

SUSTAINABILITY OF STRATEGIC MINERALS IN SOUTHERN AFRICA¹ AND POTENTIAL CONFLICTS AND PARTNERSHIPS

Dr. Stephen Burgess^{**†}
2010

The principal sustainability challenge in Southern Africa for the United States and its allies is uncertain access to strategic minerals, particularly platinum group metals (PGMs), chromium and manganese; and rare earth minerals, cobalt and uranium. The causes of this challenge are increasing global demand and supply shortages caused by inadequate infrastructure, politicization of the mining industry, and China's aggressive, monopolistic behavior in pursuit of minerals. The challenge is most acute in the five Southern African countries of South Africa, the Democratic Republic of the Congo, Zambia, Zimbabwe and Namibia. Environmental sustainability of the mining industry is another concern. The purpose of this paper is to provide scope to the problem and recommend steps the United States can take in order to ensure continued access.

Southern Africa contains strategic minerals, which the United States and its allies require for industrial purposes and that militaries need for the production and sustainment of weapons systems.² For more than four decades, the supply of minerals has been a concern for the United States, and it will continue to be so.³ The principal sustainability challenge in Southern Africa for the United States and its allies is uncertain access to strategic minerals, especially platinum group metals (PGMs), chromium and manganese, as well as rare earth minerals, cobalt and uranium. The causes of this challenge are increasing global demand and supply shortages caused by inadequate infrastructure, politicization of the mining industry, and China's aggressive and sometimes monopolistic behavior in pursuit of minerals.⁴ The challenge is most acute in two Southern African countries - South Africa and the Democratic Republic of the Congo (DRC) – and also growing in Zambia, Zimbabwe and Namibia. Environmental sustainability of the mining industry is also a concern; for example, acid mine water in South Africa poses a threat to platinum group metals (PGMs) mining, which is of considerable importance to the United States.⁵

The purpose here is to provide scope to and analysis of the problem of the sustainability of scarce mineral resources and recommend what the United States can do to ensure continued access. This report provides insight into the sustainability of mineral resources that come from

* The opinions expressed in this paper are those of the author and do not necessarily reflect the opinions and policies of the U.S. Air War College, the U.S. Air Force, the Department of Defense, or any other branch of the U.S. Government.

† Janet Beilstein, International Officer School, Air University, assisted greatly in the research project – from conceptualization through execution of the research visit through the writing of the final report. Her background in the mining industry was important in the project.

‡ Department of International Security, US Air War College, Maxwell AFB, AL 36112, Tel: (334) 953-7076; DSN: 493-7076; email: Stephen.Burgess.Maxwell.af.mil

Report Documentation Page				Form Approved OMB No. 0704-0188	
Public reporting burden for the collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to a penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number.					
1. REPORT DATE 2010		2. REPORT TYPE		3. DATES COVERED 00-00-2010 to 00-00-2010	
4. TITLE AND SUBTITLE Sustainability of Strategic Minerals in Southern Africa and Potential Conflicts and Partnerships				5a. CONTRACT NUMBER	
				5b. GRANT NUMBER	
				5c. PROGRAM ELEMENT NUMBER	
6. AUTHOR(S)				5d. PROJECT NUMBER	
				5e. TASK NUMBER	
				5f. WORK UNIT NUMBER	
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) U.S. Air Force Academy, Institute for National Security Studies, USAFA, CO, 80840				8. PERFORMING ORGANIZATION REPORT NUMBER	
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)				10. SPONSOR/MONITOR'S ACRONYM(S)	
				11. SPONSOR/MONITOR'S REPORT NUMBER(S)	
12. DISTRIBUTION/AVAILABILITY STATEMENT Approved for public release; distribution unlimited					
13. SUPPLEMENTARY NOTES					
14. ABSTRACT					
15. SUBJECT TERMS					
16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT Same as Report (SAR)	18. NUMBER OF PAGES 29	19a. NAME OF RESPONSIBLE PERSON
a. REPORT unclassified	b. ABSTRACT unclassified	c. THIS PAGE unclassified			

Southern Africa and that are of strategic importance to the United States and its allies. It analyzes the competition as well as the potential for conflict over resources. Of particular concern is possible future conflict between the United States, which needs strategic minerals for national defense and other purposes, and China, which needs an increasing amount of resources to fuel its accelerating industrialization.⁶

There is a rising scramble for and struggle over resources in Africa, especially in petroleum and mining economies.⁷ In particular, China and Chinese companies have increased their presence throughout Africa and have often engaged in practices that tend to exclude Western companies from access to mineral resources. Exclusionary practices have been known to cause threats to sustainability of the flow over resources. This rising struggle over resources comes at a time in which the United States is becoming increasingly concerned about access to and sustainability of strategic natural resources. In particular, the U.S. government is concerned about access to “defense critical resources”.⁸ At issue is how the United States and its allies can guarantee access to and help sustain these resources until viable substitutes or new technologies make them less critical. This requires increased levels of engagement with the African countries concerned, using all the instruments of American power and working with American and Western mining companies, as well as engagement with China and Chinese companies. In the future, a “worst-case” scenario might see the United States having to use coercive diplomacy in the not-too-distant future (perhaps in 10-20 years) in order to regain access to vital resources. The onset of “resource wars” has been predicted by a number of scholars and experts. Given the rising level of Chinese demand for resources, the probability of conflict is likely to rise.⁹

STRUGGLE OVER RESOURCES AND POSSIBLE CONFLICT

The new scramble for African mineral resources (and petroleum) is most similar to the nineteenth century European scramble for African minerals and land that contributed to interstate conflict, especially the First World War. European powers sought resources for continuing rapid industrialization, and now China and India need increasing supplies of mineral resources for the same purpose and are competing with the United States and the West and may come into conflict. In contrast, during the Cold War, the Soviet Union (and Warsaw Pact) had all the resources it needed to sustain industrialization and became involved in Africa in a competition for alliances against the United States and France.

The literature on the interrelationship between resource scarcity, environmental degradation and conflict can be categorized as “neo-Malthusian” and critics of such an apocalyptic position. The neo-Malthusian position asserts that there is a direct correlation

between resource scarcity, environmental stress and conflict.¹⁰ Michael Renner has argued that environmental stress and scarce resource conflicts comprise the greatest security threat since the end of the Cold War; they can cause both interstate and intrastate conflicts. The neo-Malthusians point to the struggle over water in the Middle East and Nile Basin, which has the potential to cause interstate conflict and Darfur, which evidences the relationship between environmental degradation and conflict and deteriorating human security.

Critics of the “neo-Malthusian” position caution against drawing direct causal linkages among resource scarcity, environmental stress and conflict. Nils Petter Gleditsch, a leading scholar in peace research, has demonstrated empirically that the links are not as strong as “neo-Malthusians” claim.¹¹ Thomas Homer-Dixon in his 1999 book, *Environment, Scarcity, and Violence*, specified the relationship among the struggle over resources, environmental degradation, and conflict and insecurity.¹² He cautioned against assuming a direct relationship among scarcity, degradation and conflict. Homer-Dixon identified three sources of resource depletion and degradation: supply-induced, demand-induced, and structural scarcity. Supply-induced scarcity results from a total decrease in the amount of a given resource available for consumption and is related to technologies and practices used in the consumption of the resource. Demand-induced scarcity results from an increase in total population and other changes in consumption patterns, as is happening in China and India these days. The third type, structural scarcity, is caused by a “severe imbalance in the distribution of wealth and power that results in some groups in a society getting disproportionately large slices of the resource pie, whereas others get slices that are too small to sustain their livelihoods.”¹³ Structural scarcity has been a factor in nearly every case where resource scarcity has resulted in conflict.

Generally speaking, none of these factors operate alone; all interact and reinforce each other in negative ways. Research has confirmed the links among competition over scarce resources, environmental stress, and conflict in Africa. Resource scarcity has been found to cause interstate and non-state conflicts with rising demand and limited supply. Regions run a higher risk of conflicts, and the level of conflict is affected by decreasing access to renewable resources. This report examines the hypotheses that limited supply of resources and increasing levels of demand cause increased chances for conflict.¹⁴

PROBLEM OF SUSTAINABLE ACCESS TO STRATEGIC MINERALS

The industries of the United States and its allies need a steady or increasing supply of strategic minerals. Even more important are “defense critical minerals,” which U.S. arms manufacturers must have access to in order to produce weapon systems to help maintain U.S.

national security. The United States produces a range of materials from strategic minerals, including warships, aircraft, and high tech devices and components.

Thus far, the United States and its allies have relied on free market forces in Southern Africa and elsewhere. However, U.S. and allied industries may not always have access in the future and may have to reduce output or even close. For example, a worrisome problem has been Chinese control of production of more than 90 percent of “rare earth minerals.” Recently, Chinese companies withheld them from Japan over the Senkaku/Daiyou Islands dispute and threatening to withhold them from the United States over arms sales to Taiwan. The minerals are the ingredients in key components in communications devices, satellites, and electric fuel cells and batteries that U.S. industry and the military require.

Rising Global Demand, Limited Supply and Chinese Aggressiveness

The development of new technologies and products, including magnets, fuel cells, satellites, and electric vehicles, and rapid industrialization by China and India are principal causes of rising demand. The “great recession” of 2008-9 slowed activity, but demand in 2010 revived. Limited supply is compounded by infrastructure bottlenecks, politicization of mining, and “off-take” deals by Chinese companies, particularly in Southern Africa.

Of particular concern are the aggressive and monopolistic tendencies of Chinese companies, manifested in most all of Africa’s 54 countries.¹⁵ Most of these companies have close relations with and are backed by the Chinese state. China and its companies negotiate off-take agreements to gain guaranteed access to certain amounts of ore and possibly “corner the market”. If trends hold, this activity could affect supply to the United States and the West. In addition, Chinese companies are pursuing joint ventures with politically connected state-owned firms and “black economic empowerment” companies.¹⁶ If this activity continues, there is the possibility that Western and long-established South African companies could be pushed aside and the flow of minerals reduced.

Political leaders in left-of-center regimes in Southern Africa (especially those of the African National Congress in South Africa, South West African Peoples Organization in Namibia, and the Zimbabwe African National Union-Patriotic Front) have demonstrated a growing affinity with China, especially as China continues to grow rapidly and provides an alternative development model to Western neo-liberalism as well as a source of aid and infrastructure development.

For more than a decade China has been conducting a wide-ranging drive to secure resources to fuel industrialization and economic growth. China already consumes a third of the world’s copper and 40% of its base metals and is looking for more minerals to exploit. Driven by

shortages in specific mineral commodities, Chinese mining companies have been looking to find, buy, and develop mining projects in other countries, either on their own or in joint ventures. They have prioritized the developing world, and in particular Africa.¹⁷

Chinese investments in foreign mining assets totaled \$50 billion over the past ten years and a number of Chinese companies have already emerged as global mining majors. In 2009, China was in the forefront of mining mergers and acquisitions across the world. Chinese investment in 2009 made up \$17 billion, or 22 percent, of all global mining mergers and acquisitions and 30 percent of the top ten deals by value.¹⁸

Few of these Chinese groups are dedicated mining companies; most are vertically integrated industrial complexes that do everything from exploration and mining through to manufacture. China's Shenhua Energy is the world's fourth-largest mining company in terms of market capitalization, after BHP Billiton, Vale, and Rio Tinto, and ahead of Anglo American and Xstrata. There are now five Chinese companies in a list of the world's top 40 mining companies in terms of market capitalization.¹⁹

Politicization of the Mining Industry

The free market and government taxation of mining profits have tended to provide optimal conditions for states and industry and in maintaining a steady flow of minerals to meet demand. However, politicization has occurred in the form of nationalization of the mining industry and the intervention of "black empowerment" companies, which have tended to disrupt the market and the flow of minerals. The first wave of politicization occurred in the early 1970s with the nationalization of mines and the creation of state mining companies. Zambia and Zaire (now the DRC) nationalized copper/cobalt mines with suboptimal results and had to eventually reverse course after the copper price collapsed. The Mugabe regime in Zimbabwe in the 2000s threatened nationalization of its PGM mines and pushed forward black empowerment, and the state-owned mining company has entered into joint ventures with foreign mining companies.²⁰ Proposals for nationalization of the mines are being pushed in South Africa and Namibia and may come to fruition.

"Black economic empowerment" (BEE), which has involved providing special advantages in the market place to black-owned companies, is being implemented in South Africa, Namibia and Zimbabwe. The problem is that many BEE firms and state-owned mining companies lack mining expertise and capital, which can negatively affect production. If resulting production shortfalls are sustained over a long period of time, supply of strategic minerals to the United States and its allies might be seriously constricted. Also, BEE firms are being wooed by

Chinese companies to enter into joint ventures, which could mean that the supply of minerals might increasingly flow towards China and away from the United States and its allies.

Political interference affects mining throughout the region. In states like Angola, Democratic Republic of Congo, and Zimbabwe, the government is used by elites to intervene in mining in order to extract rents and creates a disincentive to invest.²¹ This means a sub-optimal supply of minerals, including strategic minerals, and the “resource curse” for developing countries. Increasingly, Western companies are being discouraged from engaging in corrupt practices. This opens the door to Chinese companies, which are willing to engage no matter what the side costs. This means that strategic minerals could increasingly be headed to China instead of the West.

SOUTH AFRICA

The country is the most important in regard to strategic minerals and challenges to the free market. South Africa possesses 75% of the world’s platinum group metals (PGM) reserves, as well as major deposits of chromium and manganese and produces a significant amount of ferroalloys. South Africa also possesses other strategic minerals, including rare earth minerals, fluorspar, and titanium sands.²² South Africa poses a growing challenge to the United States and its allies of maintaining access to strategic minerals.²³ Aggressive behavior is being exhibited by China and Chinese companies in efforts to corner the market for a number of strategic minerals, particularly manganese ore and ferroalloys. China is investing in South Africa’s mineral sector, aiming to secure supply of specific commodities for which it has a shortage of reserves. Politicization of the mining industry is occurring in the form of black empowerment and pressures for the nationalization of mines. Infrastructure bottlenecks are problematic and reduce the flow of strategic minerals.

Acid mine water in the greater Johannesburg region could pollute major mining operations, including PGM mining.²⁴ This is a growing issue that could prove catastrophic for mining in Gauteng Province and North West Province where PGMs and other strategic minerals are mined.²⁵

Platinum Group Metals (PGMs)

South Africa dominates the production and export of PGMs, including platinum, palladium, and iridium as well as rhodium and ruthenium. PGMs have a number of unique properties, such as resistance to high temperatures and ability to catalyze chemical reactions, which make them irreplaceable in a wide range of applications. High world demand for platinum is driven by two main uses: automotive catalytic convertors, which convert harmful emissions

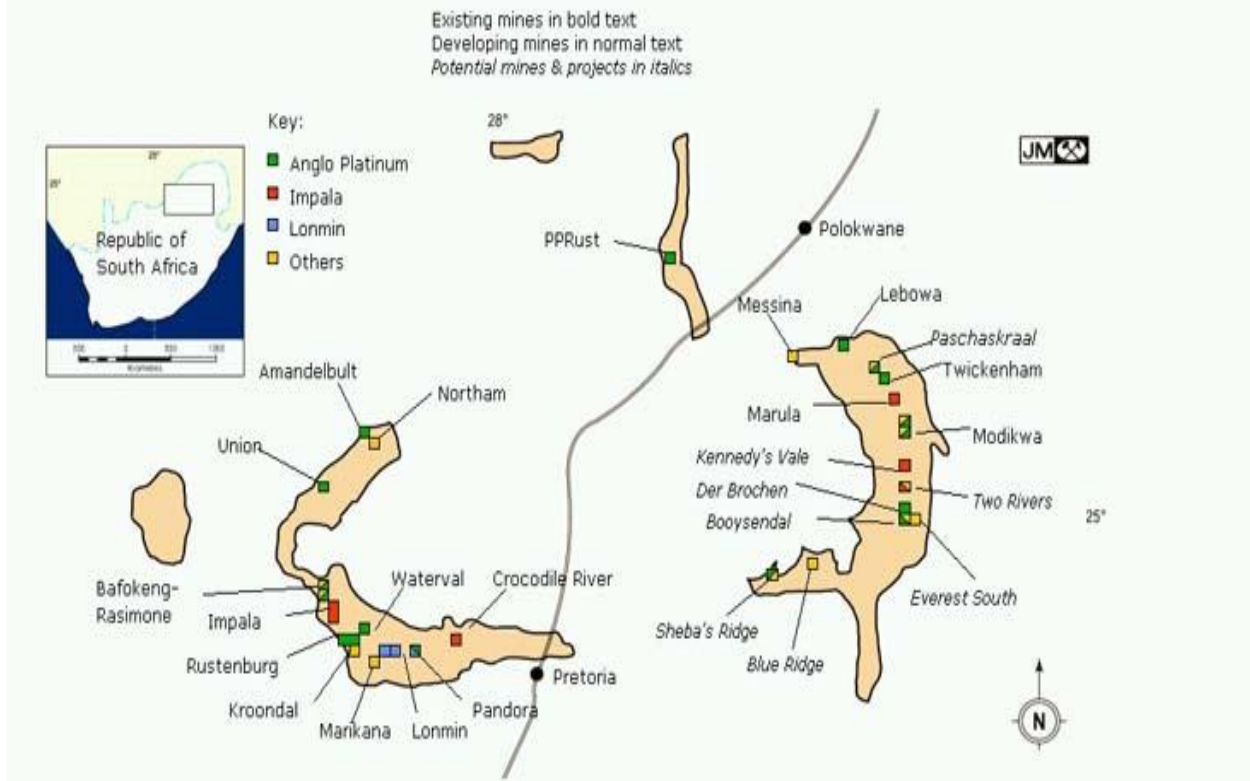
into relatively inert exhaust, and jewelry (in oriental markets). Iridium is used in petroleum and automobiles. Rhodium, ruthenium and other less common PGMs are experiencing production and supply problems; they are difficult to extract and refine and are less prevalent, and more uses are found daily. Ruthenium and iridium are in high demand because they provide vertical memory storage for hard drives and lighting. Currently, there are no problems with the supply of platinum and palladium, and the market is functioning well; recycling and below ground reserves guarantee continuing supply.²⁶

World platinum suppliers, dominated by South Africa, struggle to satisfy global demand for a metal that is virtually irreplaceable in several catalytic and industrial applications. Before the economic downturn, the platinum price soared and in 2010 has rebounded from the recession. South Africa's Bushveld Complex contains some 75 percent of world platinum reserves, occurring together with other PGMs and other valuable minerals such as cobalt. Mining in the Bushveld Complex accounts for about 80 percent of world supply.²⁷

The supply of PGMs is affected by erratic power supply, poor mine safety, and slow implementation of technologies in South Africa. Political pressures have slowed the conversion from labor intensive to capital intensive mining. These bottlenecks often lead to periodic supply shortfalls and price volatility, at times driving platinum spot prices to over 2,000 US dollars per ounce.²⁸ It takes more than seven years to bring a PGM mine on line, and the high elasticity of supply could mean future shortages for the United States and its allies. It takes more than seven years to bring platinum mine into production which means a high elasticity of supply. Furthermore, the prospect of cobalt production from PGM mines is hampered by the chronic electricity shortage in South Africa.²⁹

Below is a map that shows the main platinum mining areas in South Africa which are within a 200-mile radius of the South African capital, Pretoria (Tshwane).³⁰

Schematic Map of the Bushveld Complex
Showing Approximate Location of Platinum Mines and Projects



“Senior” PGM companies (the biggest is Anglo-Platinum, followed by Impala and Lonmin, as well as Xstrata and Northam) have assets off-shore and are not exposed to high levels of risk from politicization of the mining industry. “Junior” PGM companies, such as Aquarius, are on-shore and more exposed. Few of the junior operators have the capacity to bring mines into production and all of them are dependent on large producers for downstream processing capacity.³¹

The politicization of the PGM industry is at its initial stage and may significantly raise levels of risk. The South African Mining Charter requires mining companies to be at least 26 percent owned by historically disadvantaged South Africans (HDSAs).³² Thus far, Black Economic Empowerment (BEE) deals have had mixed success.

A BEE “junior” platinum explorer, Wesizwe, has recently entered into a joint venture with a Chinese company.³³ The Chinese mining company, Jinchuan, and the China-Africa Development Fund offered to purchase 51 percent of Wesizwe. The Wesizwe deal was designed to supply China with PGMs adding to its existing South African ferrochrome involvement. Wesizwe was in need of capital, and teaming up with Jinchuan would give Wesizwe scope to consider acquisitions in the

future. The expectation was that the Chinese would want to play a role in the running of the company.³⁴ China has focused mainly on joint venture opportunities in PGMs, ferroalloys and chromium in South Africa, and manganese and iron seem to be likely targets. Chinese companies have been fairly opportunistic and secretive in securing South African minerals deals.³⁵

Power disruptions, safety closures, and technology challenges, are currently the most costly challenges for the platinum industry. Bushveld Complex platinum production is energy-intensive and electricity supply constraints and disruptions directly restrict output and curtail the start-up of new shafts.³⁶ Labor-intensive mining, combined with challenging ground conditions have led to an unacceptably high fatality rate in the platinum industry.³⁷ This has led to a clampdown by South Africa's Department of Mineral Resources (DMR), in which mines incurring serious incidents are shut down until they can prove that all related risks have been mitigated. Such shutdowns have contributed to reduced output. Traditional methods result in about 40 percent of the platinum content of the ore reserve being recovered. Slow implementation of new technologies, such as mechanized mining and improved recovery systems, perpetuates this inefficiency. Even where new technology is being introduced, as in smelters at Lonmin and Anglo Platinum's Polokwane operations, complications have caused shutdowns and months of lost production. In June 2010, the DMR overreacted to a PGM mining accident, by prematurely imposing tougher standards for mine pillars, which could have adversely affected the supply of PGMs; however, the PGM industry gave evidence that convinced DMR that the measures were not necessary, which ended the impasse.

Chromium, Manganese, and Ferroalloys

South Africa produces more than 20% of the world's manganese and almost 40% of the world's chromium ore.³⁸ Mining analysts estimate that it is more profitable to export the raw ore than to beneficiate the ore into a ferroalloy or a specialty steel. The problem with exporting ore is inadequate railway capacity. The building of a rail line to Saldanha Bay may alleviate the bottleneck by 2014.³⁹

There are reports of an off-take agreement for most of South Africa's annual manganese ore production which has been negotiated by the China Yunnan Metallurgical Company (CYMCO). Chinese companies are interested in exporting raw manganese and chromium ore, while some have become involved in beneficiation. Chinese off-take agreements might deprive the United States of South African manganese, which is essential for the U.S. Defense National Stockpile.⁴⁰ Manganese, chromium and ferroalloys are essential in the specialty steels that go into the manufacture of warships, aircraft, missiles and other products that the DoD requires.

Over the last five years, China has become involved in South African ferrochrome mining and processing with Chinese companies Sinosteel, Asa Metals, Minmetals, and Jiuquan

Iron & Steel (Jisco) hold a significant share of various South African ferrochrome producers and explorers. Sinosteel acquired 50 percent of the Tweefontein chrome mine and the Tubatse ferrochrome smelter for a reported \$230 million in 2006, creating a joint venture with Samancor, known as Tubatse Chrome. The joint venture is situated at Steelpoort, in the Mpumalanga province, and has a ferrochrome production capacity of up to 300,000 tons per year. Sinosteel owns 60 percent of Asa Metals, which in turn owns 100 percent of the nearby Dilokong chrome mine. Dilokong has a production capacity of 400,000 tons per year of chrome ore, and two smelters with a total capacity of 120,000 tons per year of ferrochrome. China Minmetals subsidiary, National Minerals, has bought the exploration rights for the Naboom chrome project in the Limpopo province from Mission Point and Versatex for \$6.5 million. Major Chinese steelmaker Jiuquan Iron & Steel (Jisco) is involved in South African mining as a result of a \$30 million purchase of 26.1 percent of Inter-national Ferro Metals (IFM). IFM owns the Buffelsfontein chromite mine and smelter, located in South Africa's North West province. Buffelsfontein has both open pit and underground operations with two blast furnaces, and has an annual ferrochrome production capacity of 267,000 tons. Jisco will receive 50 percent of the ferrochrome production and will also have the marketing rights.⁴¹

Rare Earth Minerals (REs)

Rare Earth Minerals (Res) are in high demand for a variety of electronic and high tech components including magnets for metal detectors, batteries and electric cars.⁴² Currently, China has a near monopoly on the production and export of REs and has been using its monopoly as a weapon of foreign policy influences. China cut off supply to Japan in September 2010 in response to Japan's holding of a Chinese fishing boat captain, and Chinese officials called for a cutoff to the United States earlier in the year after the latter sold arms to Taiwan. The Chinese have yet to express interest in Southern African REs. In addition, there are rare earth deposits in several countries in East, Central and Southern Africa. At Wigu Hill in Tanzania, there is one of the richest rare earth deposits in Tanzania, and the Canadian company, Montero Mining and Exploration, is involved.⁴³

South Africa has the potential to be an exporter of REs, which may help partially offset China's virtual monopoly on production and export. However, thorium content in much of the ore will hamper the extraction process in most potential mines, which raises the issue of cost-effectiveness. The Steenkampskraal mine in the Northern Cape is projected to be a high-grade, low-cost RE producer by 2015, when the mine is likely to supply concentrate. The market for REs is highly volatile, and there are daily price determinations via auction. Increasing uses and increasing demand will drive prices higher.⁴⁴

The Department of Mineral Resources granted a new-order mining to Rare Earth Extraction Co (Rareco) for the Steenkampskraal's deposit of monazite, which is a reddish-brown phosphate mineral containing thorium, lanthanum, and cerium.⁴⁵ The Great Western Minerals Group (Canada) in cooperation with Rareco (Stellenbosch) has begun operations at Steenkampskraal. It is anticipated that the REs will be produced and might be shipped to Malaysia and the United Kingdom for processing and to a smelter in Michigan. Florien tailings are being processed at Steenkampskraal through leaching. Great Western Minerals Group CEO and President Jim Engdahl claims that the Steenkampskraal mine is projected to be one of the highest-grade rare-earth mines in the world and, therefore, one of the world's lowest-cost producers. The company is negotiating the right to purchase 100% of the RE products recovered from the mining and processing of the Steenkampskraal ore. Supply from the mine is likely to supply concentrate within 5 years and there may be a synergy with by-products from the near-by Namaqua mineral sands mining.⁴⁶

Mintek (South Africa's mineral research organization) has done work on recovery of rare earths from monazite in Palaborwa's copper mine dumps in Limpopo Province and, together with Steenkampskraal and Sandkopsdrift in Namaqualand, these are the likely rare earth supply sources from South Africa in the next ten years plus. Rare earths also occur as associated minerals that are discarded or dumped in heavy mineral sands mining around Richard's Bay, Kwazulu Natal and Vergenoeg and Buffalo fluorite mines in Northern Cape. All of these sources are rich in monazite. However, high levels of thorium are undesirable and complicate extraction and concentration of REs.⁴⁷

Beneficiation

"Beneficiation" is a key concept in South African mining and metals industries, which might be relevant to sustaining the flow of strategic metals to the United States and its allies. The original definition referred to smelting ore to extract metal. Today, the definition has been broadened to include the five stages of manufacturing metal. It also refers to programs that benefit local mining community.⁴⁸

South African Department of Trade and Industry officials prefer all 5 stages of manufacturing to be developed inside the country, as well as mining company assistance to local communities. Countries that are interested in long-term access to strategic metals could assist in the development of beneficiation and ensure long term access to strategic metals. China prefers beneficiation to take place in China, though some Chinese companies have demonstrated a willingness to engage in beneficiation. However, there are major challenges for ferroalloy and PGM beneficiation, especially ESKOM electricity shortages and South Africa's impending laws

against climate change which will limit greenhouse gas emissions. Also, the financial sector would rather support the exporting of ore rather than beneficiation, which is not as profitable and which could be prohibitively expensive.⁴⁹

Officials at the South African Department of Trade and Industry (DTI) assert South Africa's leading role in global ferroalloy supply and refer to the country's significant reserves of inputs: iron, ferromanganese, ferrochrome, vanadium, and heavy mineral sands.⁵⁰ The DTI is focused on beneficiating and developing "fourth stage" steel products within the country. Beneficiation to this stage would create the most jobs and provide a significant contribution to gross domestic product (GDP). The DTI is studying the unique value chain of each of South Africa's mineral commodities to establish the correct approach to and level of beneficiation.⁵¹ Officials indicated that the United States and its allies could secure supply of ferroalloys and other metals through investment and skills transfer in beneficiation.⁵² Officials at the Department of Mineral Resources (DMR) agreed that enabling and assisting with the South African beneficiation of certain South African mineral commodities would help secure future supply.⁵³ In sum, if the United States could assist in developing beneficiation, the supply of strategic metals from South Africa would more likely continue to flow to the United States.

Off-shore diamond mining has been conducted off-shore by DeBeers for more than 10 years, and the technology continues to improve. Given the need for capital and technology intensive investment and controlled conditions off-shore, there may be greater long-term access to off-shore minerals than to on-shore ones. The problem is that certain strategic minerals, such as PGMs, may not be available off-shore.⁵⁴

Infrastructure Bottlenecks

The shortage of railways, highways and carrying capacity hampers exports. Transnet, the transportation parastatal, has been widely criticized for inefficiency. Electricity shortages and the shortsightedness of ESKOM, the electricity parastatal, have hindered the mining operations and the development of beneficiation of PGMs, ferroalloys and other metals. The Mepudi coal-fired power plant should be online by 2014 but will not make a major difference for the mining industry. Other power plants are still years away from coming on line. There have been reports that South Africa might buy several nuclear power plants from China to help meet the electricity shortfall.⁵⁵

Politicization of the South African Mining Industry

Politicization of the South African mining industry has a negative impact on the production and supply of strategic minerals. The most prominent recent example of politicization was the alliance of the BEE firm, Imperial Crown Trading (ICT), which lacked capital and

mining expertise but had powerful political linkages, and the iron and steel multinational corporation, ArcelorMittal. The two companies joined forces to push a subsidiary of the Anglo-American Corporation out of the way in an iron ore mining venture, Anglo-American Corporation's Sishen Iron Ore Company mine in the Northern Cape Province. The situation developed after steel-maker ArcelorMittal failed to apply to convert its rights in its portion of Sishen in April 2009. Kumba Iron Ore (an Anglo-American subsidiary) then applied for the same rights, but they were granted to Imperial Crown Trading (ICT) in November 2009. One of ICT's shareholders included a former ANC employee, Gugu Mtshali, while 50 percent is held by Jagdish Parekh, a key executive of the group of companies controlled by the Gupta brothers, benefactors of President Jacob Zuma and his family and other ANC leaders. Subsequently, ArcelorMittal and ICT came to agreement on the mine and its operation.⁵⁶

Tim Cohen, a leading expert on the mining industry, made the following observation: Informed observers consider this case a "Venezuela moment": if the government enforces these rights over Kumba's, then South Africa's mining rights regime instantly moves into a different realm. Then mining rights become part of political fealty and mining houses, as they do in many parts of Africa, are obliged to pay a host of kick-backs all down the line from senior politicians to local policemen.⁵⁷

Similar treatment is being experienced by other long-standing companies, including Lonmin, a major producer of platinum group metals and other minerals in South Africa.⁵⁸ Lonmin lost the prospecting rights to some of the metals mined alongside platinum to a unit of HolGoun Group, led by a former Public Enterprises Ministry director general and Lonmin director, Sivi Gounden, his wife, Vanessa, and Miriam Sekati, an official in South Africa's Security Ministry.⁵⁹

Since 1994, political interference has affected the South African mining industry and the supply of strategic minerals.⁶⁰ In South Africa before 1994, the mining industry was the leading economic sector. Since then, mining has fallen from about 16 percent of GDP in 1994 to about 6 percent. The decline has occurred in the face of a major commodity boom, driven by the industrialization of China, India and other countries. Recently, South Africa's mining industry has dropped from being in the top half of preferred investment countries on the African continent to the bottom 10 on the latest Fraser Institute's report.⁶¹

In 1994, the democratic government led by the African National Congress (ANC) instituted a new mining rights order to give economic power to blacks and especially ANC elites. The DMR made it difficult for traditional mining companies to obtain mining licenses. The Department and its ANC appointees consider the existing mining industry to be fundamentally illegitimate, as a legacy of apartheid. At a mining congress in South Africa, mining expert Peter

Leon said that regulatory issues played only a secondary role to geology when it came to the mining industry, and that worries about regulatory issues may often be detrimental to the mining sector.

Mining junior BSC Resources chief executive Bongani Mtshisi said potential investors are not prepared to lend money to projects in South Africa without the guarantee that these investments were secure. “We even had some questions raised around the nationalization issue when trying to raise finance for a project in Namibia, because of its proximity to South Africa,” he said in a report.⁶²

The nationalization of mines is a possibility that could negatively affect production and supply. The ANC Youth League will push nationalization at the 2012 ANC Congress. There may be a state-owned mining company by 2011. Furthermore, some in the Youth League, trade union federation (COSATU), and Communist Party (SACP) are urging a shift towards China and its development model. Other experts place faith in the mainstream ANC and leaders such as Trevor Manuel, who they believe will fend off the campaign for nationalization.⁶³

South African President Jacob Zuma and Mineral Resources Minister Susan Shabangu have said that nationalization is not currently part of government policy. However, this does not guarantee it will not be part of government policy in the not-too-distant future. The ANC Youth League managed to get nationalization onto the agenda of the governing party’s September 2010 meeting, fuelling investor worries. Nationalization of South African mines has been given renewed prominence by the ANC Youth League, which in 2009 issued a discussion paper arguing for state control of 60 percent of new mines.⁶⁴ The debate around the nationalization of South African mines had created “great uncertainty” with investors, and may even see the development of some projects postponed until after the ANC’s policy review conference in 2012.⁶⁵

In discussions at DMR headquarters about access to strategic minerals, it became clear that access to South Africa’s strategic minerals will be affected by the DMR’s strategy for transformation and changes to the Minerals and Petroleum Resources Development Act (MPRDA) and the Mining Charter. A senior official at the DMR explained that a “Strategy Document” detailing the DMR’s approach to “Transformation” in the mining sector would contain key elements, including sustainable growth, meaningful transformation, and inclusion of tripartite consultation (labor, the government, and private). The promulgation of the “Mining Charter” will impose tougher government industry standards, including higher BEE requirements, which could affect production and supply.⁶⁶

A senior economist in the DMR denied that there was any deliberate tactic to allow entry of “eastern investment sources” at the expense of “western sources”. He said that the mineral

sector was a “free market” and that the United States was welcome to compete with countries like China for a share and advised that the United States should be “more aggressive like China”.⁶⁷

THE DEMOCRATIC REPUBLIC OF THE CONGO (DRC) AND ZAMBIA

The DRC has a wide range of strategic minerals, including cobalt, uranium, coltan (columbite and tantalum), tungsten, tin, and rare earth minerals. Chinese penetration is a source of major concern in regard to the DRC, which may lead to the eventual interruption of the supply of strategic minerals to the United States and its allies. State weakness and corruption are fundamental problems of the DRC.⁶⁸ The country’s problems were aggravated by a civil war that raged from 1996 to 2002 and continues in the east of the country.⁶⁹ State weakness and corruption and put U.S. and Western companies at a disadvantage and could eventually affect the supply of strategic minerals to the United States and its allies.⁷⁰ In spite of Congolese efforts to strengthen laws and supervision of mining, there are serious gaps in legislation and a lack of technical skills and administrative weakness.⁷¹

The politicization of mining in the DRC is exemplified by Gecamines - the state mining company – that benefits Congolese elites.⁷² Gecamines plays a pivotal role in deciding which foreign mining companies will have access to Congolese mines.⁷³

Gecamines has attempted to improve its declining production figures from the Copperbelt by promoting several ailing mines and projects to foreign investors. In spite of this search for investors, the Congolese government has been selective when reviewing which foreign companies will be allowed to mine in the country.

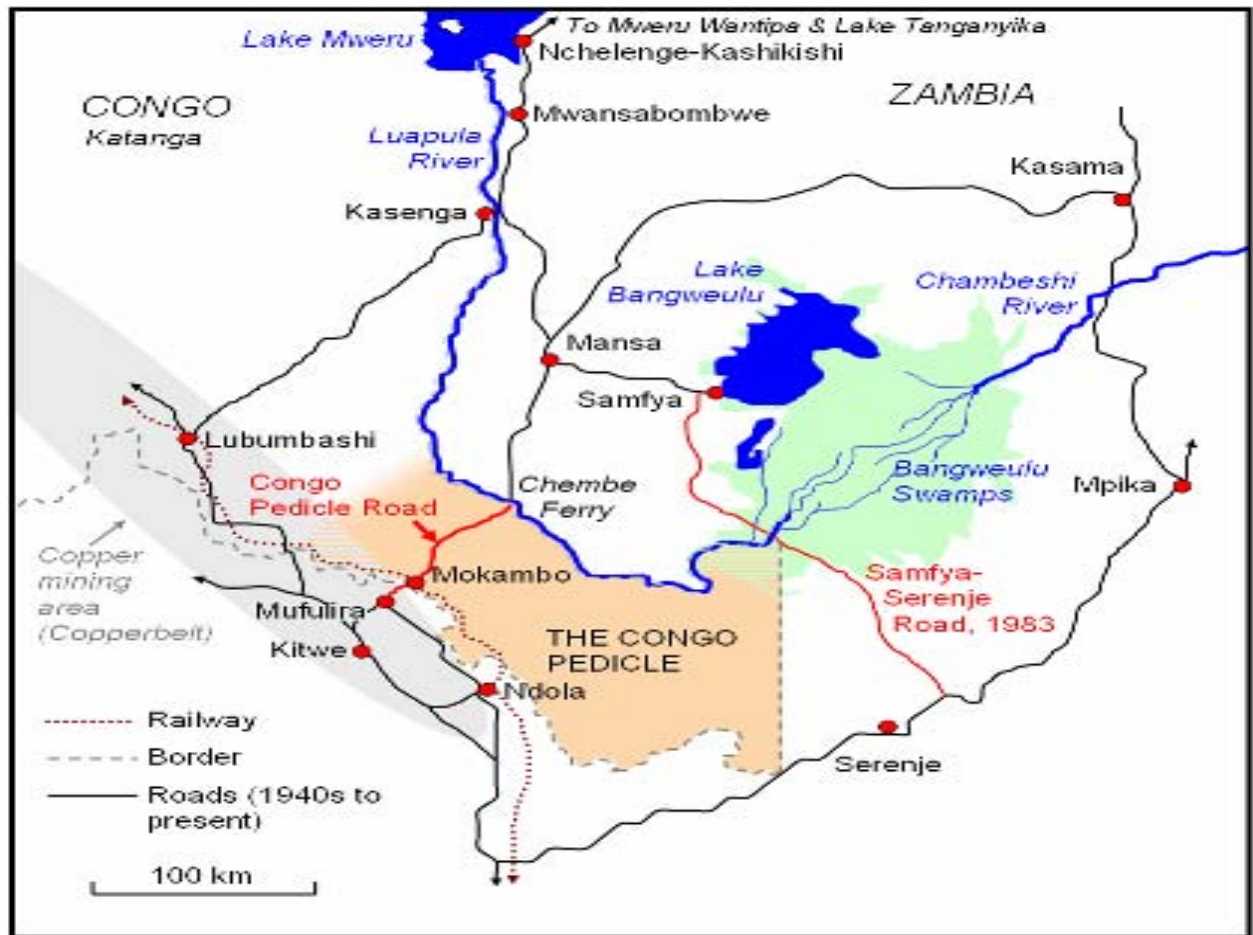
U.S. legislation restricts American companies from operating in the war-torn east of the DRC where strategic minerals for cell-phones (coltan) and electronics are produced.⁷⁴ U.S. Securities and Exchange Commission (SEC) registered companies are required to make “Disclosures relating to Conflict minerals originating in the Democratic Republic of the Congo” (DRC). This will identify those products manufactured by a company that can be proved “DRC Conflict-Free” or otherwise. A growing number of investigative reports over the past few years have linked the finances generated by the extraction of minerals in and around the DRC to the ongoing extreme conflicts between armed paramilitary organizations, particularly in the eastern regions of the country.⁷⁵

Zambia’s mining industry is more stable and better-regulated than that of the DRC,⁷⁶ and levels of corruption are lower.⁷⁷ However, there are still problems with the industry. The most high-profile problem has been Chinese companies’ mistreatment of Zambian miners and the subsequent backlash in 2007.⁷⁸

The DRC-Zambia, Cobalt, and China

At present, cobalt is the most high-profile strategic mineral the DRC and Zambia produce, given rising demand and aggressive intervention by Chinese companies. Demand skyrocketed from 2002 to 2008 with a resulting rise in prices.⁷⁹ The DRC (Katanga Province) is the world's largest cobalt producer at 34 percent, and next-door Zambia (Copperbelt Province) is second at twenty percent. Below is a map of the copper and cobalt mining regions of DRC's Katanga Province and the Copperbelt Province of Zambia.⁸⁰

Ninety percent of China's imported cobalt comes from the DRC (Katanga Province) and Zambia. The 2008 "Sicomines" deal between China and the DRC was a concession to extract 10.6 million tons of copper and 626,619 tons of cobalt, which represented a nine billion dollar Chinese investment. Three major Chinese companies were involved: China Railway Group, Sinohydro Corporation, and Metallurgical Group Corporation. These companies have a controlling interest of 68 percent. The Congolese parastatal, Gecamines, has a 32 percent interest. A most notable part of the deal was China's demand that the DRC guarantee repayment of infrastructure investments should profits from mining project be insufficient.⁸¹ In terms of the effect on the supply of cobalt, the Chinese could eventually buy large amounts of copper, which could mean large amounts of cobalt flooding the market, which could depress the price and make it non-economic to mine cobalt. However, at the moment, demand for cobalt has been driving prices higher, with a short plateau in 2009 and 2010.



As part of the Sicominex deal, China is building a road network stretching for four thousand kilometers (2,400 miles) and a railway system spanning 3,200 kilometers (1,920 miles). This is a much needed development in a country the size of Western Europe and the second largest in Africa but with only two hundred kilometers (120 miles) of tarred road. The building of a transport network is of strategic importance to the Chinese. It will make it easy to transport the copper and cobalt from mines in the land-locked Katanga region to the coast.⁸²

The nine billion dollar Chinese investment in the DRC has raised concerns, especially around environmental consequences and transparency issues.⁸³ Chinese investors complain about the lack of security in the DRC and about their own government not providing enough support. China has been slow to implement the infrastructure projects in the agreement upon have been implemented thus far. Initially the International Monetary Fund (IMF) indicated that it was not willing to continue a three year poverty reduction and growth program, if the DRC government was potentially beholden to China in terms of debt. There has also been criticism from those who fear that the government has, through this deal, found a way to line the pockets of government officials. There were concerns that Congolese negotiators did not have the necessary

capacity to take on the Chinese negotiators, a perennial problem besetting African countries in all trade and economic talks. Civil society and other stakeholders in the DRC have expressed concern about the transparency of the deal and have complained that they were not consulted.⁸⁴

There is fear that the Chinese will not honor environmental protocols. A lot of environmental damage has already been done to the DRC by mining activities. Artisanal mining and small operators have already done huge damage by excavating sites without care for plant or animal life. Thus far, the DRC government has not been clear on environmental policies and has not enforced them, with the expectation that investors would assume the responsibility to protect the environment.⁸⁵

In Zambia, cobalt production was set back in 2007 by the Chinese management's abuses at the Chambishi mine – Chambishi Metals is Zambia's largest cobalt producer - and backlash by mineworkers and politicians.⁸⁶ In 2009, output restarted at Chambishi Metals. Chinese companies remain involved in cobalt mining, especially the Non-Ferrous Metals Mining Corporation. In 2010, China provided a \$5 billion loan to private companies in Zambia, including Vedanta Resources, Canada's First Quantum Minerals, Equinox Minerals, Glencore International, and Metorex South Africa. In spite of Chinese largesse, Zambian attitudes toward China and the Chinese are more guarded than in the DRC.⁸⁷

NAMIBIA AND URANIUM

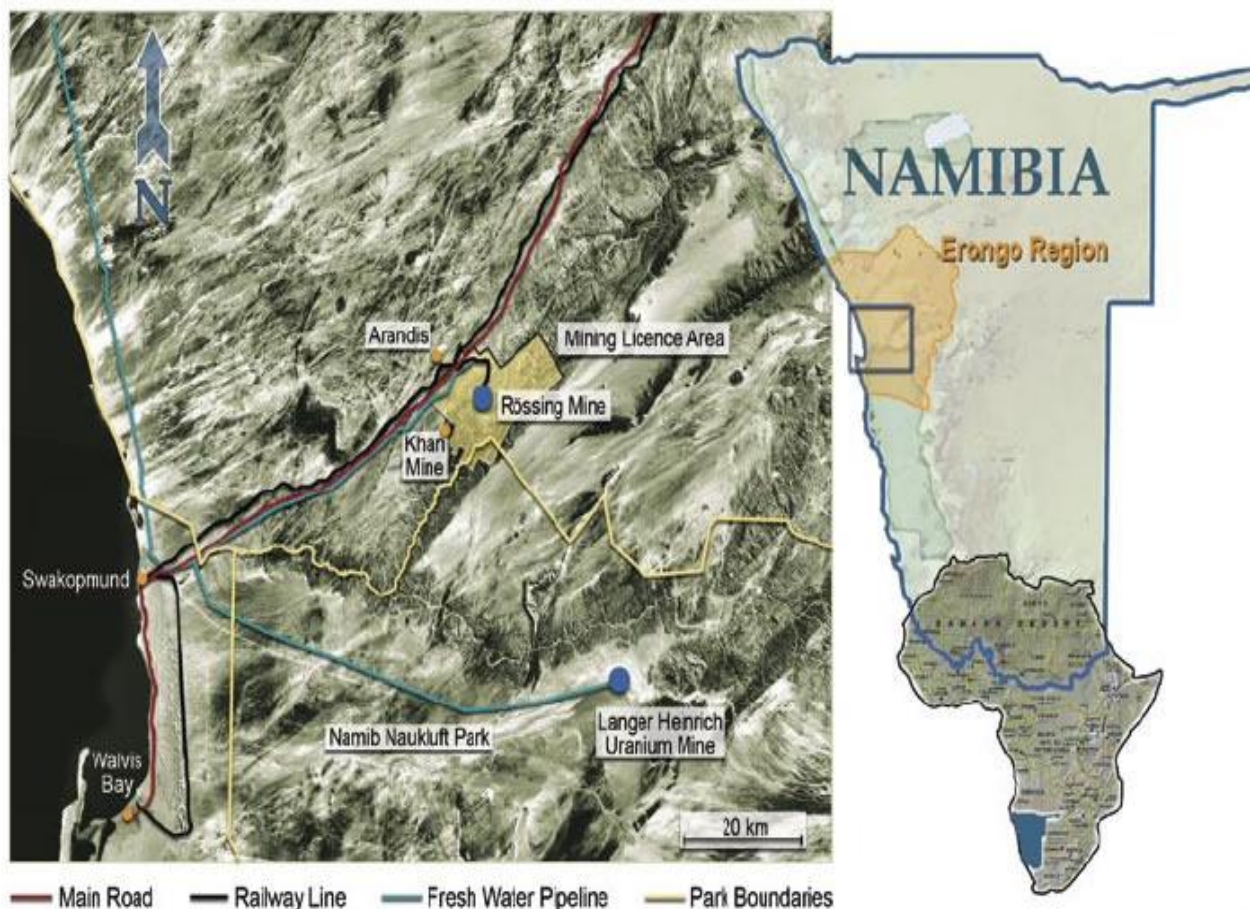
Presently, Namibia is the fourth largest uranium producer and could soon be the fourth,⁸⁸ and global demand for uranium is rising faster than demand for gold, given the rapid increase in nuclear projects.⁸⁹ Therefore, Namibia is growing in strategic importance. Namibia seems like one of the best places in Africa to invest.⁹⁰ The country is not high on Transparency International's list of corrupt countries.⁹¹

For 40 years, Rössing has been the principal uranium mine/ mining company.⁹² However, the quality of the uranium ore at the Rössing mine is declining. Furthermore, Iran is an eighteen percent shareholder in Rössing, which constrains further exploration, given a UN Security Council resolution sanctioning Iran from engaging in uranium exploration; therefore, Rössing is not involved in exploration at the Rössing South mining area and others.⁹³ The Rössing mine and adjacent uranium mining areas of Namibia are depicted in the map below.⁹⁴

Politicization of the uranium mining industry is growing in Namibia. One example was the Trade Minister giving a tax break to the uranium giant, AREVA of France, to set up a uranium processing facility in Namibia; however, hexafluoride gas that is produced from beneficiation of uranium cannot be exported. Also, the government took away rights to the Kudu

gas fields from Tullow Gas and gave them to the Russian giant, Gazprom, on questionable grounds.⁹⁵ A major concern for investors is the potential misuse of black economic empowerment (BEE).⁹⁶ Areva is now in partnership with twenty percent BEE ownership. Rössing, which is owned by Rio Tinto, now has fourteen percent ownership by Kalahari Holdings Company, the firm dominated by SWAPO ruling party elites.⁹⁷

The recently established state-owned mining company, Epangelo, has virtually no capital and may look to Russian and Chinese companies for support. Kalahari Holdings Company is seeking uranium prospecting rights and joint ventures, possibly with Chinese and Russian companies. Recently, ten Chinese companies have been approved for uranium exploration stakes with local Namibian companies. In the long run, the politicization of mining could help bring the diversion of uranium towards China, Russia and other countries and away from the United States and its allies.⁹⁸



There is growing voter dissatisfaction with the SWAPO regime which could force it to resort to a populist takeover of the mining industry and a Zimbabwe-style economic implosion.

The last elections were not free and fair and there were accusations of rigging by the ruling party.⁹⁹ In spite of residual perceptions of Namibia as having relatively low levels of corruption, systemic corruption escalated in the 2000s and is having a negative effect on foreign investors’ perceptions of the Namibian government and economy.¹⁰⁰ In particular, SWAPO’s Kalahari Holdings has been involved in some questionable deals.¹⁰¹ However, it appears that SWAPO will continue to play a prominent role in the country, given its widespread support in Ovamboland. The Namibian trade unions are not strong enough to cause SWAPO to turn to populism, as Robert Mugabe did in Zimbabwe.¹⁰²

CONCLUSION

The hypothesis that limited supply of resources and increasing levels of demand cause increased chances for conflict has been examined, and trends that may lead to future conflict have been identified. In the long term, trends are unfavorable to the United States and its allies and their companies in regard to sustainable access to strategic minerals in Southern Africa.

The industrialization process in China (and India) is around the halfway mark and is accelerating. For the next thirty years or so, China (and India) will continue to demand increasing levels of mineral resources and will continue to try to corner the market. Chinese companies, backed by the Chinese state, will continue to aggressively seek Southern African mineral resources and will out-manuever those of the United States and its allies in the region. However, for the next five years, the supply of strategic minerals will probably not be seriously affected, and market forces will continue to prevail.

In ten years, if trends hold, the United States and its allies could have problems accessing manganese, chromium, and certain PGMs in South Africa. In twenty years, the United States and its allies could experience problems gaining access to a broad range of minerals and could become involved in a conflict with China, especially in South Africa, the DRC and Namibia. In fifty years, China will be too powerful to dissuade from acting as it pleases in Southern Africa. Given these trends, it seems that conflict is highly likely.

In South Africa, DRC, and Namibia, the United States and its allies are at a disadvantage.¹⁰³ In South Africa, trends favor Chinese companies which continue to aggressively pursue off-take agreements and joint ventures with BEE companies and other firms. The looming possibility of nationalization and ANC overtures towards China threaten the functioning of the free market and unfettered supply of strategic minerals and work against U.S. and allied interests. Given increasing demand and limited supply, free market dynamics will not always prevail. The

ability to make off-take agreements will provide advantages as will agreements to buy finished metal in combination with assistance in beneficiation.

In the DRC, a different standard of behavior is required of the U.S. government and companies than those from China. The Kabila regime has made substantial deals with China, which the United States cannot hope to match. In regard to U.S. support for beneficiation, this is much riskier in the DRC than in South Africa. The DRC government suffers from corruption, and the economy is not well-regulated – assistance for beneficiation would not necessarily lead the DRC government to favor U.S. interests. One measure that could be taken is a strategic communications campaign against Chinese abuses. Also, the development of a U.S. strategic partnership with the DRC involving AFRICOM may persuade the Kabila regime to move towards the West.

In Namibia, the growing affinity between the SWAPO regime and China poses a challenge to the United States and its allies. The party elite are looking to China to help in mining development. There is heavy Chinese activity in trade and infrastructure in Namibia. Some experts point to China's interest in developing a corridor from the DRC/Zambian copperbelt to the sea as the reason for its heavy engagement in Namibia. The building of a strategic partnership with Namibia may not be possible, given the country's relative lack of security problems and small size. A Millennium Challenge Corporation (MCC) grant, followed by others, may be the most effective way to appeal to Namibia.

RECOMMENDATIONS

The United States and its allies are approaching a decisive moment in regard to the sustainability of access to strategic minerals in Southern Africa and particularly South Africa, the DRC, Namibia, and Zimbabwe. U.S. defense critical minerals will probably be affected. In South Africa, the DRC, Namibia and Zimbabwe, the United States could decide to act to prevent access from eventually being slowed and stopped or it could continue to place its faith in market forces. The advice of one South African official for the United States to "be more aggressive like the Chinese" is easier said than done. There are few U.S. mining companies in Southern Africa that might work with the U.S. government, and laws regulate U.S. corporate behavior abroad.¹⁰⁴

One measure the United States could take is to assist South Africa in developing beneficiation. U.S. aid could help to develop local mineral processing and metal manufacturing and assist South Africa in developing sufficient electricity to power such ventures. In addition, the United States could negotiate off-take agreements with South Africa and provide assistance to benefit local mining communities. The United States could encourage American mining

companies to reengage in South Africa and work with Australian, Canadian and South African companies that are committed to the free market. Also, the U.S. government could step up strategic communications, broadcasting Chinese abuses and dissuading forces in the ANC and SWAPO from moving their governments closer to China.¹⁰⁵

In order to shape the region to maintain the free market, there are a number of actions that the United States and its allies might take. They might use diplomacy to build strategic partnerships with the most important African countries. The potential for strategic partnerships could be substantial in securing access to resources. The focus might be on forming partnerships with the most strategic countries in terms of mineral resources. Most lie in Southern Africa where large supplies of cobalt, platinum group metals (PGMs) and manganese and chromium for ferroalloys can be found. In the case of strategic minerals, special attention must be paid to South Africa and the DRC.

The United States and its allies could develop military-to-military relationships with a number of strategic African countries. The U.S. National Security Council, DOD and U.S. Africa Command (AFRICOM) might develop contingencies to deal with the eventual prospect of resource cutoffs and the possibility of conflict over strategic minerals. At issue is how U.S. agencies might adjust to the forthcoming challenges.

The building of strategic partnerships is politically difficult, given the ANC regime's rejection of AFRICOM during the standup process in 2007 and 2008. South Africa is the hegemon in the region and must fully accept AFRICOM before military-to-military partnerships can be built throughout the region. The United States also continues to apply sanctions against President Robert Mugabe of Zimbabwe and his inner circle, which makes building partnerships with the Southern African Development Community (SADC) difficult. In addition, there is some resistance to U.S. foreign policy from the Kabila regime in the DRC; SWAPO in Namibia; and the dos Santos regime in Angola.

By 2020, U.S. intervention, including AFRICOM, might be needed to ensure sustained U.S./allied access to strategic minerals, which means that the building of strategic partnerships in the next decade is important. Building partnerships with Southern African countries will continue to be difficult, and AFRICOM could become an increasingly important player in this challenging process. The formulation and execution of a sound strategic communications plan is important to slowing Chinese involvement and ensured sustained access to Southern African mineral resources. In South Africa, the free market is resilient and will probably last the longest, while the DRC is the weakest and could be easily drawn away from market principles.

The United States government needs to develop a plan of how to maintain access to strategic minerals. The Japanese government already has identified the strategic minerals that are at risk, devised strategies and created agencies for maintaining access.¹⁰⁶ The European Union has also developed a raw materials initiative as it was worried about export restrictions and the difficulty in gaining access to strategic minerals.¹⁰⁷ A National Defense Stockpile Report to Congress recommended the establishment of a Strategic Mineral Requirement Program that would have the power to establish U.S. national requirements for strategic minerals and allocate resources to maintain long-term access to those minerals.

ENDNOTES

¹ Southern Africa is defined as the countries that are members of the Southern African Development Community (SADC), including the Democratic Republic of the Congo (DRC), Angola, Tanzania and Madagascar as well as South Africa, Namibia and Zimbabwe.

² “Reconfiguration of the National Defense Stockpile Report to Congress,” April 2009, http://www.acq.osd.mil/ip/docs/nds_reconfiguration_report_to_congress.pdf. Defense National Stockpile Center (DNSC), Defense Logistics Agency, Ft. Belvoir, VA.

³ Major R.A. Hagerman, “U.S. Reliance on Africa for Strategic Minerals,” The Marine Corps Command and Staff College, Quantico, Virginia, April 6, 1984 <http://www.globalsecurity.org/military/library/report/1984/HRA.htm>

⁴ Peter Brookes, “U.S. Defense Can’t be at China’s Discretion,” The Heritage Foundation, June 11, 2010 <http://www.heritage.org/Research/Commentary/2010/06/US-defense-cant-be-at-Chinas-discretion>

⁵ This research builds on previous work on resources, sustainability, and conflict as well as the role of US Africa Command in the “3 Ds” (Development, Diplomacy and Defense) in attempting to win “hearts and minds” in strategic African regions. See Stephen Burgess, “Environment and Human Security in the Horn of Africa,” *Journal of Human Security*, 4, 2, August 2008, 37-61; and Stephen Burgess, “In the National Interest? Authoritarian Decision-making and the Problematic Creation of US Africa Command,” *Contemporary Security Policy*, 30, 1, April 2009, 79-99.

In August 2010, field visits were made to areas in which the struggle over mineral resources is acute – in this case, South Africa and Namibia - and interviews with a range of actors who provided perspectives on where the competition for resources in Southern Africa is headed.

⁶ “In the BRIC of It,” *Africa-Asia Confidential*, 11, 3, September 1, 2010 (about South African President Jacob Zuma’s trip to China and China’s aims on the South African mining industry) and “The Price of Debt Forgiveness,” *Africa-Asia Confidential*, 11, 6, November 1, 2010 (about China-DRC relations).

⁷ Roger Southall and Henning Melber, eds., *The New Scramble for Africa*, Pietermaritzburg, University of Kwazulu Natal Press, 2010. Claude Kabemba and Roger Southall, eds., *South African Mining Companies in Southern Africa*, Johannesburg, Southern Africa Resource Watch, 2010.

⁸ “Reconfiguration of the National Defense Stockpile,” 2009. Defense critical resources refer to those that are needed for producing weapons and weapon systems that are critical for the defense of the United States.

⁹ Reconfiguration.” The research objectives include determining how critical natural resources dependencies influence U.S. national security interests. In particular, U.S. defense industries and the DOD are dependent on a range of strategic resources. Another objective is to determine relevant policy gaps in regard to strategic resources. For many years, the Defense Logistic Agency’s Defense National Stockpile Program (DNSP) had not updated its list of strategic resources. Now, DOD is indentifying minerals that are of strategic importance but which may be slipping away from US access.

Strategic resources include platinum group metals (platinum, palladium, rhodium, and ruthenium), chromium, manganese, fluorspar and rare earth minerals ([scandium](#), [yttrium](#), and fifteen [lanthanides](#) as well as columbite and tantalum - coltan) and titanium, molybdenum, and rhenium. Also included are columbium, gold, industrial diamonds, vanadium, fluorspar, barite, lead/zinc, iron ore, bitumen, limestone, uranium, oil, zirconium, and diamonds as well as beryllium and nickel. Ferromanganese and ferrochrome are manufactured in South Africa and are in high demand. Uranium is included in this research because of its use in nuclear weapons.

¹⁰ Michael Renner, *Fighting for Survival: Environmental Decline, Social Conflict, and the New Age of Insecurity*, New York: W.W. Norton, 1996, 17-30.

¹¹ Nils Petter Gleditsch. 1998. "Armed Conflict and the Environment: A Critique of the Literature", *Journal of Peace Research* vol. 35, no. 3, 1998, 381-400.

¹² Thomas Homer-Dixon, *Environment, Scarcity, and Violence*, Princeton: Princeton University Press, 1999, 10-25.

¹³ Homer-Dixon, 14-15.

¹⁴ Homer-Dixon, 14-15. Renner, 17-30.

¹⁵ Theodore Moran, "Is Chinese dominance distorting natural resource markets?" *East Asia Forum*, September 26, 2010 <http://www.eastasiaforum.org/2010/09/26/is-chinese-dominance-distorting-natural-resource-markets/> Moran concludes that Chinese companies thus far have not "cornered" markets but have spurred the development of other sources of supply.

¹⁶ Tim Clark, Resources Analyst, Deutsche Securities, Sandton-Johannesburg, interviewed August 23, 2010. The Chinese prefer joint ventures and off-take agreements rather than majority ownership and capital infrastructural development.

¹⁷ Keith Campbell, "Chinese miners active globally to feed economic growth at home," *Mining Weekly*, June 18, 2010, <http://www.miningweekly.com/article/chinese-miners-active-globally-to-feed-economic-growth-at-home-2010-06-18>. China is the world's biggest producer of aluminum, antimony, cement, coal, fluorspar, lead, magnesium, mercury, rare earths, steel, tin, tungsten, and zinc. However, its reserves of bauxite, copper, iron ore, lead, manganese, phosphorous, sulfur, and zinc, are limited and mostly of low grade. Its other resources include coal, natural gas, petroleum, uranium, and vanadium.

¹⁸ Campbell, "Chinese."

¹⁹ Campbell, "Chinese," The five companies are China Shenhua, China Coal Energy, Jiangxi Copper, Shanxi Xishan Coal & Electricity Power, and Zijin Mining Group. Other state-owned Chinese mining companies influential in global minerals acquisition include China Minmetals Corporation, Sinosteel, and Jinchuan Group.

²⁰ Nelson Banya, "Zimbabwe will not expropriate mines – Mugabe," *Mineweb.com*, May 21, 2010, <http://www.mineweb.com/mineweb/view/mineweb/en/page72068?oid=105540&sn=Detailhttp://www.mineweb.com/mineweb/view/mineweb/en/page72068?oid=105540&sn=Detail>. Theresa Moyo and Manasa Hwenga, "South African Mining Companies Corporate Governance Practice in Zimbabwe: The Case of Zimplats and Mimosa," in Kabemba and Southall, eds., *South African Mining Companies in Southern Africa*, 194-247.

²¹ William Wallis, "Congo deals threaten western aid supply," *Financial Times*, October 26, 2010, <http://www.ft.com/cms/s/0/a9025b56-e117-11d9-90b7-00144feabdc0.html#axzz17YOQKxuF>

²² Tim Clark. Richards Bay Minerals is the principal producer of titanium sands in South Africa. Australia is the other major titanium producer.

²³ Anton Mauve, Minerals expert, Pretoria-Tshwane, interviewed August 23, 2010;

²⁴ Environmental specialist, Pretoria-Tshwane, interviewed August 23, 2010.

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- ²⁵ “Rising Acid Mine Water could be catastrophic for Johannesburg,” *Mining Weekly*, July 21, 2010. <http://www.miningweekly.com/article/rising-acid-mine-water-threat-to-joburg-2010-07-21>. Maarten de Wit, Professor of Geology, University of Cape Town, interviewed August 20, 2010.
- ²⁶ Kenneth Beilstein, precious metals marketing expert, Metalur Corporation of Switzerland, email message September 10, 2010.
- ²⁷ Anton Mauve, minerals expert, Pretoria, email message July 20, 2010. In 2009, South Africa produced 4.73 million ounces of platinum. World supply amounted to 6.06 million ounces. World demand for platinum amounted to 5.92 million ounces. The Great Dyke in Zimbabwe, the Norilsk-Talnakh nickel deposits of the Taimyr Peninsula in Russia, the Stillwater complex in Montana, and Canada’s Sudbury nickel deposits and Lac des Isles Complex account for most of the rest of the world’s PGM reserves.
- ²⁸ Anton Mauve, email message.
- ²⁹ Tim Aiken and Sandy Wood, Head of Marketing, Anglo Platinum Ltd, 55 Marshall Street, Johannesburg, interviewed August 26, 2010.
- ³⁰ Map is from “The expansion of platinum mining in South Africa,” Platinum 2003, Johnson Matthey, 2003, p. 14. http://www.platinum.matthey.com/uploaded_files/Pt%202003/2003-SA_Expansion.pdf
- Stephen Burgess and Janet Beilstein accompanied Anton Mauve on a site visit to PGM producing area around the city of Rustenburg in South Africa’s North West Province from March 24 to 25, 2010.
- ³¹ Anton Mauve, email message. South Africa’s platinum industry is at a stage where consolidation is pending. Already a number of new players have entered the market – Absolute Holdings, Village Main – while others are reviving their activities after a difficult 18 months such as Platmin, Platfields, Anooraq Resources, Bafokeng and Nkwe.
- ³² “South Africa: Reviewed Mining Charter Launched,” BuaNews (Tshwane, South Africa), September 13, 2010. <http://allafrica.com/stories/201009131194.html>
- ³³ Campbell, “Chinese,” The five companies are China Shenhua, China Coal Energy, Jiangxi Copper, Shanxi Xishan Coal & Electricity Power, and Zijin Mining Group. Other state-owned Chinese mining companies influential in global minerals acquisition include China Minmetals Corporation, Sinosteel, and Jinchuan Group. Recently, a Chinese mining company, Virgile Asia Mining Consortium, made a competitive bid for the financially stricken Orkney and Grootvlei gold mines.
- ³⁴ “China Deal to Transform Wesizwe Platinum,” *The Africa Report*, May 26, 2010, <http://www.theafricareport.com/last-business-news/3291528-China%20deal%20to%20transform%20Wesizwe%20Platinum-%20CEO.html>. Johnson Matthey reported China’s demand for platinum pushed up global consumption in jewelry to 3.01 million ounces in 2009, an increase of 950,000 oz from the previous year. As China’s economy grows, increasing vehicle sales will further drive platinum consumption for use in auto-catalysts. Johnson Matthey reported China’s demand for platinum pushed up global consumption in jewelry to 3.01 million ounces in 2009, an increase of 950,000 oz from the previous year. As China’s economy grows, increasing vehicle sales will further drive platinum consumption for use in auto-catalysts.
- ³⁵ Sanne Mars-van der Lugt, Research Analyst, Centre for Chinese Studies Stellenbosch University, interviewed August 20, 2010.
- ³⁶ Anton Mauve, email message. Underground ventilation and smelting have particularly high power demand.
- ³⁷ Anton Mauve, email message. Ground conditions are challenging especially at depth and on the structurally weaker UG2 Reef (see the map).
- ³⁸ “China Deal to Transform Wesizwe Platinum,” South Africa accounts for 56 percent of African manganese production and 73 percent of iron ore production.
- ³⁹ Johann Pretorius, Citibank, Johannesburg-Sandton, interviewed August 23, 2010.

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- ⁴⁰ David Pineault, Paula Stead and Defense Logistics Agency Defense National Stockpile Center, interviewed September 23, 2010.
- ⁴¹ Campbell, "Chinese."
- ⁴² Cindy A. Hurst, "China's Ace in the Hole: Rare Earth Elements," *Joint Force Quarterly*, Issue 59, 4th quarter 2010, 121-126.
- ⁴³ Rare Earths Meeting at Umbono Company (Junior Exploration Company) (Dr. Paul Nex, Senior Geologist, Umbono; Dr. Jock Harmer, CEO Rare Earth International; and Kerwin Rana, Managing Director, Umbono), August 26, 2010. The Kanyika Niobium Project in Central Malawi is the subject of a government rights dispute.
- ⁴⁴ Rare Earths Meeting. Umbono has forged a joint venture with Southern Minerals Corporation LTD (SMC) to search for rare earth minerals. They were involved in a rare earth atlas in South Africa, determining what rare earth deposits South Africa has. They have undertaken four external rare earth projects, including a carbonatite project in Mozambique, Zambia, Burundi and Argentina.
- ⁴⁵ Rare Earths Meeting. Of the 17 rare earth minerals, Lanthanum is a light rare earth with Europium in the middle and Yttrium and Samarium are heavy rare earths. South African rare earth deposits are associated with alkaline carbonatites and granites.
- ⁴⁶ Rare Earths Meeting.
- ⁴⁷ Rare Earths Meeting.
- ⁴⁸ Meeting at South African Department of Mining Resources with Dr. Siyabonga Ndabezitha (Chief Director of Mineral Promotion), Andre Andreas (Director Mineral Policy and Development), Mpumzi Bonga (Economist), Alex Conradie (Deputy Director Precious and Ferrous Minerals), and Mahlatsi Koma (Deputy Director International Co-ordination), Pretoria/Tshwane, South Africa, August 24, 2010. The idea of separate regulators for mining and for community rights issues was being considered but was not likely.
- ⁴⁹ Allan Seccombe, Business Editor, *Business Day*, Johannesburg, interviewed August 27, 2010.
- ⁵⁰ Department of Trade and Industry DTI, Gerhard Nicolaus (Director Metals) and Freddie Herselman (Section Manager Metals Exports, TISA), Pretoria/Tshwane, August 24, 2010.
- ⁵¹ Mintek, *Profits from Processing*, Mineral and Economics Strategy Unit, Mintek, Randburg, South Africa, 2008.
- ⁵² DTI – Gerhard Nicolaus and Freddie Herselman, August 24, 2010. One of the intentions of the meeting was to learn more on South Africa's specialty steel commodities and their supply outlook.
- ⁵³ Meeting at DMR with Dr. Ndabezitha, Andre Andreas, Mpumzi Bonga, Alex Conradie, and Mahlatsi Koma, Pretoria/Tshwane, August 24, 2010.
- ⁵⁴ Tom Tweedy and Tony Guthrie, DeBeers Marine, Johannesburg, interviewed August 21, 2010.
- ⁵⁵ Gary Pienaar and Smita Nakhooda, Senior Researchers, Institute for Democracy in South Africa (IDASA), Cape Town, August 19, 2010.
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- ⁵⁶ Tim Cohen, "A „Venezuela moment“ in SA's noble quest for change," *Business Day*, June 24, 2010, The article covers the activities of ArcelorMittal and Imperial Crown Holdings in circumventing Kumba (Anglo-American).
- ⁵⁷ Cohen, "A „Venezuela moment“.
- ⁵⁸ Allan Seccombe, "Lonmin shares fall more than 5%," *Business Day*, August 6, 2010, <http://www.businessday.co.za/articles/Content.aspx?id=117278>
- ⁵⁹ Ron Derby and Carli Lourens, "South African Mining Investment Risk Grows, as Anglo and Lonmin Lose Rights," *Bloomberg News*, August 16, 2010. <http://www.bloomberg.com/news/2010-08-15/south-africa-investment-risk-grows-as-anglo-american-lonmin-lose-rights.html>

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- ⁶⁰ Philip Marillier, Venture Capitalist in Mining Industry, Kyalami-Johannesburg, interviewed August 28, 2010.
- ⁶¹ Fred McMahon and Miguel Cervantes, *Survey of Mining Companies, 2009-2010: 2010 Midyear Update*, Fraser Institute, Vancouver, British Columbia, p.23. <http://www.fraserinstitute.org/uploadedFiles/fraser-ca/Content/research-news/research/publications/miningsurvey-2010update.pdf>. South Africa still has the lowest corporate tax rate in Africa at 28 percent.
- ⁶² “SAfrica nationalisation debate stirs unrest-report,” *Metal- Pages*, July 27, 2010. <http://www.metal-pages.com/news/story/48225/>
- ⁶³ Tim Clark, Resources Analyst, Deutsche Securities, Sandton-Johannesburg, interviewed August 23, 2010.
- ⁶⁴ J. Brooks Spector, Public Diplomacy expert, Johannesburg, interviewed August 21, 2010.
- ⁶⁵ LONDON (Metal-Pages) 27-Jul-10. <http://www.metal-pages.com/news/story/48225/>
- ⁶⁶ Allan Seccombe, Business Editor, *Business Day*, Johannesburg, interviewed August 27, 2010.
- ⁶⁷ Mpumzi Bonga (Economist), South African Department of Mining Resources, August 24, 2010.
- ⁶⁸ In 2010, The DRC ranked 164th out of 178 countries on Transparency International’s “Corruption Perceptions Index,” tied with Guinea-Conakry, Kyrgyzstan and Venezuela and just above Angola and Equatorial Guinea.
- ⁶⁹ Jean Didier Losango, “South African Mining Companies Corporate Governance Practice in the DRC: Rushi Mine,” in Kabemba and Southall, eds., *South African Mining Companies in Southern Africa*, 152-189.
- ⁷⁰ William Wallis, “Congo deals threaten western aid supply,” *Financial Times*, October 26, 2010, <http://www.ft.com/cms/s/0/a9025b56-e117-11df-90b7-00144feabdc0.html#axzz17YQOKxuF>
- ⁷¹ Claude Kabemba, Southern African Resource Watch, Johannesburg, interviewed August 27, 2010.
- ⁷² “Congo-Kinshasa: Kinshasa's Missing Millions - Evidence of Grand Corruption Mounts in Beijing's Showcase \$6 billion Barter Deal with the Kinshasa Government,” *Africa-Asia Confidential*, FEBRUARY 15, 2010, [HTTP://WWW.SARWATCH.ORG/HEADLINE-NEWS-FOR-THE-DRC/126-MINING-AND-POLITICS-IN-DRC/1196-CONGO-KINSHASA-KINSHASAS-MISSING-MILLIONS-EVIDENCE-OF-GRAND-CORRUPTION-MOUNTS-IN-BEIJINGS-SHOWCASE-6-BILLION-BARTER-DEAL-WITH-THE-KINSHASA-GOVERNMENT.HTML](http://WWW.SARWATCH.ORG/HEADLINE-NEWS-FOR-THE-DRC/126-MINING-AND-POLITICS-IN-DRC/1196-CONGO-KINSHASA-KINSHASAS-MISSING-MILLIONS-EVIDENCE-OF-GRAND-CORRUPTION-MOUNTS-IN-BEIJINGS-SHOWCASE-6-BILLION-BARTER-DEAL-WITH-THE-KINSHASA-GOVERNMENT.HTML)
- ⁷³ Damon van der Linde, “The Democratic Republic of the Congo and the Future of Cobalt Mining,” *Resource Investing News*, November 9, 2010. <http://resourceinvestingnews.com/9381-the-democratic-republic-of-congo-and-the-future-of-cobalt-mining.html>
- ⁷⁴ Gary Nevison, “Conflict Minerals in the Democratic Republic of the Congo,” *Electronics Regulatory Group*, October 11, 2010. <http://www.electronics-ktn.com/tabid/425/default.aspx?article=Conflict+minerals+ in+the+Congo% 201771>
- ⁷⁵ Nevison, “Conflict Minerals in the Democratic Republic of the Congo.”
- ⁷⁶ Paul Barany, et al, “Strategic Minerals Industry Study,” Industrial College of the Armed Forces, National Defense University, Spring 2008. The focus is on the Zambian mining industry.
- ⁷⁷ In 2010, Zambia ranked 101st out of 178 countries on Transparency International’s “Corruption Perceptions Index,” tied with the Dominican Republic, Sao Tome and Principe and Tonga, and just below Burkina Faso, Egypt and Mexico.
- ⁷⁸ Dan Haglund, “Regulating FDI in weak African states: a case study of Chinese copper mining in Zambia,” *The Journal of Modern African Studies* , 46, (2008): 547-575.
- ⁷⁹ Haglund, “Regulating FDI in weak African states,” 547-575. In Zambia, cobalt production doubled to 4,057 tons (2009) from 1,967 tons (2001).

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- ⁸⁰ Map of Congo Pedicle Road, Congo-Zambia showing Copperbelt, Luapula River with main roads and railway, Created by User: Rexparry_sydney, February 11, 2007.
- ⁸¹ Johanna Johansson, "Patterns of Chinese Investment, Aid and Trade in Central Africa (Cameroon, the DRC and Gabon)," briefing paper for the World Wildlife Fund, Stellenbosch, Centre for Chinese Studies, August 2009, 11-17.
- ⁸² Stephanie Nieuwoudt, "Pros and Cons to Huge Chinese Investment in DRC," Inter Press Service News Agency, October 28, 2008. <http://ipsnews.net/africa/nota.asp?idnews=49031>
- ⁸³ Losango, "South African ... DRC," 152-189.
- ⁸⁴ Claude Kabemba, Southern African Resource Watch, Johannesburg, interviewed August 27, 2010.
- ⁸⁵ Nieuwoudt, "Pros and Cons to Huge Chinese Investment in DRC."
- ⁸⁶ Haglund, "Regulating FDI in weak African states," 547-575.
- ⁸⁷ John Lungu and Sumbye Kapena, "South African Mining Companies Corporate Governance Practice in Zambia: The Case of Chibuluma Mine Plc.," in Kabemba and Southall, eds., *South African Mining Companies in Southern Africa*, 47-88.
- ⁸⁸ Robin Sherbourne, Group Economist, Nedbank and Old Mutual Namibia, interviewed August 16, 2010.
- ⁸⁹ John Lorinc, "When Uranium Outshines Gold," *The New York Times*, November 17, 2010, F2.
- ⁹⁰ Robin Sherbourne, NedBank, interviewed August 16, 2010.
- ⁹¹ Rigmar Osterkamp, Department of Economics, University of Namibia, interviewed August 17, 2010. In 2010, Namibia ranked 56th out of 178 countries on Transparency International's "Corruption Perceptions Index," tied with Turkey and Malaysia and just below South Africa.
- ⁹² Tirivangani Masawi, Business Editor, *Informanté*, interviewed August 18, 2010. Mining operations are ongoing at Rössing and Lange Heinrich mines. Exploration is being conducted by Areva and Rössing South.
- ⁹³ Steve Galloway, uranium specialist, Nedbank, Windhoek interviewed August 16, 2010
- ⁹⁴ Map to Rössing Uranium Mine - Swakopmund, Namibia, 2010
<http://www.Rössing.com/popup/map.htm>.
- ⁹⁵ John Grobler, investigative journalist, Windhoek, interviewed August 18, 2010. There were reports of questionable dealings by top SWAPO government officials in regard to oil and gas leases in the Orange River basin and in the indigenization of Namibian fuel services.
- ⁹⁶ Heike Smith, ICJ Securities, Windhoek, interviewed August 18, 2010.
- ⁹⁷ Tirivangani Masawi, August 18, 2010.
- ⁹⁸ Tirivangani Masawi, August 18, 2010.
- ⁹⁹ Tirivangani Masawi, August 18, 2010.
- ¹⁰⁰ Denver Kisting and Jo Mare Duddy, *The Namibian* Windhoek John Grobler, Journalist,
- ¹⁰¹ John Grobler, August 18, 2010.
- ¹⁰² Bill Lindeke, *Institute for Public Policy Research*, interviewed August 17, 2010. Michael Schultheiss, Friederich Ebert Stiftung, interviewed August 16, 2010.
- ¹⁰³ The United States has good relations with two mining countries in the region - Zambia and Botswana – and should continue to have sustainable access to their minerals, including diamonds, copper and cobalt.
- ¹⁰⁴ Allan Seccombe, Business Editor, Business Day Johannesburg, interviewed August 27, 2010.
- ¹⁰⁵ Brooks Spector, Public Diplomacy expert, Johannesburg, interviewed August 21, 2010.

¹⁰⁶ Japanese government (especially the Ministry of Economy, Trade and Industry – METI) and industry work closely together on strategic minerals, as was evidenced during the October 2010 rare earth minerals crisis caused by Chinese companies cutting off supply.

¹⁰⁷ Claude Kabemba. Southern Africa Resource Watch is focusing on South African export restrictions.

See also European Commission, Enterprise and Industry, Raw Materials,
http://ec.europa.eu/enterprise/policies/raw-materials/index_en.htm