel under the embargo, but they also argued that with tight security it may be possible to continue exchanges of nuclear material.[109] Disregarding the embargo would be a risk for both Israel and South Africa, but the importance of the relationship meant that Israel considered this, and the ambassador even admitted it in these documents. The challenge with this point in history is that South Africa and Israel needed to operate more covertly than they had in the previous five years. The United States placed a spotlight on the South African government and a ban on trade between South Africa and Israel it would be risky to continue commerce. Arguments claimed it was necessary to continue these exchanges to keep the relationship between the two states. South Africa was the only nation that sold uranium to Israel, so this was critical to keep the Israeli program functional.

[109] Ibid

Despite the implementation of the arms embargo on South Africa, the South Africa-Israel relationship stayed incredibly strong. In February 1979, South African officials visited Israel to complete a test of the Israeli Intermediate Range Ballistic Missile. Israel created this system to stay top secret, and knowledge of the test extended only beyond those working on the project, senior cabinet members, and senior generals. According to a top-secret South African memo on the missile system titled "Memorandum South African Defence Force, 'Report on Special Visit to Israel - 19 to 23 February 1979'" its development began ten years ago, and twelve test launches took place before the test the South African officials attended. The memo overviewed the events of the test launch and looked at the Israeli perspective of the invitation to the South Africans.

The South African government saw this invitation as a goodwill gesture more than an attempt to gain state cooperation with the development of the missile system, primarily since its development aimed at the use of strategic targets in surrounding Arab States.[110] While this development and invitation may not have directly broke the arms embargo with South Africa, it was perilous for them to invite South African officials. If the United Nation discovered South African officials attended the test, Israel would likely face United Nations embargoes. Instead, they showed the South Africans how vital the partnership between the two nations was. This gesture continued to strengthen the bonds between the nation as they edged towards the 1980s, an era in which the partnership took even greater risks.

One major event dictated he relationship between these two powers in the 1980s which occurred on September 22nd, 1979. The United States satellite Vela Hotel picked up an

[110] "Memorandum South African Defence Force, 'Report on Special Visit to Israel - 19 to 23 February 1979'", March 13, 1979, Wilson Center Digital Archive, South African National Defence Force Archive, HSAW 520/3/4/6, Vol. 1. Obtained and contributed by Sasha Polakow-Suransky. https://digitalarchive.wilsoncenter.org/document/11665

unidentified double flash of light near the South African territory of Prince Edward Islands. While no countries took responsibility for the events, the last forty-one times a similar flash picked up by the Vela Hotel satellite resulted from a nuclear test. To this day, independent researchers believe a nuclear explosion caused the flash, and many believe this resulted from the South African Israeli partnership. Documents about these events are not public and likely never will be to. The secondary historiography published on the events is the best way to understand what truly took place.

After the Vela Hotel incident in 1979, South Africa's nuclear program went into a inactive stage. The Kalahari site remained inactive from 1977 until 1987, when it reopened for one year before South Africa prepared to undergo non-proliferation in 1991. Perhaps after the failures of the construction of the Kalahari site in 1977 and the international pressure in the years after the Vela Hotel event in 1979, South Africa realized they had overplayed their hand and experienced a fallout. Between 1980 and 1991, South Africa entered damage control over the publicized failures of their nuclear program. These program failures resulted in a loss of trust between South Africa and its Western partners. When its partners lost confidence in South Africa, it opened the government up to more critique of the apartheid system. Simultaneously South Africa faced critique of apartheid over its nuclear failures. It also faced mounting international scrutiny for the racial policies of the apartheid government. The two-pronged attack South Africa faced proved to be too much for the survival of the nuclear weapons program. Following a decade of dormancy within the nuclear program South Africa entered the NPT in 1991 and started the process of retiring and dismantling its nuclear weapons.[111] In 1993

[111] Pabian, Frank V. "South Africa's nuclear weapon program: Lessons for US nonproliferation policy." *The Nonproliferation Review* 3, no. 1 (1995): pg. 11.

Prime Minister F. W. de Klerk announced that South Africa voluntarily joined the NPT after possessing nuclear weapons. In a speech to the United Nations, de Klerk admitted South Africa had nuclear weapons from the late 1970s until early 1990. He claimed that at the program's termination, South Africa only possessed six weapons of the seven they planned to build. Only certain ministers knew that the program existed on a need-to-know basis. De Klerk also crucially admitted that the intention was never to use the devices. They always existed with an emphasis on deterrence. By the time of this speech on March 24, 1993, South African officials already deconstructed the weapons, and the nuclear weaponry chapter of South African history came to a close.[112]

Conclusion

The international relations of South Africa regarding nuclearity can be broken into two distinct ages by the relationships that South Africa had during given eras. The first era defined by relationships with the United States and France initially lifted South Africa into some nuclear relevance. This relationship only gave them the essential material and intelligence. It raised South Africa's prestige and reduced dependency as the government had two reliable partners who helped to raise the profile of the apartheid regime. The second era of South Africa's nuclear international relations involved its partnership with Israel to develop weapons. Israel provided unique pieces to the South African weapons program. Throughout this relationship, South Africa continued to balance the leverage of its nuclear programs mindfully. In contrast, it avoided dependency on one nation above all others, including when it worked with Israel. Ultimately the

[112] "Speech by South African President F.W. De Klerk to a Joint Session of Parliment on Accession to the Non-Proliferation Treaty", March 24, 1993, Wilson Center Digital Archive, Archives.un.org. Contributed by Jo-Ansie van Wyk.
https://digitalarchive.wilsoncenter.org/document/116789

relationship with Israel and its product of it, a nuclear weapons test site and test upset the United States and the Soviet Union. As a result, even under the United Nations embargo, South Africa's government had access to technology and intelligence from its allies even as relations with the United States government turned sour. South Africa already had no relationship with the Soviet Union, but the loss of the United States as a partner had a hugely negative impact. The loss of trust resulted in a broader critique of apartheid from the rest of the globe and more isolation from trade. The next decade was exceptionally dark for South Africa. Israel provided intelligence and technology much more openly than the United States. Israel provided investment and technology that allowed the South African government to operate covertly when it dealt with weaponry while still making massive strides as it began to develop nuclear energy in South Africa.

Chapter 5: Mining Labor and the Framework for Apartheid

Introduction

South Africa's apartheid government remained in power until 1994. Yet, as early as the 1970s, South Africa's government felt external pressure to dismantle the minority apartheid government and push for an equal society. These pressures came in the form of economic sanctions, quotas on imports, and other economic toolsets aimed at slowly reducing the quality of life for South Africa's white ruling elite. Many foreign governments implemented these sanctions on South Africa after protests in their own countries. Citizens protested the treatment of Black South Africans who worked the most demanding jobs and saw no benefits from the dangers of their work. Across the United States, Britain, and other western nations, protests aimed at not only the government but also transnational corporations who worked in South Africa to extract natural resources from the mines. Native South Africans emigrated into mining communities to work for the nationalized government mining system as a form of neocolonialism. In South Africa, the government-controlled uranium mines where workers extracted uranium from deep within the Earth. These workers functioned under government oversight and policies implemented by the racialized structures of the apartheid government. Other mines focused on removing other minerals, such as gold, these miners worked under transnational corporations that exported precious metals from South Africa to foreign nations.

Gabrielle Hecht touched on these topics throughout her research, where she concentrated on mine workers' treatment, pay, housing, and safety concerns. Her work exposed much of the detrimental treatment these workers received and the risks they took by working in the mines.[113] Hecht recalled the history of mining labor in South Africa, beginning in the 1870s as the

[113] Hecht, Gabrielle. *Being Nuclear*, pg. 251

diamond mining industry multiplied. Years later, in 1886, the gold industry in South Africa followed a similar pattern and moved to the Transvaal region of the country. As supply continued to stay high, gold mining houses kept the prices stable by keeping production prices low—the primary tool for doing this involved keeping wages low. In 1926 white mineworkers still saw their Black colleagues as a threat to their jobs. After a series of strikes, revolts, and elections, the government passed legislation that kept skilled jobs in white miners' hands.[114] These regulations remained as South Africa's government constructed a uranium mining industry in the 1950s,

This chapter aims to answer questions on the importance of South Africa's apartheid government in shaping the mining industry, however the resources contributing to the arguments are one sided as a result of accessible perspectives. Many of the resources including the secondary scholarship provided a strong background on the mining industry, yet the primary sources from the Anti-Apartheid organization in England, as well as newspaper articles, published outside of South Africa. These do not illustrate the entire picture of how apartheid policies shaped mining industry, but they do outline how important Black labor was to the development of the systems which perpetuated racial profiling across South Africa's mining industry and the importance of race in the history of South Africa's nuclearity.

The economics of mining in South Africa during the 20th century led to many questions about why the country relied so heavily on the mining industry, whether this related to uranium or other mining. South African economist Francis Wilson published extensively on the labor forces used in South African mines in the 20th century. His book *Labour in the South African Gold Mines 1911-1969*, published in 1969, looks at the conditions faced by miners and how they

[114] Ibid, 250

differed between white and Black miners. This this research applied outside of the gold mining industry in the uranium mining industry as much of the uranium mining took place in the waste from gold mines, especially in the early years of South Africa's uranium mining industry.[115] The book explicitly outlined the pay disparities between white and Black mineworkers from 1911 to 1969. In 1911 the pay gap between white and Black miners was 11.7 pounds sterling earned by each white mineworker to 1 pound earned by each Black mineworker. These disparities continued to grow until 1969, where the ratio of pay to white miners was 20.1 pounds sterling to every 1 pound earned by Black mineworkers.[116] These policies outlined the most basic injustices faced by Black South Africans who worked in the mines, yet this brushed the surface of the challenges they faced across all parts of society associated with the mines. Mining played an incredibly significant role in South Africa's society, but this was largely because of the geologic make-up of the country. Mining was the largest industry in the 20th century. The accessibility of uranium and other valuable minerals was entirely responsible for the long history of mining in South Africa and the influence mining had on shaping South Africa's economy and society.

Civil disobedience and protest played an important role in South African labor history for much of the 20th century. A young Mahatma Gandhi was responsible for some of these cases at the start of the century. Gandhi lived in South Africa as a young lawyer in an Indian community with a large population of mine workers. Some of Gandhi's earliest civil disobedience work took place to counteract the injustices faced by diamond miners of Indian backgrounds. Gandhi's protest focused on gaining more rights for Indian and Asian workers in South Africa who faced

[115] Dasnois, Nicolas. "Uranium mining in Africa: a continent at the centre of a global nuclear renaissance." 2012.
[116] Wilson, Francis. *Labour in the South African Gold Mines 1911-1969*. London: Cambridge University Press, 1972. pg. 46

horrific working conditions during the Boer War.[117] Civil disobedience campaigns provided a lens for understanding the injustices faced by miners and provides context for how conditions changed across the century.

To understand the challenges workers faced in South African mines, its crucial to recognize which issues faced the most protest from laborers. When examining protest movements in South Africa against the Apartheid government, there are two ways to look at them, through the domestic protest movements by mine worker unions and other domestic groups, but also from an international perspective. To understand what predominately white protesters in Britain and the United States focused on with their movement.

As Hecht and others note in their work, the "color bar" remained in play especially as mining became more dangerous with the introduction of uranium mining in the 1950s. Migrant workers from rural South Africa, Malawi, Mozambique, and Lesotho provided much of the labor forces exploited in South Africa to produce uranium and other minerals.[118] Within South Africa, the mining industry continued to act as a severe form of neocolonialism against Black South Africans. This industry exported South Africa's natural wealth to Europe and the United States. This chapter looks at domestic and international protests and mining strikes to understand how South Africa's minority apartheid government and countries like the United States benefitted from the cheap mining products produced by South Africa's labor force.

Domestic Protests and Strikes

Throughout the apartheid government era, there were a series of strikes against mining corporations and governments when Black South Africans saw immense mistreatment in South

[117] Power, Paul F. "Gandhi in South Africa." *The Journal of Modern African Studies* 7, no. 3 (1969): pg. 446. http://www.jstor.org/stable/159062.
[118] Hecht, Gabrielle. *Being Nuclear*. pg. 252

African mines. British Anti-Apartheid materials provided the context of how South African apartheid policies governed the mines since the late 1800s when diamond discoveries led to the development of the mining industry for gold and diamonds under the eye of Cecil Rhodes. Rhodes formed the De Beers Consolidated Mines Ltd in 1880. At the start of the 20th century, De Beers employed 20,000 people, and up to 90% of these workers were Africans. Conditions under De Beers bordered on slavery, with African mineworkers held in compounds for the duration of their work contracts. Security forces used horrific techniques to ensure workers didn't swallow diamonds during their contracts. Guards forced Africans to consume castor oil and stewed dried fruit, then confined them to a room with strict supervision to ensure that guards could search their excrement for stolen diamonds.[119] During their contracts, it was illegal for miners to leave their place of work, authorities tracked down and shot those who escaped. As most of the workers were Black, the state banned union activity and miners' strikes.

Many of these policies remained as South Africa's mining industry evolved to include large scale goldmining. Beginning in 1949 the uranium industry grew out of the gold mining industry with the same policies in adjacent locations using the same labor pools and equipment. Most of this mining took place in Witwatersrand and the adjacent basins outside of Johannesburg. The policies first instated for diamond and gold mining continued with the treatment of Black laborers through apartheid government policies and the housing and wages that these workers received. In the gold and diamond mines transnational corporations used these policies, but in the nationalized uranium industry the government implemented the same working conditions on miners employed by the state.

[119] South Africa: The Crisis in Britain and the Apartheid Economy. By Dorcas Good & Michael Williams, n.d. Group 1499, Box 1, Anti-Apartheid Movement London 1976, 1984, [1985?], 1987, 1993, E.S. Reddy Papers, Yale University Manuscripts and Archives, New Haven CT.

Mining conditions became a point of international interest in the 1980s as countries sanctioned South Africa for its racialized policies. In 1980 the United Nations hosted a symposium on transnational corporations in South Africa and Namibia. John Gaetsewe, Secretary General of the South African Congress of Trade Unions, published a symposium paper titled "Life and Labor in Transnational Enterprises in South Africa." The report addressed the conditions for laborers in South Africa and riots and strikes against these conditions during the 20th century. It addressed how some of the earliest legislation against labor protests in South Africa stilled ruled the industry. As early as 1944, the government banned gatherings of 20 or more people following a general strike of miners to protect the mines from union activity. Gaetsewe argued that this is one reason mining conglomerates managed by transnational organizations cannot continue paying what he described as "starving wages to Black workers"[120] During the 1970s, mining riots ripped across South Africa's mines. Instead of addressing the rioters' demands, leadership appointed the Intergovernmental Commission into Riots in March 1975 which punished those who rioted.

Vella Pillay, a South African economist wrote another symposium paper for the United Nations symposium in November of 1980. Pillay was a South African economist and leader in the British anti-apartheid movement. His paper examined the relationships between South Africa and the transnational corporations that exploited the natural resources of Namibia and South Africa. The paper reported on the importance of the South African mining industry to the country and the immeasurable abuses of power which made it so prosperous for the government. In 1979 the total value of South Africa's mineral production was just under $11 billion. As a whole

[120] Transnational Corporations: Allies or Instruments of the apartheid system, 6-7 November 1980, MS1499, Box 20, United Nations Symposium on "Transnational Cooperation's in South Africa and Namibia" London 1980, November 6-7, E.S Reddy Papers, Yale University Manuscripts and Archives, New Haven CT. pg. 6

industry, mining employed just under a million employees, yet only about 4% were white. Although this industry made up a large portion of the GDP of both South Africa and the colony of Namibia, much of the financial backing and capital came from American and British corporations. Pillay continued to focus on how the development of the mining industry under the apartheid system led to some of the worst wages and working conditions in the South African economy. Compared with other South African industries, gold and uranium mining ran at a profit level significantly higher than the aggregate wage bill of the industry. This led to the daily unjust living and working conditions that South African miners faced for minimal pay.[121] Pillay argued that this reasoning was responsible for the massive profits in mining and the business practices that continually exploited the Black mineworkers.

The U.N. wrote documentation from the South African perspective that provided a new view on the importance of mining in South Africa. While South Africa relied on mining as a significant source of wealth for the country and its people, it also took away from a large portion of the population more than it gave them in return. This led to ideas of neocolonialism, as the mines extracted from indigenous Africans who held ownership of these lands before the arrival of colonial Europeans. These patterns continued into the apartheid government which still removed wealth from modern South African people and lands for decades.

One of the most recent issues over the treatment of workers was the case against Tjeluvuyo Mgedezi for his role in organizing the South African NUM (National Union of Mineworkers) at the Vaal Reefs Mine in 1987. From The Anti-Apartheid archive, there are a series of promotional pamphlets produced by the National Union of Mineworkers (NUM) and the British group the Joint Campaign Against the Repression of Trade Unionists in South Africa

[121] Ibid, 15

and Namibia. The government cleared two other NUM miners of the same charges from the same case months before. At the same time, Tjeluvuyo Mgedezi remained in faced the death penalty at any moment. Mgedezi's case was significant because he was a Vaal Reefs Goldmine leader. He was the Chairman of a shaft stewards committee at Vaal Reefs, a mine owned by an Anglo-American Corporation. The incident in question resulted in the death of four white team leaders, who the Black workers saw as the most repressive leaders who acted in mine management. These documents summarized a series of violent incidents that management blamed on "faction fighting" within the mines. The pamphlet casts the blame of the thousands of miners who passed away over the previous years on the poor safety that stemmed from the hands of the team leaders.[122]

The authors of the anti-apartheid material who described Mgedezi's case cited a specific tragedy, the Kinross disaster, where 177 miners perished in a gold mining shaft. According to a *Washington Post* article published the days after the disaster, toxic fumes caused the deaths in the mining shaft. The mining company used flammable polyurethane tunnel sealant in the shaft that released toxic fumes asphyxiating the victims. At the time of the tragedy in 1986, miners received a modest equivalent of $150 a month for their labor. Many migrated to the Transvaal region to do this work and returned home once a year for four to six weeks. Nonetheless, as late as 1986, corporations gave roles to different workers based on their race. Groups of Black men worked under a white supervisor. One specific Black man, often known as the "boss boy,"

[122] Save Miners Leader by National Union of Mineworkers and Joint Campaign against the Repression of Trade Unionists, 1989, MSS AMM 1814, AMM Archive, Bodleian Library

prepared the dynamite for explosions while the white supervisor stayed away from the dangerous work.[123]

Following the disaster, the mine blocked NUM from providing its evidence at the inquiry, and the government cleared the company of responsibility for any of the deaths. Regarding the ongoing case of Mgedezi, the day before the incident, Mgedezi questioned if all mineworkers should continue working under current conditions; the mine refused this request to keep productivity high in the mines. In similar instances in other mines, management used armed vigilantes to curb the growing power of the South African NUM and its actions.[124] These cases all come from the history of gold mining in South Africa which meant transnational corporations ran the mines. While they provided a framework for the conditions in uranium mines as it is much more difficult to find documents that reference uranium mining conditions. The conditions at government uranium mines were in many cases the same as gold mines run by transnational corporations, but documentation on uranium mines is much harder to locate.

These documents and instances illustrated the longer-term challenges of South Africa's relationship with the apartheid system in the mining industry. In all truth, South Africa still has not abandoned its apartheid past in present-day mining. According to a *New York Times* article published in December of 2007, "Those who own the mines are chasing profits at the expense of people' lives."[125] The death rate in South Africa remained significantly higher than other mining

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[123] Claiborne, William. "Toxic Fumes Said to Kill 177 in S. African Mine." The Washington Post. WP Company, September 18, 1986. https://www.washingtonpost.com/archive/politics/1986/09/18/toxic-fumes-said-to-kill-177-in-s-african-mine/fb2c39f7-93b3-408d-b3e8-88833868e471/.

[124] Save Miners Leader by National Union of Mineworkers and Joint Campaign against the Repression of Trade Unionists, 1989, MSS AMM 1814, AMM Archive, Bodleian Library

[125] "South African Miners Strike for Better Safety Conditions," December 5, 2007. https://www.nytimes.com/2007/12/05/world/africa/05safrica.html.

hotspots including Australia and North America. This article covered the largest South African miner strike in two decades which brought tens of thousands of miners to the streets of Johannesburg. While some conditions improved and pay rose, there is still a cold line that dictates the role someone plays in the mining system. The divisions by this line are still largely along racial lines. Even after all the international pressure that brought the apartheid regime to its knees many of the western corporations that run mines in South Africa still used outdated policies that continued to exploit Black miners.

International Protests and Pressure

International protests on South African labor conditions coincided with criticism of the apartheid in the 1970s. South Africa faced a significant shift in public opinion as western countries became more outspoken about the changes needed in South Africa's government to ensure racial equality for more citizens. A large part of the protests took place internationally against corporations who mined in South Africa and used South Africa's racialized apartheid laws for guidance on how to treat workers.

To introduce the mining industry in South Africa and the workings within apartheid frameworks across the entire industry, clear patterns emerged concerning the relationship between South African Black laborers and the greater system they worked within. According to British Anti-Apartheid Materials these patterns existed within the entire system. A pamphlet titled "South Africa: The Crisis in Britain and the Apartheid Economy by Dorcas Good and Michael Williams outlined the broad exploitations of Black workers in South Africa and how the British government and corporations supported these through the relationship between South African natural resources, British industrialism, and cheap South African labor. Most specifically, this report outlined wage differentials between Black and white workers in the coal

mining industry in South Africa, as reported in the *Financial Mail* in 1974. Black employees numbered 65,576 and received an average wage of $7.30 per week, while white employees numbered only 7,276 and earned average wages of $139.73 per week. This contributed to a fact brought up later in the report that South Africa has an exceptionally high labor turnover rate that exceeded 100% per year, meaning that workers rarely worked in these positions for up to a year.[126]

These figures outlined how firms in need of labor viewed South Africa as a bottomless pit of new, usable labor, specifically in these low-paying mining positions. The government exploited the South African labor pool to the point where workers no longer wanted to work these positions. In that case, the government brought in laborers from migrant crews to support the lack of labor within South Africa.

While South Africa's mines played a significant role in this conversation, South Africa's colonial holding of Namibia also reflected many pieces of apartheid South Africa's policy towards laborers and how it reflected in the mining industry. Namibia was a crucial colonial holding for South Africa because it was another large producer of uranium. Namibia was home to the Rössing uranium mine. The largest open pit uranium mine in the world. A British movement known as "The Campaign Against the Namibian Uranium Contracts" (CANUC) published a series of promotional pamphlets in January of 1980 that highlighted British relationships in Namibia and South Africa. British leadership exploited the Black mineworkers who provided uranium both for the British government and British transnational corporations. Throughout this time, South Africa illegally remained in Namibia, according to the U.N. accord

[126] South Africa: The Crisis in Britain and the Apartheid Economy, MS1499, Box 1, Anti-Apartheid Movement London 1976, 1984, (1985?), 1887, 1983, E.S Reddy Papers, Yale University Manuscripts and Archives, New Haven CT.
[126] Roberts, Alun. *The Rossing File: The Inside Story of Britain's Secret Contract for Namibia Uranium*

in 1966, which removed South Africa from its jurisdiction over Namibia. South Africa stayed in Namibia for the next few decades. In South Africa, the South African government controlled any land and mining that involved uranium; in the colonial holding of Namibia, they exported these responsibilities to Rio Tinto-Zinc, the British multinational giant that opened the Rössing uranium mine in 1976.

According to the CANUC documents published in Britain, the conditions at the Rössing uranium mine were deplorable across the board. The mine reached its production goals as early as 1979, just three years after it opened. The conditions for workers were not up to standard. Rio Tinto barred entry for journalists and photographers in 1977 after reports of a strike of 700 workers called in security reinforcements who used tear gas and guard dogs on the crowds of workers.[127]

The Namibian workers at Rössing worked under a discriminatory system of wages, working conditions, and living standards. According to the wage table published in 1977 that CANUC accessed the mine made an open distinction between, "the day rate for Black and colored employees." Wages varied on an eight grade pay scale for Black employees ranging from $350 to $1,450 per month. Their white counterparts received a pay scale with no less than twelve grades where the minimum earned $775 per month, and the maximum was $36,000 per month. Within the breakdown of Black miners, 85% were in the four lowest pay grades; white workers did not face these challenges, as 65% of these workers worked in the top six grades. In 1979 Rössing changed the pay scales they claimed: "firmly established a non-racial policy."

[127] Roberts, Alun. *The Rossing File: The Inside Story of Britain's Secret Contract for Namibia Uranium*. London: Namibia Support Committee, 1980. pg. 44

Nothing changed. Rio Tinto divided employees divided into 17 separate monthly wage grades. Following these policy changes, 68% of the workforce remained in the six lowest pay grades.[128]

While a vast majority of the workforce at the Rössing mine was Namibian, there was a group of migrant workers as well. 85% of the workforce was Namibian, while the remaining 15% originated from Malawi, South Africa, and Namibian ethnic groups, including the Damara and Ovambo peoples. The movement of these local peoples focused on the men. The company forced men to move into the south of Namibia to gain access to work under South African occupation, which confined the Ovambo to the north of the country. This had long term impacts on the Ovambo people as most of the men moved to the southern parts of the country for large fractions of the year. This migration pattern had massive influences on family life.

Beyond pay, many of the workers in the Rössing mine relocated to live in towns near the mining site. CANUC highlighted the housing provided to Black miners as one of the more obvious "callous and racist policies." The report highlighted the township of Arandis, a township explicitly built for Black and colored mine workers at Rössing. Reporters from *The Guardian* visited the township after its completion. Reporting described the living quarters as some of the worst they saw in Namibia. In 1978 Black workers spoke out about their living conditions commenting on the unsanitary conditions they received compared to the excellent housing that white workers had in Snakopmund for more reasonable rent.[129] In Swakopmund, the white township located some forty-five miles from the mine, all single workers had a private room with a bathroom. In Arandis, the Black mineworkers had very different conditions. In "single quarters," workers lived in two to a room, regardless of the initial purpose of the room. Workers slept in the kitchen, living room, and shared bathrooms. Injustices continued during the commute

[128] Ibid, 49
[129] Ibid, 53

to the mines. Buses that carried Black workers were always stopped at the entrance for ID checks, while white buses passed through into the mine without ID checks. The mine jailed Black workers who forgot their IDs for up to a day.[130]

Policies at Rössing reflected those also used in South African mining operations. These policies reflected the close relationships between the gold and uranium mining industries and the broad injustices Black South Africans and migrant workers faced in South African and Namibian mines. These policies provided a framework for the South African labor policies inflicted on miners in uranium mines. South Africa's labor provided for its nuclear program which worked as a symbol of racial supremacy on the international stage even as South Africa became more isolated under apartheid sanctions and embargoes. The use of embargoes in the late 1970s against South Africa raised the profile of the nuclear program as it became South Africa's only viable point of strength needed to remain relevant on the global stage.

Visual history from Western countries also showed a new view of the British opinion on South African labor policies and the treatment of Black workers in the mines. Protests in western countries played a significant role in the sanctions placed on South Africa by their former western partners. These images illustrated the ideals of the young class of British students who took to the streets to protest the treatment of Black miners in South Africa. The photos from various sources including the *Morning Star*, a British newspaper focused on the perspective of the left-wing and wrote on social, political, and trade union issues in Britain and abroad.[131] The images span from as early as the 1960s into the late 1980s, where anti-apartheid protests in Britain became some of the most widespread in western countries. While many of these protests

[130] Ibid, 58
[131] Howe, Mark (2001). *Is That Damned Paper Still Coming Out? The Very Best of the Daily Worker Morning Star*. London: People's Press Printing Society.

didn't focus on a specific issue, these movements all focused on the relationship between the South African state and the workers in the South African mines, whether they produced diamonds, gold, or uranium. British protests addressed problems in South Africa as well as the colonial holding of Namibia, where indigenous Africans worked in mines run by companies based in London. One protest outside the Rio Tinto headquarters in London's St. James's Square requested that Rio Tinto (also known as RTZ) reformed its policies. This protest took place on Namibia day, following a judgment by the International Court of Justice that South Africa's rule in Namibia was illegal. Young protesters stood in front of the headquarters with signs that requested the release of Namibian political prisoners, more significant support for U.N policies in Namibia, and claims that RTZ profits come from Black slavery. The protesters appeared to be relatively young people from a well-off background, as they are well-dressed and white. At the same time, they represented a new generation of political activists; long hair, a symbol of free thinking in the 60s and 70s, led to questions of why these protesters are involved in these issues. The protesters also held signs of support for the South West Africa People's Organization (SWAPO) an independence movement in Namibia.

Figure 5: Anti-apartheid Protesters outside of the Rio Tinto Headquarters in London in Support of Namibian Independence. From AMM Archive (Bodleian Library, 1973)

The following image showed a daily protest outside of the London headquarters of the Anglo-American, Consolidated Goldfield and other South African mining groups. The protesters raised over 75,000 Pounds for the miners. The picture showed two members of Parliament from the Labour Party Tony Banks and Jeremy Corbyn. In their hands they held leaflets that police stopped them from distributing to the crowds at the protest outside of the offices of the Anglo-American Corporation.

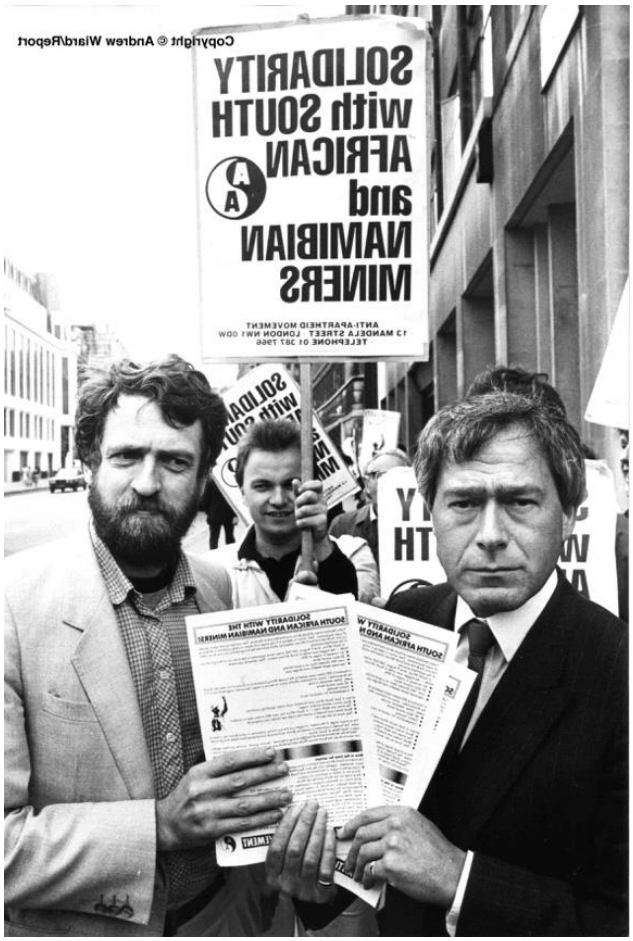

Figure 6: Labor Party MPs Tony Banks and Jeremy Corbin Protest British Corporations Involvement in South African Mining. From AAM Archive (Bodleian Library, 1987)

Minutes of a meeting held between Anti-Apartheid movements and other solidarity groups held during the United Nations and Organization of African Unity Conference on Sanctions against South Africa on May 23rd, 1981. Address the challenged of building a unified international movement against the apartheid government. These meetings, held at the UNESCO building in Paris, addressed the relations between the organizations that worked to dismantle. These groups shared the same ideas regarding the representation of Black groups in South Africa and international diplomacy. Throughout the meeting different members came forward with relevant information. Akira Kushuhara of the Japanese anti-apartheid movement shared how

Japan imported South African and Namibian uranium despite the guarantee that Japan would observe UN decree Number One.[132] By purchasing Namibian uranium Japan ignored the statutes of UN decree Number One which stated that, "The Decree provides for the seizure of any Namibian natural resource taken from the Territory without Council authorization and for forfeiture of the resource so seized to the Council for the benefit of the people of Namibia"[133] In 1980s South Africa's government faced many challenges from the most severe era of isolation during the ruling of the apartheid government. South Africa managed race relations for decades using racist policies under the apartheid rule. These policies ultimately went up in flames as western countries could no longer turn a blind eye to the atrocities that took place in South Africa and the pressure South Africa's government from the rest of the globe brought the apartheid government to its end in 1994 just a few years after South Africa signed the NPT.

Conclusion

South Africa's policies surrounding labor in mines reflected many other themes identified within South Africa's history of uranium. Primarily the relationships with foreign countries played a massive role in the program's success. These international relations also played a detrimental role for the South African state once countries began to protest and placed sanctions on South Africa and isolated it from the rest of the word. In the same vein, South African policy itself also significantly took away rights and benefits from South African workers in the mines to ensure that the prices of uranium but also other essential minerals remained low so that South

[132] Minutes of the meeting of Anti-Apartheid Movements and other Solidarity Groups, MS1499, Box 20 UN-OAO International Conference on Sanctions Against South Africa, Paris 1981 May 20-27, E.S Reddy Papers, Yale University Manuscripts and Archives, New Haven CT.
[133] UN Council for Namibia, Implementation of Decree No. 1 for the Protection of the Natural Resources of Namibia: study on the possibility of instituting legal proceedings in the domestic courts of States: report of the United Nations Council for Namibia., New York, United Nations Council for Namibia. pg. 3

Africa stayed a primary exporter to the west. While this benefitted South Africa's ruling class, it also took away dramatically from the working class, which felt most of these policies.

Overall, the primary relationship between the South African apartheid government and South African nuclearity was the relationship built on apartheid policies that reduced the role of Black South Africans to the lowest stature in the mining industry. These workers labored in the most dangerous jobs for the lowest pay and had minimal mobility between their jobs and the "homes" the mining agencies provided. This collaboration is yet another example of the role of the South African government in using nuclear resources as a symbol of white power in the 20th century.

Race not only influenced South Africa's economic relationships it also played a significant role in the downfall of nuclear program. As South Africa edged towards the downfall of the apartheid government the reality that a democratic Black government would access to nuclear weapons became a reality. A *New York Times* article published in 1993 questioned this decision from the South African Prime Minister F.W. De Klerk to enter the NPT prior to the handoff between governments. The African National Congress approved scraping the nuclear weapons program, but they also questioned Prime Minister de Klerk's statement that the government eliminated all weapons grade uranium.[134] Questions remained over the motivation for the destruction of the program given the inevitability of a democratic South Africa. *The Atlantic* asked De Klerk about these truths in 2017. De Klerk claimed that there is no truth to the theory he wanted to keep weapons out of the hands of a Black South African government instead he described the new stability around the globe as a main motivation for the retirement of South

[134] Keller, Bill. "South Africa Says It Built 6 Atom Bombs." *The New York Times*, March 25, 1993.

Africa's weapons. The fall of the Berlin Wall, dissolution of the Soviet Union, and more locally a peace accord in Angola and the withdrawal of Cuban troops from Namibia created a more stable global order.[135] Because these threats no longer existed, De Klerk argued that South Africa no longer needed its weapons and saw this as the moment to retire them. While race played a role in the retirement of South Africa's nuclear program it was not the only influence that hindered the progression of the program in the 1980s.

[135] Friedman, Uri. "Why One President Gave up His Country's Nukes." *The Atlantic*, September 9, 2017. https://www.theatlantic.com/international/archive/2017/09/north-korea-south-africa/539265/.

Conclusion

South African history showed how uranium made the country an influential state on the global stage. It leveraged uranium to its advantage, but in the end the nation could not hold up the apartheid regime. International pressure ended apartheid and with-it South Africa's ambitions as a nuclear superpower. South Africa's uranium deposits at Witwatersrand and Kalahari were crucial to for South Africa's economy, but also provided valuable material for the South African nuclear program and the leverage used towards others that built this program. South Africa's complex histories both from the natural and human perspective outlined the challenges for postcolonial nations, which often face issues further reinforced by patterns of greed.

South Africa's story of mining reinforced this narrative by examining the paradox of lacking access to nuclear technology, but also producing a large percentage of the world's uranium. South Africa's unique geology with its exposed deposits and richness, made it a literal "gold mine" for centuries. It attracted attention for various reasons – gold, diamond, and uranium. The kimberlite activity and past interactions between cratons created a perfect environment for the development of valuable minerals. The apartheid governments policies on extracting these minerals evolved after the failures of the 1886 Witwatersrand gold rush when transnational corporations extracted all the wealth from the Witwatersrand region. The nationalized uranium program in 1949 was a direct response to failures of 1886. To consider this history, the context of the natural history must be understood. South Africa's mineral resources in particular its uranium resources acted as a destabilizing force especially in the 1970s and 80s. The actions of colonial powers and neo-colonization by transnational corporations is responsible for many of the injustices faced in South Africa today. South Africa's immense mining infrastructure stemmed from its immense geologic luck which initially propelled the country forward before South Africa overplayed its hand and fell into nuclear irrelevance.

The uranium resources empowered the state at some movements but also later in history weakened it. For much of the twentieth century uranium and the South African nuclear program helped sustain apartheid, keeping South Africa a relevant global power as isolationist sanctions and embargoes cut the country off from much of the world.

Across the modern history of South Africa mining policies and the mining industry rose during the beginning of the apartheid government regime. This meant that many policies of the apartheid government indirectly came from colonial and post-colonial mining operations. While these operations existed before the need for uranium mining many of the practices carried over across the growing mining industry as uranium grew in stature. These policies remained in effect for the decades that followed, ultimately coming to an end after the fall of the apartheid government in 1994. Still the implementation of apartheid policies across all mining industries illustrated the importance of the greater mining industry to the South African economy. This government relied so heavily on mining for the country's economy that the apartheid government ensured the mining systems in place allowed for maximum profitability. [136]

The apartheid governments access to nuclear technology was deeply associated with race and colonialism in the history of South Africa. The apartheid South African government used nuclear technology to project power on the greater global system and protect itself from criticism of apartheid. South Africa never intended to use its weapons, but Gabrielle Hecht argued to be a nuclear nation it needed to develop nuclear weapons to remain influential.[137] By gaining enrichment technology, civilian energy, and ultimately nuclear weapons South Africa projected

[136] Davenport, Jade. *Digging deep: A history of mining in South Africa*. Jonathan Ball Publishers, 2013. Pg. 184
[137] Gabrielle Hecht, *Being Nuclear: Africans and the Global Uranium Trade*, 2014. pg. 28

its initial geologic luck as a form of techno politics that promoted the countries place in the global nuclear system.

Because of its white government during most of the late 20th century other governments afforded South Africa many more freedoms to explore nuclear technologies and infrastructures. Black ruled African countries did not have the same access provided by leading western powers including the United States and Britain. Because of its white minority government South Africa had greater access to technology and intelligence from these nations which ultimately was responsible for the development of South Africa's technology. The racially motivated development of technology was also connected to the decline of South Africa's entry into the Nuclear Proliferation Treaty. Just years before South Africa's apartheid government lost control of the country the government leadership signed a treaty to deconstruct its military nuclear program in 1989, just five years before the democratically elected Black government came to power.[138] In 1991 South Africa dismantled the last of its nuclear weapons. In 1992, David Albright and Mark Hibbs reported that one South African official admitted that South Africa joined the NPT and accepted IAEA safeguards because of De Klerk's government's concern for the future.[139] The white government chose to dismantle the nuclear weapons program while they still had the power before it transferred to a Black democratically elected government. South Africa remained the only African nation to possess nuclear weapons, even though it was all done under a white minority government.

Issues of nuclear possession remained relevant when discussing South Africa because South Africa is still the only country in Africa that has had possession of nuclear reactors for

[138] Howlett, Darryl, and John Simpson. "Nuclearisation and denuclearisation in South Africa." *Survival* 35, no. 3 (1993): pg. 161.
[139] Pabian, Frank V. "South Africa's nuclear weapon program: Lessons for US nonproliferation policy." *The Nonproliferation Review* 3, no. 1 (1995): pg. 10

electricity. While the initial development of this program was under the white minority government South Africa remains the only active civilian nuclear program on the African continent.[140] This illustrated not only the freedoms South Africa was offered in the second half of the twentieth century, but it also demonstrated how important it is for the nation to have a continual source of raw uranium, as well as the technology to enrich uranium for energy use. As a result, South Africa's nuclear infrastructure played a leading role in the African continent, even though favors paid to the apartheid government by western partners created this possibility.

[140] Gil, Laura. "Is Africa ready for nuclear energy?." *Africa Renewal* 32, no. 2 (2018): pg. 30

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