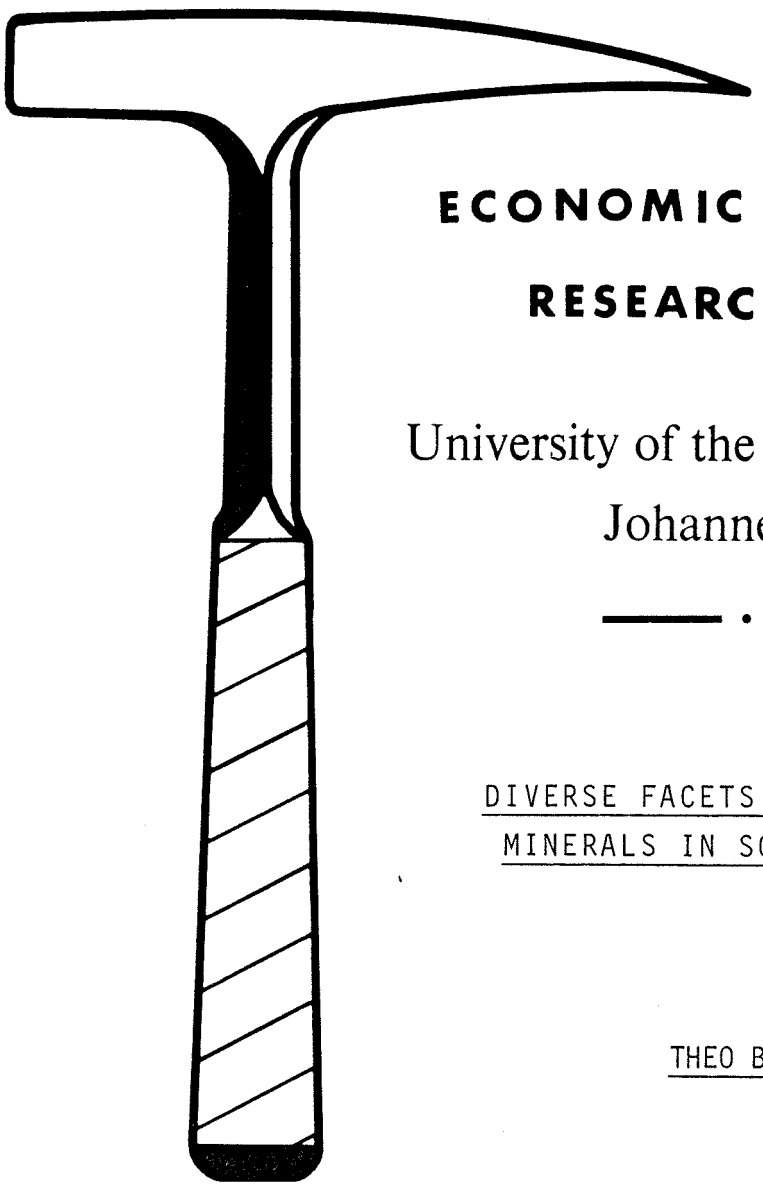

ECONOMIC GEOLOGY RESEARCH UNIT

University of the Witwatersrand
Johannesburg

DIVERSE FACETS OF STRATEGIC MINERALS IN SOUTH AFRICA

THEO BEUKES

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by

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ABSTRACT

Southern Africa, in general, and South Africa, in particular, are major producers and suppliers of mineral commodities to the international market. Several of these mineral commodities are essential, or of critical importance, to modern industrialized economies, particularly those of Western countries. Events of the past decade have focused increasing attention on the adequacy of mineral supplies. Contemplation of the World's disappearing supplies of minerals and other exhaustible assets has led to demands for regulation of their exploitation.

Mineral commodities considered to be essential for economic prosperity are classified as strategic. Too often, however, the analyst of strategic minerals indulges in hyperbole. Demonstrable untruths and dubious contentions pass for known facts, while time-tested principles of applied economics are contemptuously dismissed as nonsense.

The paper compares conflicting views with regard to strategic minerals and attempts to draw conclusions applicable to South Africa as an important supplier of minerals.

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DIVERSE FACETS OF STRATEGIC MINERALS IN SOUTH AFRICA

This article is based on a paper delivered at the EGRUSEG ENCAENIA, a one day joint meeting of Southern African members of the Society of Economic Geologists (Africa Region), and invited guests of the Economic Geology Research Unit, University of the Witwatersrand, Johannesburg, held on October 7, 1980.

The views expressed are those of the author and do not necessarily represent the views of either his employer, the Society, or the University.

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DIVERSE FACETS OF STRATEGIC MINERALS IN SOUTH AFRICA

The most common philosophic model relating to exploration is "cause and effect". This philosophy operates on the basis that there must be a rational explanation of why an ore body occurs *here* and not there - to be sure, this is a question that has occupied the minds of many an enemy of South Africa. So much so, that one journalist referred to South Africa as "The *un*strategic location of strategic metal supplies".

Strategic is narrowly defined as "materials essential in war". More broadly, it concerns the strategy to manage factors of production, so as to obtain and retain a position of power; the power being referred to as economic and/or political power. With reference to minerals, the concepts of economic and political power are of necessity interwoven. Regrettably, however, the tendency exists not only to confuse the two, but also to give precedence to the political.

Events of the past decade (specifically since "limits to growth") have focussed increasing attention on the adequacy of mineral supplies. Contemplation of the World's disappearing supplies of minerals and other exhaustible assets led to demands for regulation of their exploitation. Even the man in the street posed the question whether in fact we would have any mineral resources in our future. Before long, mineral commodities considered to be *essential* for the economic prosperity were considered to be of *strategic* importance. Too often, however, the analyst is trapped, by the bad habit of many discussants of the strategic importance of our minerals to indulge in exaggerated statement. Demonstrable untruths and *dubious* contentions pass for known facts, while time-tested principles of applied economics are contemptuously dismissed as nonsense. Against this background I should like to introduce a *provocation*. That is, South Africa's minerals are *not* as important strategically as numerous journalists and speakers would have us believe.

Proponents of the strategic importance of South Africa's minerals usually refer to the contribution made by the mining sector to the Western World mineral supply (see Table 1). The argument goes, that South Africa is the World's largest producer and exporter of gold, platinum-group metals, gem-diamonds, chrome, manganese, vanadium, vermiculite, andalusite and asbestos. Moreover, South Africa is the second largest (or at least amongst the top 10) producer and exporter of antimony, uranium, fluorspar, nickel, coal, copper, tin and silver. During 1979 South African exports of vanadium, P.G.M.'s and vermiculite comprised more than 70% of the Western World's exports in these commodities. Gold exports accounted for 57%, while andalusite, chrome ore, and manganese ore, among others, contributed upwards of 25% to total World exports in these commodities. The argument is further substantiated by reference to the known mineral reserve statistics, which are impressive, notwithstanding the shortcomings associated with the calculations and comparisons of such reserves (see Table 2).

The conclusion follows that, in a World military power sense, because South Africa is such a strategic supplier of minerals (particularly to the Western World) the Republic is in an ideal position to impose mineral boycotts or cartels. By denial or limitation of mineral supplies or a drastic increase (or threats of increase) in the prices of commodities, it is suggested, indeed believed, that the Republic could gain the political and/or economic upper hand.

To gain some perspective on this viewpoint one should consider comments by C.K. Leith (1943):

> *"Potential World control is not necessarily afforded by control of any of the great land masses, but .... it lies in the control of mineral resources, wherever they are, backed up by control of the air and the sea".*

In contrast J.K. Galbraith (1958) noted:

> *"If one is condemned to consider the possibilities, there now remain very broadly two possible kinds of war. One follows the pattern of the Korean War where the scale, objectives, and weapons are all circumscribed. There is also the atomic and thermo-nuclear holocaust".*

He further argues that the aggregate output of the economy, and therefore by implication, its mineral position, is unimportant in either kind of war.

Earlier writers place minerals in a central position *vis-à-vis* World military strategy, reacting mainly to the experience of World Wars I and II. These were wars which extended a considerable length in absolute time and where resources could be mobilized and produced in order to fight. The economic potential, that is, the supply position, of the major combatants becomes of importance in such wars of attrition. Total resources that can be brought to bear, in material, transportation facilities, and manpower, become the critical factor determining the long-range military situation and the eventual outcome of the conflict.

TABLE 1

SOUTH AFRICA'S ROLE IN WORLD MINERAL EXPORTS, 1978

South Africa's (including Bophuthatswana) mineral exports estimated as a percentage share of Western World and World exports.

MINERAL COMMODITY	SOUTH AFRICA'S EXPORTS (metric tons)	WESTERN WORLD		WORLD	
		RANK	%	RANK	%
PLATINUM GROUP METALS	*	1	91	1	58
VERMICULITE	186 665	1	80	1	78
VANADIUM (Metal)	*	1	73	1	59
GOLD (Metal) --- kg	706 416	1	67	1	48
MANGANESE METAL	*	1	67	1	52
FERROCHROME	*	1	58	1	51
ANDALUSITE, SILLIMANITE	68 652	1	49	N/A	N/A
GEM DIAMONDS --- carats	3 667 000	1	46	1	36
CHROME ORE	1 451 597	1	40	1	28
MANGANESE ORE	*	1	36	1	30
FERROMANGANESE	*	1	22	1	20
DIAMONDS (Gem, Industrial) --- carats	7 726 605	2	28	3	20
INDUSTRIAL DIAMONDS --- carats	4 049 000	2	21	3	15
FLUORSPAR	384 387	2	21	2	15
URANIUM (Metal)	*	2	20	N/A	N/A
ANTIMONY TRIOXIDE	*	3	23	3	21
ZIRCONIUM	*	2	9	N/A	N/A
ASBESTOS (Fibre)	*	3	12	4	9
COAL (Anthracite, Bituminous)	15 388 668	4	13	6	8
ANTIMONY (Metal)	1 629	6	7	8	5
IRON ORE	*	7	5	8	4
NICKEL (Metal)	*	7	3	8	3
COPPER (Metal)	*	7	3	9	3
TIN (Metal)	2 212	9	1	10	1
SILVER (Metal) --- kg	96 704	10	1	13	1
ZINC (Metal)	21 632	17	1	22	1

* Classified Data

Source : Minerals Bureau, South Africa

TABLE 2

SOUTH AFRICA'S ROLE IN WORLD MINERAL RESERVES, 1979

South Africa's (including Bophuthatswana) mineral reserves as a percentage share of Western World and World reserves.

MINERAL COMMODITY	SOUTH AFRICA'S RESERVES (metric tons)	WESTERN WORLD		WORLD	
		RANK	%	RANK	%
MANGANESE ORE (in-situ)	12 139 800 000	1	93	1	78
VANADIUM (Metal, 30m depth)	7 760 000	1	90	1	49
PLATINUM GROUP METALS (Metal, 600m depth)	30 200	1	89	1	75
CHROME ORE (300m depth)	3 096 830 000	1	84	1	81
GOLD (Metal)	16 500	1	64	1	51
FLUORSPAR (CaF_2 content)	31 400 000	1	46	1	35
ANDALUSITE, SILLIMANITE	104 000 000	1	45	1	34
VERMICULITE (Crude)	73 000 000	2	30	2	29
DIAMONDS --- carats	72 000 000	2	23	2	21
URANIUM (Metal, up to $50 lb U_3O_8)	391 000	2	18	N/A	N/A
ANTIMONY (Metal)	300 000	2	18	3	5
ASBESTOS (Fibre)	8 500 000	2	8	4	5
ZIRCONIUM (Metal)	4 000 000	2	12	4	10
PHOSPHATE (Contained concentrates)	1 796 000 000	3	9	3	9
COAL (largely bituminous)	82 000 000 000	4	10	6	6
ZINC (Metal)	12 067 000	4	10	5	8
LEAD (Metal)	6 157 000	4	5	5	4
NICKEL (Metal, 600m depth)	5 830 000	5	8	7	6
TITANIUM (Metal)	33 256 000	3	17	3	15
SILVER (Metal)	8 700	5	6	6	4
COBALT (Metal)	70 000	5	5	7	4
IRON ORE (30m depth)	9 500 000 000	6	6	7	3
COPPER (Metal)	6 400 000	11	2	13	2
TIN (Metal)	ø	11	<1	13	<1

ø Classified Data

Source : Minerals Bureau, South Africa

But all of this changed with the atom bomb.

In "The Economics of Defense in the Nuclear Age", Hitch and McKean (1960) posed the question: "Defense against what?".

They identified three kinds of war:

1. All-out nuclear war.
2. Limited local conflicts.
3. Wars of mobilization.

In the event of a *nuclear war* the economic potential is important only to the extent that it has been translated in the reality, to build up effective forces for the delivery of nuclear explosives. Such an accomplishment makes minimal reliance upon our minerals position and is of no significance whatsoever, both as to our total productive potential at the time of war, and our stockpiles and reserves of minerals. A nuclear war therefore diminishes the "strategic" value of our minerals. In the case of *limited local conflicts* economic potential also appears to be less than decisive, even in cases like Korea and Vietnam. It moreover, has limited importance in countering offensives conducted by infiltration, subversion, civil war, or diplomacy. In a *war of mobilization*, access to mineral supplies and stocks plays a major role in the outcome. This is the World War II-type conflict. However, this type of war has a relatively low probability of occurrence in these days, and would only seem possible when strategic bombing of major centres by both sides proved ineffective. Otherwise, it would be a short war.

From the arguments, it would seem that the significance of "strategic" mineral supplies during conflict is no longer great. It is, however, the forces available which are significant. The size of the existing forces rests upon a social decision as to the amount of productive capacity that will be diverted during peacetime to the maintenance of such forces. Since, during peacetime, minerals are available regardless of where produced and assuming market normality, the *significance* of a nation's *minerals* position becomes much less.

This is *not* to say that the concept of a *secure supply of minerals* is of no consequence. It is of great importance to our economy that minerals be available in abundance at low cost. Because of the rapid growth in mineral demand on a World-wide scale and because of the prolonged period of political unrest in many parts of the World which are major suppliers of important minerals, the domestic resource base is of great significance. But it clearly is *not controlling* in the military power sense.

With regard to coercion of the market, or cartelization, of one or all of our minerals, the argument becomes more economic in nature. Since the successful formation of the O.P.E.C. and the continued and simplistic over-reaction by the media, the aspirations of such market interventionists have become more pronounced. However, these aspirations are not generally shared by either the producers or mineral economists. The motivations for non-market intervention or formation of a cartel are obvious. They include:

(i) a desire to improve the terms of trade between the mineral raw material exporter and the importer,

(ii) a desire to capture larger portions of the presumed rising "economic rents",

(iii) a perceived need to conserve limited mineral resources,

(iv) an expressed need to provide an assured base for the development of domestic processing industries, and

(v) a desire to control the prices for mineral commodities in order to reduce the harmful impact of cyclical volatility in commodity markets.

The effectiveness and potential success of such actions of non-market intervention, however, depends on several factors. The cartel can only be successful if:

(i) its members control a significant portion of the export market for the mineral commodity,

(ii) cartel members control a significant portion of the production capacity and/or reserves,

(iii) the ability of individual cartel members to:

(a) forgo export earnings and the internal economic impact of decreased production, and

(b) to withstand and overcome the impact of possible retaliatory action by consumer countries individually or in oligopsony,

(iv) the sharing of strongly held and cohesive economic and/or political objectives by members of the cartel,

(v) the exported mineral commodity would have to be one for which the demand is relatively unresponsive to price changes, and for which

(vi) substitution of alternative products is not too readily available, and

(vii) alternative sources are not too readily available.

Certainly, importing countries have some vulnerability in their varying degrees of dependence on imports of particular minerals from the Republic (see Table 3). However, the conjunction of situations favourable to major cartel action is not generally considered to exist beyond the case of petroleum. When one considers the list of conditions which are required for favourable cartel action, the immediate reaction is that the political diversity between the R.S.A. and other major producers of critical raw materials, specifically the Soviet Union, precludes cooperative action. A conclusion of this nature, however, totally ignores the economic dimension. Moreover, it fails to give credit to either the Russians or the South Africans for being astute marketeers of mineral commodities, the classic example of which had been gold. Cooperative market action does not only follow from formalized cartels. In fact the theoretical market structure for all mineral commodities is the monopolistic competition.

Be that as it may, the fact is that it is just as important for South African mine developers to have assured markets for their commodities, as it is for the importers of our minerals to have assured supplies. A secure supply of minerals, especially the continued availability of these minerals, is the lifeblood of any modern industrialized economy. South Africa's comparative advantage in World trade rests in large part on this country's natural wealth, and our standard of living depends on our ability to find exports to pay for our essential imports of both consumer goods and machinery and equipment (see Table 4 for an overview of the mining sector's contribution to the Gross Domestic Product. A possible reduction in mineral exports could be viewed with relative equanimity *if* an increase in other international earnings was readily available to offset the loss. However, there is no evidence that agriculture, manufacturing or the service industries are capable of the vast expansion in foreign markets that would be necessary to redress the balance (Table 5 and Figure 1 presents a comparison of sectoral contributions for selected years).

In 1943, Lovering noted that:

> *"the concentrated value of gold, diamonds, and other minerals has stimulated exploration; their exploitation has led to commerce and power, their exhaustion to national decline and poverty. Mineral production has been instrumental in determining the course of history many times in the past and promises to be of increasing importance in the future".*

However, Clawson (1964) wrote in contrast:

> *"We doubt if anyone will assert that natural resources alone, no matter how high their quality or how large their quantity, are sufficient for rapid economic growth".*

Issues related to the strategic importance of South Africa's minerals which have been much publicized are: (i) stockpiling programmes by major industrial countries, and (ii) the imposition of a total embargo on the R.S.A. These issues are to a large degree inter-related. The type of stockpiling referred to here, should be considered to be a politically motivated programme in contrast to "economic stockpiling", as suggested by the World Bank and Third World commodity producer countries, which would be an attempt to stabilize the markets for mineral raw materials and ensure the developing country producer a relatively high and stable price and foreign exchange earning.

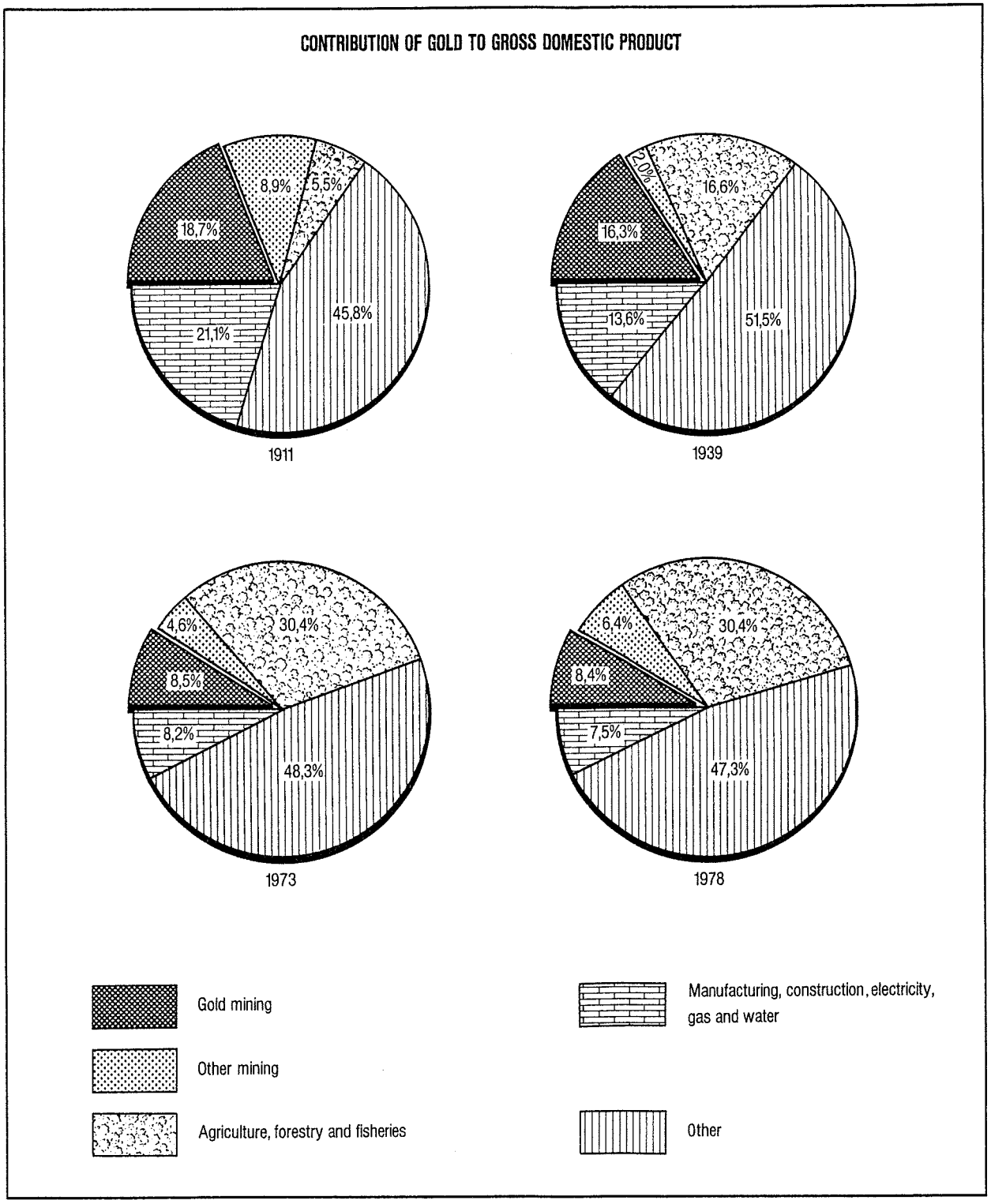

Figure 1 : *Contribution of gold to South Africa's gross domestic product for the years 1911, 1939, 1973 and 1978.*
Source : *South African Yearbook, Van Wyk (1979).*

The "political stockpile" decision is a function of potential lack of stability or disruption in supply of a critical raw material, as perceived by the consuming industrialized country. Specifically, the decision of the U.S.A., Britain, France and West-Germany to stockpile minerals imported from South Africa, will to some extent be influenced by a "political risk" factor which the importing country may or may not believe exists in the R.S.A. The greater the perceived risk the more likely the country is to stockpile and the larger the stockpiling programme is likely to be . The stockpiling programme will amongst other things, be a function of the import dependence of a particular economy and the order of the expected cost to the economy in the event of supply disruptions.

TABLE 3

IMPORT DEPENDENCY OF THE INDUSTRIALIZED WESTERN WORLD COUNTRIES ON SOUTH AFRICAN MINERAL SUPPLIES

Percentage of each countries total mineral imports supplied directly by South Africa in 1978

COMMODITY	JAPAN	UNITED STATES	UNITED KINGDOM	W. GERMANY	FRANCE	ITALY	E.E.C.
ANDALUSITE GROUP MINERALS	71	∿90	65	15	-	32	N/A
ANTIMONY	-	6	∿90	15	7	-	10
ASBESTOS	34	4	18	12	8	49	12
CHROME ORE	52	48	79	66	24	23	50
COAL	30	49	<1	19	37	16	23
COPPER	9	-	6	10	-	3	7
DIAMONDS	7	52	N/A	26	3	7	N/A
FERROCHROME	71	79	18	54	37	33	49
FERROMANGANESE	-	45	46	4	-	18	25
FLUORSPAR	27	23	-	12	-	-	7
GOLD	-	-	66	5	16	59	56
IRON ORE	5	-	10	8	7	7	6
MANGANESE ORE	35	4	46	73	41	53	45
MANGANESE METAL	-	31	74	52	54	73	78
NICKEL	18	4	-	17	14	23	7
PLATINUM GROUP METALS	28	55	58	9	17	52	28
VANADIUM	90	87	-	6	20	-	25
ZINC	-	4	-	9	-	-	3
ZIRCONIUM	7	1	7	16	2	<1	4

Source : Minerals Bureau, South Africa

Any disruption in the supply of a critical raw material will impose an economic cost on the industrialized economy. To reduce their import dependence, and concomitantly the economic cost associated with supply disruptions, the importing countries may administer any combination of the following measures:

(i) Government financed and controlled stockpiling programmes of critical minerals,

(ii) subsidization to encourage domestic productive capacity, assuming the raw material is available internally,

(iii) subsidization of the development of domestically available, but unconventional, sources of a specific commodity,

(iv) financing research and development of alternative and less costly technologies,

(v) imposition of tariff and non-tariff barriers to imports, in order to encourage internal production of similar products or substitutes,

(vi) allocation of quotas on imports to reduce dependence and on exports to curtail exploitation of potentially critical raw materials, and

(vii) negotiate bi-lateral or multi-lateral supply agreements to ensure continued availability. This measure is an attempt to develop alternate sources of supply of the same commodity, not to be confused with substitution (i.e. of one commodity for another).

To stockpile, is but one measure available to a country in its attempt to reduce its import dependence and therefore the economic cost associated with supply disruptions. In any event, the decision to stockpile is one that is subject to constant revision, as circumstances dictate. The extent to which a Government is prepared to expend taxpayers' money, which expenditure will certainly curtail the availability of funds for more "social" projects, will provide an indication of:

(a) the vulnerability of the individual economy to supply disruptions, and

(b) the probability (albeit subjective) of disruption. Stated differently, the degree of instability ascribed to a particular source or supplier of the commodity,

(c) the degree of instability associated with alternative sources of supply of the particular commodity,

(d) the state of the economy of the importing country at the time of decision making i.e. Government funding ought to be more readily available during economic boom than would be the case during economic recession,

(e) the importance associated with a particular Government and country's desire to intervene politically, into South Africa's domestic affairs (e.g. it is to be expected, at least theoretically, that the disposition towards South Africa of a Communist Regime in France will be substantially different from that of the present Government).

TABLE 4

CONTRIBUTION OF THE MINING SECTOR TO G.D.P.

R MILLION (AT CURRENT PRICES)

YEAR	GDP	MINING	%
1970	11949	1207	10,10
1971	13190	1164	8,82
1972	15023	1513	10,07
1973	18678	2244	12,01
1974	23055	3068	13,31
1975	25731	3050	11,85
1976	29143	3297	11,31
1977	32728	4015	12,27
1978	37222	5598	15,04
1979	44575	8067	18,10

CONTRIBUTION OF THE MINING SECTOR TO G.D.P.

R MILLION (AT CONSTANT 1970 PRICES)

YEAR	GDP	MINING	%
1970	11949	1207	10,10
1971	12543	1170	9,33
1972	12929	1116	8,63
1973	13505	1161	8,60
1974	14614	1150	7,87
1975	14983	1123	7,50
1976	15214	1162	7,64
1977	15221	1249	8,21
1978	15571	1260	8,09
1979	16147	1331	8,24

Source : Calculated from the South African Reserve Bank Quarterly Statistical Bulletin.

It is a fact that the measures (i) to (vii) on Page 7, if imposed, represent a direct cost to the particular country's economy. Each measure, will, to a greater or lesser extent, exert demands on the particular economy and its available factors of production. The order of this demand (cost) will be a function of the scarcity and rarity of the mineral commodity concerned.

Certain Governments of industrialized countries, have for some time given attention to direct investment of Government funds to alleviate their perceived vulnerability (individually and collectively), and their dependence on external sources of mineral raw material supplies in general, and dependence on South Africa in particular. However, these attempts, half-hearted

SECTORAL SHARES OF THE G.D.P.

	1920 %	1925 %	1930 %	1935 %	1940 %	1946-50 %	1951-55 %	1956-60 %
Agriculture	21,7	20,2	14,0	13,7	12,1	15,8	16,5	13,3
Mining	19,4	16,0	17,2	19,5	20,6	18,0	12,0	13,3
Manufacturing	7,1	7,7	9,2	10,7	11,6	18,0	20,1	20,3
Other	51,8	56,1	59,6	56,1	55,7	45,4	48,6	46,9
TOTALS	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0

Source : South African Yearbook, Van Wyk (1979)

at best, have had limited success to date. This was succinctly summarized by J. Santini (1980) when he noted:

> *"The (United States) Government's record in responding to this mineral crisis has been nothing short of dismal ---- after 3 years and $3.3 billion ---- the matter of U.S. vulnerability (remains) unaddressed".*

Given that the United States of America's attempt to decrease its mineral raw material supply vulnerability is superior to that of any other industrialized country, it is reasonable to infer, that to maintain normal trade relations with the Republic of South Africa, as a proven reliable and stable supplier of mineral raw materials, continues to be the least costly (economically speaking) alternative for the mineral importing industrialized countries.

The potential economic cost for an individual minerals raw material importing country, associated with a disruption in supply of critical minerals, can be summarized as follows:

(i) increased prices for imports, assuming these imports are readily available. The order of the expected increase in price will be a function of the scarcity (alternatively the non-availability) of the mineral raw material. Higher prices for imports represents a net transfer of factors of production from the importing country to the alternative foreign source. The negative impact on balance of payments is only the most obvious, and

(ii) higher cost of domestic production of the raw material or substitute, be it conventional or unconventional exploitation. In the event of an expansion of domestic production capacity (assuming resource availability), it is most likely that the unit cost of the commodity will increase substantially. Producers will accordingly obtain a non-market incentive to develop deposits, which deposits were previously uneconomical. The resulting distortions in the allocation of factors of production is an additional cost that will vary from one case to another.

(iii) consumer costs

(a) utilization of substitutes - usually at increased costs,

(b) costs associated with alternative technologies, previously considered to be uneconomic, and

(c) costs associated with enforced savings or cut-backs in consumption or totally abstaining from consumption,

(iv) costs associated with the type and magnitude of a measure. This cost may be identified as an insurance payment i.e. it will be incurred whether the supply disruption occurs or not. In the case of stockpiling for example, it constitutes

(a) the purchase cost of the commodity,

(b) the storage cost associated with the stockpiled material,

(c) the administrative cost,

(d) the distribution costs in the event of a disruption and utilization of the stockpiled material, and

(e) the opportunity cost associated with the investment,

(v) the re-distribution of income amongst consumer, producer and government. Even though this potential cost element, considered from a welfare economics perspective, may be quantified with difficulty, it should not be underestimated or ignored.

The conclusion follows that the order of the expected cost to a particular country's economy will in turn provide indication of that country's willingness to impose a total trade embargo on the Republic of South Africa or its willingness to veto such a resolution at the United Nations.

Whatever the view, it cannot be ignored that it is equally important to both consumer and producer of mineral raw materials, to maintain healthy trade relations and to prevent any non-market intervention in the market. There is little doubt that such intervention, particularly the politically inspired variety, would prove to be an economically costly exercise. This cost will in all probability exceed the expected benefits to be derived from intervention.

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