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We know that the world economy nourishes us all, we know that we live in a shrinking planet. Materially as well as morally our destinies are intertwined.

—Henry Kissinger
at the United Nations
September 1975

AFRICAN MINERALS AND AMERICAN POLICY

by

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In 1972, a Massachusetts Institute of Technology team of four American and Norwegian specialists in systems dynamics and management published a new and unusually thought-provoking study dealing with the interrelated problems of population growth, agricultural productivity, industrial production, pollution, and natural resource depletion. Published under the aegis of The Club of Rome and written in layman's language, their book, *The Limits to Growth*, was both a popular success and the subject of much critical comment and evaluation within the academic community. Drawing together under a new methodological umbrella masses of data—on population dynamics, industrial production, economic growth rates, arable land, food production, chemical and pesticide contamination, nutrition, life expectancies, and mineral consumption—and fitting these data into a preliminary world model capable of being manipulated to test competing theories and development strategies, the MIT team was able to arrive at a number of disturbing conclusions relative to the future of our planet and species.

It is well beyond the intended scope of this study to explore fully all the conclusions reached in *The Limits to Growth*. Rather, my analysis will be confined to the question of natural resource depletion as it may affect American foreign policy; through use of the tools and methods of analysis developed by the authors of *The Limits to Growth*, an attempt will be made to demonstrate the possibility that sheer economic necessity may soon force a drastic reevaluation of America's relationship with Third World suppliers or producers of raw materials, particularly in Sub-Saharan Africa.

The authors of *The Limits to Growth* foresaw a situation in which:

If the present growth trends in world

population, industrialization, pollution, food production, and resource depletion continue unchanged, the limits to growth on this planet will be reached sometime within the next one hundred years. The most probable result will be a rather sudden and uncontrollable decline in both population and industrial capacity.¹

This rather ominous Malthusian forecast would seem to guarantee that, long before world reserves of raw materials are exhausted, the major industrial powers will be drawn into increasingly sharp competition over the resources they must have to keep their industrial base in operation. Expressed another way, so long as the United States is mining bauxite in Jamaica and the USSR is mining it somewhere within its zone of primary economic influence, competition remains at most a question of productivity, technological innovation, and access to markets. However, when readily exploitable sources of necessary ores and minerals close to the United States are exhausted, and when the industrialized nations must turn to the remaining undeveloped supplies or do without, then economic competition must become more direct and potentially more disruptive in terms of its impact on political stability and great-power relationships.

AFRICA'S ROLE

In attempting to demonstrate the importance of Africa as a potential source of raw materials, this study focuses on eight metals: aluminum (bauxite), chromium, cobalt, copper, iron, manganese, platinum, and uranium. These minerals were selected because they are found in commercially exploitable quantities in Sub-Saharan Africa, because they have a variety of applications in American industry, because they represent metals for which there are at present no generally suitable substitutes, or because they represent important underused deposits of metals widely recognized to be essential to all industrialized nations.

A glance at the following list will illustrate some of the ways these eight metals are

commonly used, and the economic importance of their various applications:²

- *Aluminum* is used for engine parts (pistons, carburetors, fuel pumps), body panels, battery boxes, aircraft components, lightweight piping of all kinds, electrical appliances, and a variety of consumer durables.

- *Chromium* is used in metallurgy, specifically alloyed with steel to produce stainless steel; in the manufacture of refractory bricks used to build metallurgical ovens; and in the chemical industry.

- *Cobalt* is alloyed with iron in turbine blades, compressor discs, magnets, bearings, cams, pump and valve parts, and seals.

- *Copper* is used for electrical connections of all types, wire, radiators, cartridge cases, and railroad car boxes. It has an enormous number of industrial applications.

- *Iron* is used in the construction, shipbuilding, armaments, and railroad industries. It has virtually limitless light and heavy industrial application.

- *Manganese* is used in batteries, in the production of pig iron, and as an alloy of iron, aluminum, and silicon.

- *Platinum* is used in parts requiring resistance to chemical corrosion; in controlling automobile emissions; in electrical components such as contacts, slip rings, and commutators; in thermocouples; in thermometers; in sensor shields; in jet thrusters used in spacecraft attitude control; and as a chemical catalyst.

- *Uranium* is used in the production of power, in the fabrication of weapons, and in medical research.

This list is by no means exhaustive, but it does give some feel for the scope of the problem and the potential significance of the relationship.

The table on the following page presents the core of the argument. A brief glance at the "Static Index" column would seem to indicate that at present rates of consumption neither the world nor the United States stands in any immediate danger of exhausting its supplies of these metals. The key phrase here is "at present rates of consumption." The economic history of Western Europe, Japan,

and the United States over the last half century gives little reason to expect that consumption rates will remain constant. The proofs and arguments advanced by the authors of *The Limits to Growth* have been accepted in the abstract, but no industrialized nation, least of all our own, has yet shown a

willingness to undergo the serious social and economic disequilibrium that would accompany the adoption of resource utilization strategies designed to harmonize patterns of consumption and available supplies. In a political sense, these may be decisions which cannot be made in a

CRITICAL METALS: CONSUMPTION, PRODUCTION, AND KNOWN RESERVES

	Known Global Reserves (1970)	Static Index (years)	Average Projected Rate of Growth	Actual Growth (1973)	Exponential Index (years)	Countries or Areas With the Highest Reserves (% of World Total)	Consumption by US and Other Prime Consumers (% of World Total)	Remarks
Aluminum (Bauxite)	1.17 x 10 ⁹ tons	100	6.4%	9%	31	Australia 33% Guinea 20% Jamaica 10%	US 24% USSR 12%	Ghana also has reserves of 300 million tons.
Chromium	7.75 x 10 ⁸ tons	420	2.6%	8%	95	RSA 75%	US 19%	Rhodesia also has large reserves.
Cobalt	4.8 x 10 ⁹ lbs.	110	1.5%	9%	60	Zaire 31% Zambia 16%	US 33%	Zaire produces 59% of the world total.
Copper	308 x 10 ⁶ tons	36	4.6%	7%	21	US 28% Chile 19% Zambia (unknown) Zaire (unknown)	US 31% USSR 13% Japan 11%	African nations account for 21% of world production.
Iron	1 x 10 ¹¹ tons	240	1.8%	11%	93	USSR 33% S. America 18% Canada 14%	US 24% USSR 24% W. Germany 11%	Liberia and Gabon also have major deposits of high-grade ore.
Manganese	8 x 10 ⁸ tons	97	2.9%	6%	46	RSA 38% USSR 25% Gabon (unknown)	US 14%	Gabon's reserves are estimated at 200 million tons.
Platinum	429 x 10 ⁶ troy oz.	130	3.8%	21%	47	RSA 47% USSR (unknown)	US 35%	
Uranium	3.097 x 10 ⁶ metric tons	133	10%	56%	27	US 30% RSA 23%	US 55%	A third of Free World reserves is in Africa. Of this, 92% is in RSA.

NOTES:

The basic format is adapted from *The Limits to Growth*.

The Republic of South Africa is abbreviated as RSA.

The Static Index reflects the number of years known reserves will last at the present rate of consumption.

Actual growth figures reflect growth in production rather than consumption. The difference between the average projected rate of growth in consumption and the actual rate of production growth is probably attributable to stockpiling.

The Exponential Index reflects the number of years global reserves will last with consumption growing exponentially at the average rate of growth. For the sake of consistency, this is calculated by using the same formula used in *The Limits to Growth*.

Data on bauxite, cobalt, copper, iron, and platinum are updated through 1973.

Information on uranium is taken from Tony Hodges, "Africa's Uranium: Few Gains, Big Dangers," *Africa* (November 1975), pp. 18-20. Where possible, data have been cross-checked.

US consumption of uranium is 55 percent of non-Communist consumption.

democracy in anticipation of a crisis. An immediate and impending shortage of one or more of these crucial metals may be the only stimulus capable of creating public and governmental support for policies designed to balance available resources and rates of consumption. Inevitably, by the time the public realizes the seriousness of a particular shortage, it will probably be much too late to satisfactorily resolve it.

For the foreseeable future, the prognosis remains greater and more direct competition for fewer and less readily exploitable supplies of minerals. As the "Growth" and "Exponential Index" columns of the table seem to indicate, if growth rates in consumption and production continue to accelerate, the future is less than 100 years away.

Africa's importance as a source of minerals and ores lies not so much in what the continent is producing now, though that is certainly significant, but rather in its position as the last major frontier in mineral exploration and exploitation. At present, the United States is obtaining most of its imported bauxite from Jamaica and Surinam. Similarly, we buy the bulk of our imported copper from Canada, Chile, Mexico, and Peru. The iron ore required to supplement domestic mine production also comes largely from suppliers within our own hemisphere: Canada, Brazil, and Venezuela. And, though we are the Free World's largest producer of uranium oxide (U_3O_8), we import almost 5000 tons of uranium annually from Canada. The point of these illustrations is that at the moment we are meeting our total domestic requirements for many crucial minerals by buying the ore from countries that are politically friendly, geographically proximate, and well situated for exploitation in the sense that existing deposits are capable of being developed without excessively high capital outlays for exploration, transportation, and site development. The question remains, where does the United States go when these deposits are exhausted?

The answer is the Third World and, within the Third World, Africa.

The following table shows that the United States is already dependent to a large degree on African suppliers for some of these metals, in spite of the fact that access to those minerals we are buying from sources in Africa has sometimes been complicated by political considerations.³

	Domestic Demand Supplied By Foreign Sources	Domestic Demand Supplied By African Sources
Aluminum (Bauxite)	68%	1%
Chromium	67%	31%
Cobalt	100%	61%
Copper	26%	1%
Iron	29%	7%
Manganese	98%	40%
Platinum	100%	11%
Uranium	None	None

Chromium, in particular, offers unusual problems for American businessmen and policymakers. Most of the known supplies of this essential alloy are either in the Soviet Union or in Southern Africa, specifically in South Africa and Rhodesia. For obvious reasons, neither source is entirely satisfactory, but our recent reliance on Rhodesian supplies of ferrochromium and

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chromite has caused the United States serious political problems—including a loss of diplomatic credibility—in our dealings with independent African nations opposed to the continuation of minority rule in Southern Africa.

The Republic of South Africa, because of its widely condemned policies of social, economic, and political discrimination based on race, is also an anathema. Perhaps no single issue arouses such universal support in independent Africa as the question of political and social justice for South African blacks. Trade with South Africa—whether for chromite, gold, and diamonds or for wine, meat, and grain—therefore carries with it very considerable political liabilities for any nation that attempts to trade with Pretoria and maintain normal relations with other African nations.

Other metals—aluminum, copper, iron, and uranium—are less immediate problems; however, it does not require unusual foresight to see that if world reserves of these metals do approach exhaustion in 31, 21, 93, and 27 years respectively (at the exponential growth rate), the African share of known global reserves is going to become more important to US industry than it now is. Nor is it unreasonable to anticipate that other industrialized nations will begin to show an increased interest in Africa's mineral resources at approximately the same time we do.

NEW TECHNOLOGY AND NEW SUPPLIES

For the purposes of this discussion, I have assumed that all major recoverable deposits of the eight metals listed have been found. This may not, in fact, be the case. As the pressures on existing supplies increase, the incentive for consumers to seek new supplies grows proportionately (witness the burst of activity in oil exploration following the Arab oil embargo). Technology offers considerable grounds for optimism in this regard. Until it became common knowledge that the *Glomar Explorer* was prospecting for submarines, it was widely thought that this vessel was

attempting to develop procedures for recovering verified deposits of mineral-rich nodules from the ocean floor. Recent advances in space technology offer hope of new discoveries, and systematic scanning of the Earth's surface by a variety of different photographic and electronic means may also uncover deposits of minerals undetectable by more conventional methods. Should such deposits be found in sufficient quantities to justify further exploration and development, they would naturally affect the timetables and forecasted rates of depletion cited in the table. On the other hand, while such discoveries, if they occur, may postpone the inevitable competitive scramble for resources, they are unlikely to prevent it altogether.

One possible result of an imminent clash over particular metals would undoubtedly be a spurt of scientific interest in developing substitutes. Here again, I have assumed for purely pedagogical purposes a constant technology. It is difficult to imagine a satisfactory substitute for steel in all its myriad uses, but faced with the possibility of economic regression, or conceivably even extinction, technology may yet provide practical substitutes for some of these metals in some of their applications. Such substitutes would have a salutary effect on consumption of the natural ore, and they would unquestionably affect the terms under which American consumers and manufacturers would attempt to regulate their trade with their various suppliers.

PROBLEMS FOR AMERICAN POLICYMAKERS

It we accept that something must be done to insure that American industry does have access to Africa's mineral wealth, several alternative courses of action suggest themselves for further examination.

The first of these requires a much greater degree of commitment to African development needs and political aspirations than has heretofore been consistent with American foreign policy. Through the 50's and 60's, Africa constituted part of

America's zone of indifference. Preoccupation with events in Southeast Asia, in the Middle East, and to a lesser degree in Europe, meant that African problems and issues attracted little attention. American policymakers could see little reason for an increased American presence on the continent, and Africa itself did not command the kind of constituency within Congress or the government that would insure that questions of importance to Black Africa would be addressed. Within the State Department, the African Bureau has, until very recently, played a secondary role to the larger and more prestigious European and Middle Eastern Bureaus; within Congress, only the members of the Black Caucus and the House Subcommittee on Africa consistently address issues of importance to the 40-odd nations south of the Sahara.

An increased American commitment to Africa does not necessarily mean more aid, more Peace Corps volunteers, and more military assistance. In the 17 years since the bulk of the nations in Black Africa began moving toward independence, many African political leaders have acquired a vastly enhanced understanding of economic affairs and considerably greater sophistication in establishing the conditions and terms under which foreign businesses will be allowed to operate in their countries. In most cases, African political leaders seem determined to insure that exploitable reserves of raw materials will pay for the development of their countries. In a recent article on African uranium resources, one spokesman for the Government of Niger was quoted as saying, "Either uranium allows us to finance economic development, or we will leave it where it is so as to not dissipate this inheritance uselessly."⁴ This statement probably reflects the attitude of most mineral-rich African nations toward resource development.

Some of the more specific means by which the United States might improve its relationship with primary producers of raw materials are: increased assistance with food supplies;⁵ assistance in finding and developing further supplies of raw materials;

tariff preferences and concessional trading arrangements with selected nations whose minerals are considered most essential to our own economic well-being;⁶ training and technical assistance programs, particularly in agriculture; and support for the creation of a special agency within the International Monetary Fund (IMF) to assist underdeveloped countries during periods of violent fluctuation in the price of or demand for their commodities. In some respects, the IMF is already following this latter course of action. Assistance is being provided to nations suffering severe balance-of-payments deficits as the result of the high cost of imported oil.

This latter tactic has one significant drawback: It is nonspecific. Participation in this type of agency would deprive the United States of the ability to favor those nations whose policies and business practices are compatible with our own. In blunter terms, the United States could not reward those nations which support US policies and goals and deny assistance to those which do not. The notion of using economic pressure to influence policy in sovereign nations may not be entirely consistent with America's self-image, but there is ample historical precedent for including it in this analysis as a practical consideration.

As part of the price of access to necessary metals, African nations would almost certainly expect increased American support for African political goals. The previous Secretary of State's speeches at Lusaka and at the United Nations would seem to indicate acceptance of this fact and, perhaps, a swing away from issue avoidance in our relationships with the independent nations of Sub-Saharan Africa.

In his New York speech, Mr. Kissinger seemed to offer hope for reconciliation between the industrialized West and the Third World. He recognized the essential validity of the Third World's claims for a larger share of the rewards of economic development, and in acknowledging the symbiotic relationship that binds together suppliers and consumers,

he voiced his support for granting the Third World nations a greater role in determining their economic destiny.

In his Lusaka address, Mr. Kissinger dealt more specifically with issues of special import for Africans. For the first time, the United States clearly and unequivocally called for real progress in rationalizing South African racial policies and modifying or bringing *apartheid* to an end. Mr. Kissinger also aligned the United States on the side of the angels on the emotionally charged questions of independence for Namibia and an end to white minority rule in Rhodesia. The Secretary stated his support for the Lusaka Manifesto and for the 1966 and 1968 Security Council resolutions imposing economic sanctions on Rhodesia. Also, he promised to seek repeal of the controversial Byrd Amendment, under the terms of which the United States had unilaterally violated the sanctions imposed on Rhodesia. (This amendment was subsequently repealed, under the Carter Administration.)

Both speeches were warmly received by African audiences, I believe as much for their seeming recognition of Africa's importance as for the content of the various detailed recommendations.

OBSTACLES TO CREATING A CLIMATE FOR INVESTMENT

Simply deciding that it is in the best interests of the United States as a nation to build closer economic and political ties with our potential African suppliers does not by itself insure the accomplishment of that. American businessmen have historically been reluctant to risk large amounts of capital in developing nations—particularly in Africa. Widespread nationalization of expatriate businesses (in some instances without compensation) in Ethiopia, Tanzania, Nigeria, Uganda, Libya, Zaire, and several other countries has created understandable distrust in the business community. The unpredictable behavior of some African leaders (Colonel al-Qadhafi and Field Marshal Amin, to cite two notorious examples) has also contributed greatly to foot-dragging in the private sector.

The problems of a general lack of political stability on the continent and local shortages of skilled and semiskilled labor must also be addressed before Western businessmen can be expected to show any real enthusiasm for initiating large-scale development schemes in Africa south of the Sahara. The first of these, the rather marked turbulence characteristic of political activity in many African nations since independence, is a problem largely beyond our ability to influence. Improved economic opportunity brought about by larger American investment in mining, mineral extraction, and mineral processing can certainly act as a stabilizing influence in specific cases, but the problem of who governs remains in most instances a variable over which we have little or no control.

The second obstacle to creating an attractive investment climate on the continent, the lack of skilled and semiskilled labor, can be corrected through recourse to some of the training programs mentioned earlier, though the programs must be on a larger scale than anything yet attempted. Training Africans to function as supervisors and technicians has the additional advantage of being politically more acceptable to African governments than bringing in expatriates with the necessary skills.

From an investor's standpoint, the Republic of South Africa presents several unusually thorny problems. Recent estimates by Embassy officials in Pretoria indicate that the US already has approximately \$1.5 billion in direct investment in South Africa. The country is unusually well-endowed by nature with coal, platinum, gold, iron, manganese, phosphates, diamonds, chromium, copper, lead, uranium, and other metals needed by European, North American, and Japanese industries. As a potential supplier of these materials, South Africa is immensely attractive and far too important in terms of known world reserves of these minerals to be ignored. However, as a political entity, South Africa's widely condemned racial policies make it the target of enormous international disapprobation and potentially the scene of a savage and bloody racial conflict. America's policy toward this country must therefore seek to prevent war in South Africa, with all

the political and economic risks inherent in an outbreak of fighting; failing in that, America's policy should attempt to create strong political ties with possible alternative regimes to insure continued access to the country's minerals. This feat of diplomacy is, I freely admit, easier to conceive in theory than to execute in the real world.

THE ROAD AHEAD

Given that supplies of raw materials are finite and that at some point in the relatively near future access to diminishing reserves of particular ores will become of much greater importance than at present, the United States must soon adopt a series of strategies that will insure continued access to those reserves.

In addition to encouraging private investment and increasing our commitment to African political goals, we must identify those nations whose mineral resources justify a major American diplomatic and economic effort. At a minimum, these should include Liberia (iron); Ghana (bauxite and alumina); Guinea (bauxite); Zaire (copper and cobalt); Zambia (copper); Gabon (iron, manganese, and uranium); South Africa (chromium, manganese, platinum, and uranium); and Namibia (copper and uranium). Other nations may suggest themselves for similar treatment, though for political, economic, or strategic reasons rather than their positions as suppliers of metals. Kenya, the Ivory Coast, Nigeria, and possibly Angola fall into this latter category. This summary does not take into account present political realities in, for example, Guinea and Angola. It merely pinpoints those nations whose attitude

towards us could become crucial to our survival as an industrialized nation.

As can be seen from the foregoing discussion, in the months and years to come Africa must play an increasingly important role in the destiny of our nation. By the end of this century, questions of overextended American diplomacy or the cost of increasing our commitment to various key African nations may prove less important than the demonstrable necessity of building closer political relationships with the nations that control our raw materials.

NOTES

1. Donella H. Meadows, et al., *The Limits to Growth* (New York: Universe Books, 1972), p. 23.
2. Derived from US Department of the Interior, Bureau of Mines, *Minerals Yearbook, 1973* (Washington: US Government Printing Office, 1976).
3. Figures are computed from data in the *Minerals Yearbook, 1973*. The platinum statistics are somewhat misleading in that the US produces some of its own platinum-group metals and imports more than its domestic needs for refining and export. South Africa remains the world's second largest producer, behind the USSR, and the third most important source of US platinum. With regard to uranium, The Atomic Energy Act of 1954 prohibits the use of foreign uranium in domestic reactors. In terms of world resources, the US has more uranium—and is exploiting it faster—than any other non-Communist country.
4. Tony Hodges, "Africa's Uranium: Few Gains, Big Dangers," *Africa* (November 1975), pp. 18-20.
5. Even in nations like Gabon—with large iron, manganese, and oil deposits—food production and modernization of the agricultural sector have not kept pace with the overall rate of development. Gross domestic product (GDP) is rising about 10 to 80 percent per year, but agriculture accounts for only about 5 percent of the GDP in any given year. Agricultural production has dropped or remained steady, but agricultural imports have nearly doubled.
6. In this regard, the US already lags well behind the member nations of the European Economic Community.

