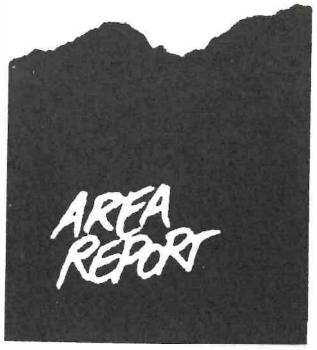


# The debate over strategic mineral vulnerability: implications for Canada

*By David G Haglund*

**Canada is a major producer of a number of minerals that are of critical importance to the industrialized countries. David G Haglund examines how this has affected and will influence Canadian production and export of non-fuel minerals. He also analyzes the concept of "vulnerability", which is of central relevance for any understanding of strategic-minerals questions.**

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## Introduction

Concern for some aspect of their strategic-mineral supply has been an intermittent worry of the industrialized states for much of this century. The purpose of this paper will be to assess the likely implications for Canada of the current wave of uneasiness regarding strategic minerals, especially in respect of the possibility that such worry might get translated into policies on the part of Canada's trading partners that might have an impact, positive or otherwise, on Canadian mineral production. Although Canada itself does have significant *import* interests that are not substantially different from those of other developed countries, it is primarily the export side of Canadian strategic-mineral developments that will merit attention in these pages. On the one hand, it may be that Canadian mineral supply might come to take on a "political value added" due to the perception of Canada as a stable, reliable source of supply in world marked by increased instability and chaos.[1] On the other hand, it is possible that in some instances Canada might be adversely affected should nervous consumers, above all the United States, begin to adopt mineral-sourcing strategies that, inadvertently, redound to the detriment of Canadian export interests: among the most widely discussed possibilities in this context, of course, has been the seabed-mining question, but as we shall see, other "vulnerability-reducing" options potentially open to the US and fellow OECD members could have a backlash on Canada.

## The contemporary meaning and nature of vulnerability

Because of its relevance to any basic understanding of strategic-minerals questions, the concept of "vulnerability" warrants a brief discussion here. It is a staple of minerals analysis to regard vulnerability as being qualitatively different from the far less serious condition we call "dependence". To treat the two synonymously is not only fallacious; it is counterproductive, if what one intends to do is contribute to rational policy debate. Few would quarrel with the above conclusion. Indeed, Bruce Russett has recently summed up the major reasons for not letting a concern about import-dependence boil over into a conclusion that only forcible access will provide guarantees for the continued provision of raw-material supply; and in his argument (to which I shall presently return) he draws upon the well-discussed distinction, developed by Robert Keohane and Joseph Nye, between "sensitivity" and "vulnerability" interdependence.[2] However laudable, not to say vital, is Russett's declared objective of attaining rigor in policy analysis, it is far from easy to achieve conceptual clarity, even in regard to such highly important terms as dependence and vulnerability. Take for example the Keohane/Nye distinction: if the differentiation is to have any use whatsoever, it is precisely because it permits us to gauge the relative efficacy of measures designed reduce the adverse costs imposed from without that we associate with the negative aspects of interdependence. As the authors phrase it,

> "in terms of the costs of dependence, sensivity means liability to costly effects imposed from outside before policies are altered to try to change the situation. Vulnerability can be defined as an actor's liability to suffer costs imposed by external events even after policies have been altered." [3]

The problem with the terminology available to the mineral-analysis community is not, as is sometimes argued, that interdependence cannot logically mean anything other than vulnerability interdependence, although those who make such claims (for instance David Baldwin or Kenneth Waltz) are not without support for their argu-

ments.[4] The problem is rather that vulnerability has commonly come to be used in a way that denudes it of the static qualities that apparently give it the meaning it is supposed to have, if, to repeat, it is to be distinguished from dependence. States, according to this view, are truly only vulnerable if they lack policy options that can mitigate the costly effects of their dependence upon other states; if they have such options, they are at worst sensitive to the imposition of short-term costs generated beyond their borders, by forces over which, for the moment, they have little control.

One logical implication, then, of a strict interpretation of vulnerability along the lines of, say, Keohane and Nye, is that it becomes almost a contradiction in terms to speak of strategies for reducing or mitigating vulnerability; for as we have seen, the truly vulnerable are precisely those luckless states that suffer what they must at the hands of countries and forces more powerful than they. It quickly becomes clear what is wrong, for the purposes of minerals analysis, with such a construe: in attempting to render more flexible our language, so as to answer the very compelling need for concepts that will enable us, as Bruce Russett and others argue, to make the kinds of distinctions we need between one's levels of imports — in and of themselves suggestive of nothing necessarily more noteworthy than convenience — and one's inability to achieve any freedom of maneuver vis-à-vis international minerals markets, we run the risk of impoverishing our vocabulary. Ironically, though we take notice of those authors, such as Baldwin or Waltz, who would have us discard the notion that there could be something labeled "sensitivity interdependence",[5] we might rather pay some heed to a call for the abolition of the concept "vulnerability interdependence", for insofar as raw-material supply is concerned, the reality is how *little* most industrialized states really are at the mercy of minerals forces beyond their control. We are all, it seems, able to avoid the pains of genuine vulnerability, at least when it comes to our mineral imports, though as we shall see below, this is not a universally accepted contention.

Why, then, is such frequent resort made to the notion of vulnerability in attempting to describe and explain contemporary minerals postures and policies of so many Western consuming countries?[6] The short answer is that it seems to be necessary, and nothing better has suggested itself than this somewhat misleading term. And this is so because such heavy use is made of that other term, "dependence", when referring to the *net import reliance* of any given country.[7] All this is more than a little reminiscent of the famous Abbott and Costello skit, "Who's on First?", for what we have been engaged in is a confusing series of conceptual displacements, a linguistic Gresham's law, with perfectly good terminology being bumped aside by newer, but imperfect, usages. Consider the reasonably cogent attempt made several years ago by James Caporaso to draw a line between dependence and dependency: while the latter term was held to connote nothing so much as the "absence of actor autonomy", the former was considered to be subject to structural specification. What Caporaso's analysis showed him was that import dependence involved a combination of the following characteristics: essentiality of the good in question; concentration of its supply; and the substitution, conservation, or diversification options available to the consumer of the good.[8]

Now compare this set of conditions with that drawn up by two prominent minerals economists, Hans Landsberg and John Tilton, who take pains to develop a sharp differentiation between import dependence and vulnerability. It may be, they argue, that the former is a necessary condition of the latter; but it is not a sufficient one. Among other factors relevant to a determination of vulnerability are: the identity of exporters; the diversification prospects of importers; domestic production possibilities; opportunities for substitution and conservation; the essentiality of the imported commodity; and the presence of stockpiles.[9] Though their index contains a few more items than Caporaso's, it is apparent that what the two economists mean when they employ the term vulnerability is nothing other than what the political scientist intends by the world dependence.

As a political scientist who has a tolerable respect for the sharp edge of Ockham's razor, it might seem odd that I am advocating employing the economists' category of vulnerability. I do so as a concession to practice; for the reality is that, to the majority of minerals analysts, vulnerability has become since the mid 1970s a virtually irreplaceable concept; while dependence has come to take on the connotation formerly associated with levels of imports (or, net import reliance). By now such copious reference has been made to the hazards of "import vulnerability", and the need for policies capable of reducing, mitigating, or even eliminating it, that it would be senseless to insist upon the synonymous usage of vulnerability and dependence, at least for the purposes of this essay on minerals. But to make the distinction between dependence and vulnerability is only to take the first step along the path of exploration of potential risk to importing countries' supply. We must now move to an examination of the contemporary nature of vulnerability.

Those who analyze contemporary questions of mineral vulnerability tend to fall into one of two camps: one group argues that to the extent industrialized (and industrializing) states have cause for concern about their future supplies of industrial commodities, it is largely due to *economic* considerations; the other group holds that while economic symptoms may indeed manifest themselves in disturbed minerals

markets, the underlying cause of supply disruption in at least the short-term future will be *political* in nature. I shall address these two competing assessments in turn.

## The economic dimension of vulnerability

The economic interpretation of minerals vulnerability can itself take two forms. There had been, through much of the last decade, uneasiness on the part of some analysts who convinced themselves that the limits to growth were not only apparent, but proximate — and this because of shortages of raw materials in an absolute, physical sense. I have indicated elsewhere what I believed to be erroneous about such a perspective, and shall not repeat myself here.[10] However, there is a more plausible economic argument that does deserve some attention: it takes expression in the fear that future supply of minerals will be jeopardized by a current lack of investment in the global mining sector.

This fear had a fairly wide currency in the OECD countries during the latter part of the previous decade, but has abated in the past few years, due to the combination of recession early in the 1980s and the persistence of glut in most minerals markets down to the present time. The concern that lack of investment might at some future date imperil the West's mineral supply, though founded in part on a bleak reading of recent minerals market trends, also owes its existence to the belief that the less-developed countries (LDCs), in flexing their commodity "muscles" over the past two decades, and above all in proscribing the freedom of maneuver of international mineral-extraction enterprises, have put themselves in the unhappy position of being unable to develop their own resources at levels sufficiently high to sustain anticipated future world demand, yet at the same time are either unwilling or unable to attract the foreign investment they need for resource development. According to this perspective, the LDCs are living off the legacy of past, and efficient, control of their mining sector by the foreign multinational corporations (MNCs). But eventually they will have to conduct their own exploration and development, and the worry is that for a variety of reasons the task will prove too much for them.[11] Thus, according to some writers, the most likely future cause of mineral-supply disruption will be the presumed current lack of investment in prospecting and exploration, something that is aggravated though not caused by the current unfavourable investment climate for minerals in general.[12]

There is reason to dispute the above assumption concerning the ability of LDCs to sustain output in minerals, at least if the recent record of Latin American countries is any indication. In the past decade or so mining enterprises in this part of the Third World — and not, it bears noting, only in those countries disposed to private-sector efforts — show little sign of being unable to generate increased levels of production; to the extent that Latin countries will be able to pick up any slack occasioned by shifts in productive capacity away from Africa, then the region appears in a position to reassume the significance to minerals markets it possessed during the 1930s, when it was a substantial mineral province.[13] Anyone familiar with recent analyses of the supply side of "structural change" in the world mineral industry will be only too aware that the problem with Latin America is hardly one of *under*production.[14]

Caution should also be exercised in concluding that a shift in investment away from LDCs, assuming this still to be an accurate claim, must translate into a loss of investment in the world mining sector. The recent hard times aside, there seems to be little basis to the worry that huge net losses in mineral investment *were* taking place in the 1970s. What seems to have been occurring during the last decade, at least, was a relative displacement of mining investment from the LDCs to such "developed market economies" (DMEs) as Canada, Australia, the Republic of South Africa, and even the United States. Between the start of the 1960s and the middle of the 1970s, for example, the LDC portion of overall mineral-exploration investment experienced a substantial decline in relative terms, falling from 35 per cent of the total for 1961—65 to 14 per cent for 1971—75.[15] Since ore grades tend to be lower in the DMEs than in the LDCs, it is alleged that the shift in mining activity necessarily implies higher-cost production in the future. This assumption can only be sustained if it can be shown that ore grade must always have a determinative bearing on extraction costs, a proposition that some mineral economists find unpersuasive. Whatever the relationship between ore grade and extraction costs, there is, as Phillip Crowson observes, "certainly no clear tendency for costs to be lower in less developed countries".[16]

Some analysts go so far as to suggest that the world has had too much exploration activity in recent years, and that there are now more ore bodies awaiting development than ever before. As the example of nickel demonstrates, fear of future shortage can serve as a powerful stimulus to new exploration efforts, culminating in the expansion of global productive capacity and, ultimately, depressed prices.[17] If the argument that world resources cannot sustain future mineral demand is itself not sustainable, neither, apparently, is the argument that insufficient investment today must redound to the detriment of consuming countries, if for no other reason than that it is not clear there is insufficient investment.[18] It may well turn out that the current optimism about long-term mineral supply will seem as ill-considered a decade from now as the regnant pessimism of the early 1970s appears today.[19] We cannot know. What we can state, however, is that those who ponder the OECD mem-

bers' vulnerability to mineral-supply disruption resort much more to political than to economic explanations.

## The political dimension of vulnerability

The starkest, and to some, most appealing aspect of political vulnerability in world minerals markets takes the form of the "resource-war" hypothesis — an argument that achieved some popularity at the start of the 1980s, but that has been flagging of late. In its heyday, the resource war was widely seen to consist in a two-pronged, and dual-motive, Soviet effort to interfere with the West's supply of essential minerals. Prong one was the oil supply of the Persian Gulf; prong two the hard-rock minerals of southern Africa, a region it became fashionable to regard as the "Persian Gulf" of nonfuel minerals. The motives were as clear as the methods. The first was the crippling of Western military potential, and thus military prowess, by an interdiction of the supply of those minerals most needed by OECD economies. This was argued to be a credible avenue to world supremacy for the Soviets, one that would avoid the perils of a direct military confrontation with the West (although why acts of blatant economic warfare should have been held to be relatively risk-free was never adequately explained by the resource-war theorists).

The second motive — and this was an argument pursued by many who read geopolitical significance into recent short-term shifts in patterns of Soviet mineral trade — was linked to an assumption that raw-material depletion stalked even the mightily endowed Soviet Union, and that faced with scarce supplies of industrial minerals and equally scarce amounts of foreign exchange, the Soviets would simply have to rely on military force to secure access to resources.[20] Though most often invoked to account for Soviet policy in the Persian Gulf, and secondarily in southern Africa, the resource war could and did serve as a handy device for plumbing the materialist depths of other aspects of Soviet foreign policy, such as the invasion of Afghanistan.[21]

Although scarcely credible today, statements such as the following had a surface plausibility at the start of this decade:

> "The United States and its Free World allies are in an undeclared and, so far, bloodless 'resource war' with the Soviet Union — and are in grave danger of losing that war." [22]

The situation being parlous, called for quick action, and among the necessary corrective measures were an arms build-up (especially the expansion of the US Navy, so vitally needed to guard far-flung "sea lines of communications", or SLOCs as they came to be called); the abandonment of détente, the sooner the better; and the construction of a newer and closer relationship with the Republic of South Africa, heralded by many resource warriors as constituting nothing less than the bulwark of the material base of Western civilization.

> "If South Africa is lost to the West", warned one proponent of the resource war, "the next step aimed at achieving the Soviet goal of global domination could be a disruption of oil supplies to the West, attempts at Marxist take-overs in Chile, Peru, and Brazil, and the promotion of labour unrest through Communist-dominated labour unions in Australia." [23]

Seldom has the right assimilated more throughly the teachings of left-wing foreign-policy analysts than during the height of the resource war. What Lenin had instructed an earlier generation of students of foreign-policy behaviour, and what more recent "radical revisionist" analysts such as Harry Magdoff and Michael Tanzer have reiterated — namely that capitalist economies were impelled toward imperialism and globalism in some important measure because of their need to secure access to raw materials — was now being trumpeted, *mutatis mutandis,* by conservative exponents of the resource war.[24] Lose access to vital industrial minerals, they cautioned, and the West will lose economic and ultimately military power vis-à-vis the Soviet Union, just as certainly as if it had been bested in military struggle.

Ordinarily, one would not be terribly surprised to encounter diminishing audiences for economic determinism of the sort displayed by the resource-war theorists. After all, Marxian and other radical revisionists have not had an easy time gaining widespread acceptance in US foreign-policy circles. But while the policy relevance of radical revisionism might today remain minimal, what *is* surprising when one contemplates the fate of the resource-war perspective is that it foundered in seas decidely calmer, from an ideological point of view, than those in which radical theoretical vessels have come to ruin. How is one to account for this?

In some measure, the recent tribulations of the resource-war theorists have been related, curiously, to the above-mentioned ideological congeniality. One of the most important, if maddening, questions confronted by those who try to understand and explain foreign policy is the relative power of "ideology" versus "interests" as motivating forces in statecraft.[25] I will not attempt to resolve the conundrum here, for it strikes me as the sort of puzzle that will generate confusion for some time to come, but I do introduce it to make a point: that the opponents of détente seized upon the presumed (and presumably justifiable) need to defend material interests as a primary explanation for and focus of their extreme disquiet with détente. Although no doubt some true believers among the resource-war school probably did ground their opposition to détente entirely or largely in terms of an

assessment of American material interests, it is difficult to escape the conclusion that for many resource-warriors of the late 1970s the spectre of raw-material conflict was a heaven-sent way of demonstrating the folly of what they took to be a misguided, immoral, and ideologically unsound policy toward the USSR.

The linkage to an ideological aversion to détente and a heightened concern for American mineral supply was initially made in the mid 1970s, following the decade's first oil shock.[26] It was not long before disturbing parallels were being drawn between US setbacks in the Persian Gulf and Soviet/Cuban gains in southern Africa; and after Congress rebuffed the Ford administration's attempt to arrange military assistance for the FNLA and UNITA, on the basis of there being no "vital" US interests at stake in Angola, anti-détente advocacy quickly became embedded in an interest-based calculation of risk and gain. With the Vietnam experience so recent, it is hardly surprising that this should have been the case.

Another factor that has contributed to the reduced plausibility of the resource-war hypothesis is the relaxation of concern in the West about mineral supply — a relaxation that has in the past few months, however, itself begun to dissolve. During the latter part of the 1970s and throughout 1980, many analysts in the West were making dire forcasts indeed about future access to strategic minerals, oil in particular, but certain nonfuel minerals as well. For crude oil, the Iranian revolution seemed to portend such a grim energy future for import-dependent Western countries that well-respected energy experts such as Walter J Levy could and did foresee

> "a series of future emergencies centering around world oil (that) will set back world progress for many, many years. And the world, as we know it now, will probably not be able to maintain its cohesion, nor be able to provide for the continued economic progress of its people against the onslaught of future oil shocks — with all that this might imply for the political stability of the West, its free institutions, and its internal and external security." [27]

Given the apparent sharpening of a nonfuel mineral "crisis" at roughly the same time as the world oil situation was threatening to turn critical again, it seemed only logical to assume that nonfuel strategic minerals shared attributes that in the early 1970s had been associated primarily with oil: essentiality, as well as grave uncertainty as to future supply and price. For nonfuel minerals, an event that was the near-equivalent of the Iranian revolution took place in the summer of 1978 — the Katangan rebel attacks near Kolwezi.[28] This disrupted copper and cobalt production in Zaire for two months and set off a panic in cobalt markets, which resulted in a greater than 700-per cent increase in the spot-market price for cobalt, from 6.75 USD a pound to 50 USD a pound.[29] Principally as a result of the Kolwezi (or "Shaba II") incident, analysts in the United States and other dependent Western countries began to reach hasty conclusions that their countries' dependence on nonfuel minerals was as important — and troubling — as their dependence on imported oil. Indeed, in the United States some claimed that dependence in nonfuel minerals was an even graver problem than dependence in oil; for the United States, it was held, might conceivably regain self-sufficienty in oil but "in many cases there are no substitutes for the (nonfuel) minerals imported from foreign sources, countries which are often unstable at best, hostile at worst." [30]

Those who equated nonfuel mineral dependence with oil dependence failed to pay proper heed to the tremendous differences in magnitude between the former and the latter. In the case of the United States during the time of the cobalt panic, net imports of nonfuel minerals were amounting to not quite 3 G USD, as compared with net energy (mostly oil) imports of nearly 75 G USD. Internationally, aggregate exports of metallic ores, concentrates, and scrap were accounting for slightly more than 1 per cent of total world exports, contrasted with a 20-per cent share for fuel exports.[31] It is generally accepted that one of the characteristics of strategic minerals is that they be essential to economic well-being.[32] By this gauge, it is clear that, in value terms, oil is vastly more essential than all the nonfuel minerals put together. Given the diminution of anxiety about oil-supply of the past few years, it is hardly surprising that there should have been a concomitant lessening — until the upsurge in violence in South Africa — of concern about oil's "analogue", the nonfuel minerals. One of the positive aspects of the recession of the early 1980s, at least from the standpoint of the consuming countries, was that in relieved pressure (and worry) in respect of their access to minerals; for not since the Depression of the 1930s had most minerals been so abundant and, in real terms, so cheap.

Some additional considerations must be adduced to explain the recent lack of receptivity encountered by the resource-war advocacy. The first relates to the changing perception of LDC commodity power. It is apparent, from the coign of vantage of the late 1980s, that nervous analysts such as C Fred Bergsten greatly overestimated the influence effect of "poor power" during the early part of the 1970s.[33] Though it might be thought that such alarmist prognosticators were in the distinct minority, the opposite appears closer to the truth: where a vigorous OPEC once inspired tremulous visions of future developments in world mineral markets, today the wave of the future seems to be the hapless International Tin Agreement.[34] The world, it seems, has become a buyers' market, with a vengeance, and

this altered marketing context has not provided fertile soil for the resource-war advocacy.

Further contributing to the woes of the resource warriors has been the rather successful effort made on the part of numerous Sovietologists to debunk their alarmist scenario of a Soviet economic offensive. Now, it may well be that in the Alice-in-Wonderland domain that is the precinct of Kremlinologists, ordinary canons of empirical scholarship should never be invoked; nevertheless, until it can be demonstrated persuasively why we should abandon a critical insistence upon at least some confirming evidence of theses, we are perhaps well-advised to observe what Robert Legvold told a US Congressional subcommittee five years ago:

> "simply no evidence exists suggesting that Soviet leaders think in terms of strangling the West by denying it strategic nonfuel minerals in peacetime." [35]

Although not in itself proof of anything, such a statement does reflect the position of the academy, and seems to be consistent with the mineral-policy community in Western Europe, where the resource war never was taken very seriously — not even in NATO headquarters, where one might have expected at least a glimmer of interest in such an hypothesis.[36]

But if it cannot be shown that the Soviet Union is embarked upon a conscious effort to deny Western industrial societies access to raw materials, it should not be concluded that it has no interest in world mineral markets. The Soviet Union has been and remains a leading mineral producer, one that derives a substantial proportion of its foreign exchange from mineral exports.[37] Though one of the most self-sufficient countries, it is also a significant importer of certain minerals, notably barite, bauxite and alumina, bismuth, cobalt, fluorspar, tin, and tungsten.[38] To some observers, the Soviets are entering a "transitional period", in which they move from a position of self-sufficiency to one of increasing import dependence, with the implication being that they will be providing stiffer competition to Western countries for scarce raw materials. Not surprisingly, this possibility has been heralded as an imminent probability by resource-war analysts, who hoped to demonstrate that the Soviets would seek abroad what they could no longer produce at home.[39] Those who prefer an alternative explanation for recent surges in Soviet imports argue that price differentials and not depletion have been responsible for Soviet purchases in world markets, where commodities can often be had for a price less expensive than the cost of domestic production.

Whatever the reasoning behind Soviet mineral-import policy, overall Soviet mineral planning continues to envision maximum feasible self-sufficiency, and the USSR remains one of the few countries capable of having and realizing such a policy objective. But whether they will "need" foreign minerals more in the future than they have in the past, the Soviets can be expected to try to avail themselves of opportunities to further their economic and political interests wherever possible, including the sensitive southern African region, the focus of so much minerals anxiety since the late 1970s. It is conceivable, maybe likely, that Soviet foreign policy interests of a non-mineral nature will have an impact on mineral developments in southern Africa and elsewhere, but this hardly constitutes a basis for assuming that the USSR has launched a resource war: to infer from Soviet activity in Africa the existence of a resource-denial strategy is to commit the fallacy of mistaking correlation and consequence for motivation and cause.

This brings me to the final point worth making in connection with the demise of the resource-war thesis, and also leads into an assessment of the most likely contemporary cause of supply disruption. I refer, of course, to the current situation in South Africa. Outside of the Republic of South Africa itself, the resource-war hypothesis in its fullest bloom never got anywhere the reception that it got in some circles in the United States, where it was disseminated by important foreign-policy lobbies such as the Committee on the Present Danger and other conservative groups.[40] It was even a theme in the 1980 campaign speeches of presidential candidate Ronald Reagan, as well as others associated with the Republican campaign. One such person was Alexander Haig Jr, who dramatically announced to a House subcommittee in September 1980 that "the era of the 'resource war' has arrived."[41]

During this earlier period, it was common for resource warriors to speak of *southern* Africa as the problematical region, one that in many ways was similar to the Persian Gulf, in the sense of being both mineral-rich and politically volatile; it was what geopoliticians would refer to as a classic "gray area" in international politics.[42] During the cobalt scare of the late 1970s, it was Zaire that occasioned the most discomfort among minerals analysts; but the discomfort was mitigated somewhat, for the resource warriors at least, by the solace of knowing that the root "cause" of the West's cobalt difficulties was, ultimately, the source of all that was wrong with the world, namely the Soviet Union (abetted by its Cuban ally). Today, in the case of South Africa, we lack the certitude of having a nefarious and clearly identifiable foe at hand, and this has worked to the detriment of the resource-war advocacy.

It has worked to its detriment precisely because the moral dimension of the current struggle to dismantle the apartheid regime must make any government — including and especially those headed by Ronald Reagan and Margaret Thatcher — draw back from what, just a few years ago, was a logical implication of the resource-war argument. A

half-dozen or so years ago, it was not uncommon to encounter pleas for the preservation of the southern African status quo that were predicated upon frank considerations of material interest: certainly there were many in the Republic of South Africa who focused upon the presumed need of the Western countries for South African minerals as sufficient reason to believe that the West, loathe though it might apartheid, would simply be incapable of doing anything about it. Either support us and our institutions, ran the familiar argument, or bear the material consequences that would attend the destruction of that system, of which you in the West, whether you like it or not, have been the principal beneficaries.[43]

The resource war has not been able to withstand the change in its theatre of operation, for what the shift from the broader southern African context (with its ominous spectres of Soviet/Cuban imperialism) to the narrower South African one has done has been to expose the moral dilemma that confronts states with an interest in protecting their material interests. The odious nature of the current South African regime renders it simply impossible for even its least-hostile Western critics to give so much as the appearance of buttressing the status quo for the sake of mere material interests. Instead of finding its mineral custormers rallying, however grudgingly, behind it in its struggle for survival, Pretoria witnesses its trading partners — sometimes noisily, sometimes not — exploring alternative sources of supply for those raw materials whose production and reserves South Africa dominates. Thus, when president P W Botha publicly reminds Western states how vitally dependent they are, for example, on the Republic's chromite, the effect of that intended. Rather than cow them, such not-so-veiled threats to withhold supply impel Botha's Western critics to continue doing what the more astute among them have in any event been undertaking for some years, namely attempting to reduce their vulnerability to disruption in mineral supply coming from South Africa.

To return to a distinction introduced at the start of this paper, it seems that those resource warriors who imagined that the West must be led into backing South Africa on the basis of mineral considerations committed the analytical error of confusing dependence — even near-total dependence — with vulnerability. There is no reason to dispute the obvious fact that, today, South Africa accounts for an impressive share of world production of certain vital industrial minerals; furthermore, it similarly possesses a significant proportion of global reserves of these same commodities. Taking just the most "problematical" of the strategic nonfuel minerals, it can be seen that South Africa in 1984 produced roughly the following percentage shares of world output of: *chromite,* 32; *manganese,* 13; *platinum group metals* (PGM), 41; and *vanadium,* 40. Not only is South Africa a leading producer of each of these minerals, it also has the following percentage share of world reserves of: *chromite,* 84; *manganese,* 71; *PGM,* 81; and *vanadium,* 47.[44]

Where the resource-war advocacy made its most serious mistake was in substituting an impassioned call for securing access, with all that such a dramatic policy might entail, for a more sober contemplation of the means available to Western states to reduce their collective and individual vulnerability. I shall presently review some of these means, with a special emphasis on their potential implications for Canadian export interests; but before ending this section on the contemporary aspect of vulnerability, I wish to emphasize that Western states do have a legitimate worry about supply disruption in at least a limited range of strategic minerals, economic arguments based on postulations of glut to the contrary notwithstanding. It is not given to any of us to say what the future holds for South Africa. Nevertheless, one can advance some reasoned speculation on the likely causes of mineral-supply disruption associated with the current political turmoil there. In dismissing the resource-war thesis as a credible explanation, I do not wish to imply that there is no potential supply problem that might, with proper policy measures, be remedied, if only in part. To the contrary, it strikes me that a prudent calculation of supply-disruption prospects would rate as eminently possible, if not imminently probable, any of a number of scenarios. Some, for example, concentrate on the effect that sanctions (or counter-sanctions), if rigorously applied, might have on mineral supply.[45] Others, however, foresee disruptions occurring not as a result of such deliberate policy choices as sanctions, but rather as an unintended consequence of heightened socio-politico chaos — chaos that would have the same effect on South African nonfuel-mineral production as turbulence in Iran had on that country's oil production and exports several years ago.

Political risk assessors, in their more candid moments, will confess that theirs is an exceedingly aleatory business. It is true, as one text explains, that "comparison of policies' economic benefits and costs is a critical element in policy-making". However, this same book goes on to note that invariably, "measurement of these costs rests heavily on a subjective appraisal of risk and on judgments as to how heavily should weigh possible effects."[46] Henrik Ibsen expressed part of the risk assessor's dilemma when in *Hedda Gabler* he had one of his characters. Tesman, observe "we know nothing of the future". To this another character, Lovborg, replied: "No, but there is a thing or two to be said about it all the same".[47]

The "science" of political risk assessment, it is commonly conceded, has limited predictive power. One cannot

reasonably demand or realistically expect precise statements about the unknowable — namely, the prospects for future interruptions in the supply of strategic minerals currently being produced in South Africa. This does not amount to an abandonment of any and all attempts to forecast probable developments affecting international minerals markets; it is simply to acknowledge the reality that all such attempts run the risk of verging upon "vulgar" empiricism. Econometric forecasting, which can give the superficial appearance of predictive prowess, can say nothing at all about the economic consequences of difficult-to-foresee political factors. The most that one can expect from political forecasting is that it proceed on the basis of reasoned, or reasonable, conjecture.

In the matter of the resource war, I argued that the conjecture was neither reasoned very well nor very reasonable. The same charge should not be levelled against assessments of risks associated with the current unrest in South Africa, and for that matter, other parts of the southern African region. There is, in both the Republic and the region, enough evidence of recent political turmoil to presage further instability. If South Africa possessed few or no minerals, then the raw-material implications of its political upheaval would be nugatory. But South Africa is not Northern Ireland or Lebanon, and until the West is able to mitigate its vulnerability to supply disruptions associated with South Africa, then it will come as a surprise to no one that, for the last part of the 1980s and perhaps into the next decade, analysis of contemporary issues in strategic minerals will largely take the form of thinking about tha future of South Africa.

South Africa represents far from the first episode of politically induced strategic-mineral concern in the West; it is unlikely to be the last. In the geopolitics of minerals, the only thing that seems constant is the axiom, "Gray areas come, and gray areas go". But South Africa does constitute the "crisis" of the moment. Let us, then, examine the potential implications for Canadian export interests in nonfuel minerals, in the increasingly likely event that Western consuming states continue their attempt to reduce their vulnerability in respect of South African minerals.

## The reduction of vulnerability and its implications for Canadian export interests

There are several options open to consuming countries seeking to mitigate their vulnerability to disruptions in the supply of their imported strategic minerals. Five categories might be cited as encapsulating the range of options available to importers in the contemporary period of concern over minerals sourced from South or southern Africa:

- stockpiling;
- import diversification;
- increased domestic production;
- substitution; and
- conservation.

In the pages below, I probe the degree to which this range of choice could present both challenges and opportunities to Canadian mineral production and exports.

As a major mineral exporter — and the world's leading exporter of nonfuel minerals — Canada stands to be affected by vulnerability-reducing strategies adopted by Western consuming states. More than 10 per cent of the Canadian GNP is accounted for by mineral production (including fuels), which in 1985 totalled 45 G CAD. Of this amount, some two-thirds was sold abroad, reflecting the country's high propensity to export. In 1985, more than 25 per cent of Canadian merchandise-trade exports consisted of crude and fabricated nonfuel minerals. The United States takes the lion's share of Canada's mineral exports, and was the market for 73 per cent in 1985. That same year, Japan absorbed 8 per cent, the EEC (excluding Britain) 5 per cent, and Britain 3 per cent of Canadian mineral exports.[48]

In a world where politically induced disruption worries seem to be on the increase, Canada would appear to rank as a most reliable source of supply. The problems associated with mineral development in much of the world seem to be pleasantly absent from Canada: in particular, there is no impending political upheaval to curtail mineral production and exportation, and foreign investors, despite some infrequent grumbling, really are offered as hospitable an environment in which to carry on development as they are likely to find anywhere else. Nor is the changed political climate merely a function of the priorities of the Progressive Conservative government that came to power in September 1984; Canadian mineral policy has undergone a minor revolution in the past decade, in recognition — albeit somewhat belated recognition — of shifting international realities in the domain of minerals.

But old memories have a way of lingering; and what is striking is that, though the assumption of Canadian reliability as a source of supply contains much more truth than myth, there remains a group of minerals analysts who are somewhat dubious of the wisdom of becoming more dependent upon Canadian mineral supply. This has been particularly so in the case of uranium.[49] But other instances of Canadian "unreliability" continue to surface from time to time, with the effect of casting some doubt upon presumptions that Canadian-sourced minerals must, by dint of their country of origin, have the kind of "political value added" referred to earlier in this paper.

For example, some British commodities experts have expressed skepticism about Canadian dependability, either because of perceived labour militancy or because they retain an outdated belief that Canadian governments — at both the provincial and federal levels — continue to regard the mining industry as a

natural adversary.[50] One such expert reminded me that the only genuine minerals "crisis" Britain has experienced in the entire post-World War II years occurred in 1969: the disruption of Canadian nickel exports resulting from a lengthy strike.[51] Similar reference is made in a recent widely publicized US Congressional report on vulnerability, where the claim is made that

> "of the few significant interruptions in US materials supply in the past 30 — odd years . . . , the most disruptive was probably the loss of nickel from Canada during the 4-month nickel strike in 1969." [52]

Nor was nickel the sole commodity to be identified in this context. Japan sought and achieved a greater diversification of its molybdenum supply as a result of labour unrest at Canadian molybdenum mines in 1979, which retarded production.[53] Sometimes it has been Canadian foreign-policy aims, and not labour militancy, that have stimulated anxiety on the part of Canada's customers; and in this context one thinks of the effect that uranium-export policies had on several European states and Japan during the late 1970s.[54] In some extreme instances, there were even those (expecially in the United States) who came by the end of the 1970s to look upon Canada as an ideologically suspect country, with all that this could entail for those states dependent upon Canadian mineral supply. According to this narrowly held perspective,

> "the developing minerals and energy situation in Canada is such that the reliability of traditionally friendly Canada as a long-term source of strategic minerals for America must be questioned." [55]

To those who adopted this view, Canadian participation in the uranium cartel, and a mooted (by none other than Prime Minister Trudeau himself) formation of a nickel cartel in 1977, provided disturbing evidence of an ominous trend.[56]

Despite the undeniable evidence that not all would or do regard Canada as a quintessentially reliable source of supply, it remains the fact that most minerals analysts do consider Canadian supply to be, if not perfect, nearly as "safe" as domestic supply, which itself can be and often is subject to labour-related disruptions. In respect of the geopolitics of minerals, Canada remains what it has been for some decades: a valued producer and supplier of a range of nonfuel minerals. Thus, to determine whether Canadian export interests can expect to derive benefit from the contemporary vogue of uneasiness over minerals availability requires us to ask whether Canada can realistically be able to step up its output of those minerals whose supply is held to be increasingly problematic. As we have seen, it is primarily those minerals whose productive capacity and reserves are concentrated in South (and, to a lesser degree, southern) Africa that have lately been occasioning the most concern in nonfuel minerals markets. These may or may not be the most "strategic" minerals, but they do tend to elicit the most attention from import-dependent states: chromium, manganese, the platinum group metals (PGM), vanadium, and — though this is less and less a source of consternation — cobalt.

Not all consuming countries have identical lists of minerals they worry about. The United States, for example, regards vanadium as a strategic mineral, but has had no great concern about it, since the country has until the recent woes of both the US steel and uranium-mining sectors, been nearly two-thirds self-sufficient.[57] In addition to those found in the "core group" of problematic commodities, some other minerals are variously cited by consuming countries as being worthy of attention. The Economic Directorate of NATO has isolated the core group as well as the following, in its research on the collective vulnerability of the Alliance: blue asbestos, titanium, columbium/niobium, tantalum, tin, tungsten, and antimony.[58] In its own study of group vulnerability, the European Community has listed the above (minus asbestos, tin, and tungsten) but added phosphate rock, molybdenum, and nickel.[59] At the start of the 1980s France considered itself to have either a "very great" or "great" vulnerability in respect of silver, PGM, industrial diamonds, phosphate, zirconium, titanium, cobalt, vanadium, antimony, copper, manganese, molybdenum, and tungsten.[60]

Britain remains what it has been for some time, import-dependent on a broad range of minerals, but has curiously not been as nervous about its near-total reliance in some minerals upon South Africa as some think it should be, though it did undertake a modest stockpiling effort a few years ago in cobalt, chromium, manganese, and vanadium.[61] On the other hand, part of the Thatcher government's resistance to the imposition of economic sanctions is probably related to the country's substantial dependence upon South African chromium, PGM, and manganese; for although it only conducts 1.2 per cent of its total foreign trade with South Africa, Britain does get nearly 90 per cent of its chromium, 60 per cent of its PGM, and 55 per cent of its manganese from the Republic.[62]

For its part, West Germany had contemplated stockpiling in the wake of the nonfuel-minerals scare of the late 1970s, but abandoned this effort in November 1980. The German stockpile was intended to contain chromium, manganese, cobalt, vanadium, and blue asbestos (crocidilite) — although in the case of the last commodity, it was more than a little curious that blue asbestos was being targetted, in one part of the FRG bureaucracy, for banning (on health grounds) at the very same time that another branch of the government was considering stockpiling it.[63] Germany, like Britain, has a fairly high degree of

dependence upon South Africa in some of the problematic minerals. Its dependence in manganese is about 70 per cent, and in chromium nearly 50 per cent; but in PGM German dependence on South Africa appears to be much lower than is the case for Britain, although one is ill-advised to generalize too much from import statistics, for while Germany does purchase substantial amounts of PGM from the Soviet Union, it also gets a good deal of platinum and palladium *metal* from countries such as Britain and Switzerland, which themselves are large importers of South African PGM.[64]

Japan began to stockpile minerals in the 1970s, more for the purposes of stabilizing commodity prices than because of security-of-supply considerations.[65] But in April 1983 a complicated stockpiling plan was approved by the Japanese government, designed to provide a short-term (60-day) supply buffer for several minerals needed by Japanese industry. The plan calls for the creation of three stockpiles, one operated by the government, one by the private sector, and the third jointly operated by government and business — all of which would be under the general supervision of the *Ministry of International Trade and Industry* (MITI). Among the minerals stockpiled are cobalt, chromium, manganese, molybdenum, nickel, tungsten, and vanadium.[66]

As the above partial survey of problematic minerals reveals, once one departs from the "core group" of strategic minerals, there is a lack of consensus on the importance of the remaining minerals. This lack of consensus might be considered one of the best arguments for a broad construction of the term "strategic minerals". Canada, by virtue of its being the world's largest exporter of nonfuel minerals, becomes according to a broad interpretation the world's pre-eminent supplier of strategic minerals. But how helpful is such a designation in practice, given the current uneasiness about mineral supply engendered by events in South Africa? It would seem not to be very helpful, for the good reason that Canada does not particularly stand out as a supplier of the "core group" of minerals. Indeed, Canada is 100-per cent dependent upon imports for three of the five core-group minerals (manganese, vanadium, and chromium).[67] Indeed, the country's dependent position has led some analysts to suggest that Ottawa might be advised to create a strategic stockpile of its own, an idea that to date has not met with much enthusiasm in either government or industry.[68]

Canada is, however, a non-negligible producer of two of the five minerals in the core group: cobalt and PGM. It is one of the half-dozen largest cobalt producers in the world, and though not in the same category as Zaire, which accounts for more than half of global production, it still furnishes around 6 per cent of world supply.[69] Canada ranks third in world production of PGM, and is responsible for some 6 per cent of world mine output in this group.[70] But both cobalt and PGM are by-products of copper and nickel production in Canada, as indeed they are in the USSR and many other producing countries — though there has been a recent surge of exploration activity in Canada intended to identify deposits that could be worked for their platinum content alone.[71] Barring any major discoveries, it seems unlikely that Canada could dramatically increase its production of either PGM or cobalt in response to supply disruptions in southern Africa, unless of course the marketing prospects for nickel and copper (especially the former) were such as to permit economic expansion of output. And this does not appear probable, given the sluggish markets for each of these commodities.

In theory, it could be argued that a total cut-off of southern African PGM and cobalt supply might cause such dramatic price spikes in either mineral as to make their production profitable as primary products in their own right, with nickel and copper becoming co-products. But if such price spikes were to occur, there would no doubt be both a severe contraction in consumption *and* an increase in production from other countries' currently marginal or subeconomic deposits. The result would then be either a global production share for Canada that is not appreciably different from the present share, or a larger relative share for Canada of a declining global output. In either event, it is difficult to see how Canada could expand greatly its production of PGM or cobalt unless nickel and copper were to serve as the engines of such expansion.

Interestingly, there is probably some potential for Canada to enter production of two of the other core-group minerals: chromium and manganese. Currently mining neither chromium nor manganese (though it did exploit some domestic chromium deposits in the Eastern Townships of Quebec as recently as 1949), Canada has both chromium and manganese deposits — resources that, according to some, might sustain economic production if prices were to rise "significantly".[72] Production prospects are probably greater for chromite than for manganese, and one of the more interesting recent developments with respect to strategic minerals in Canada has been the studies done to determine whether the Bird River Sill, in Manitoba, might be capable of sustaining production. The Manitoba deposits, located in the Bird River and Euclid Lake areas, are the property of Dynamic Mining Exploration Ltd which is not expected to make a decision on whether to go into production for some time to come.[73] Canada's potentially exploitable chromite deposits are not limited to Manitoba; other provinces that have deposits are Quebec, Newfoundland, and Ontario.[74]

Canada has never produced manganese, but it does have some potentially expoitable deposits in Newfoundland, Nova Scotia, New Bruns-

wick, British Columbia, and Quebec. The problem with Canadian manganese is exemplified by Quebec's deposits; these are so far below the minimum cutoff point for economic production that it is unlikely they will be developed in the near future. For example, though the province has deposits grading from 12 to 20 per cent manganese, ore grades currently being exploited by major world producers are in the 38 to 55 per cent range.[75] While it is technically feasible to upgrade the ores in the 12 to 20 per cent range to 30 or 35 per cent manganese content, it is costly.

This last comment serves to indicate that any future Canadian production of either chromite or manganese depends on either technological (or price) developments that will render economic those deposits that are currently subeconomic, *or* some form of government subsidization. It it this last consideration in particular that is worth pondering, given the current mood of uneasiness being expressed about the continued reliability of southern African supply. Can Canada derive any benefit from the current malaise of import-dependent Western states? In particular, given its outsize share of Canadian mineral exports, coupled with its historic attentiveness to the security implications of mineral dependence, is there any reason to suppose that the United States might do as it has done in the past, namely subsidize the development of productive capacity in Canada?[76]

To the extent the United States has had a coherent strategic-mineral policy at all (a point some will debate), it has consisted in maximum reliance upon the principle of least-cost acquisition, preferably from friendly stable countries if the least-cost producers are not domestic, *plus* reliance upon the strategic stockpile and such other government initiatives as the Defense Production Act of 1950 (DPA). It can be said that, in the past, each of these components of policy have had implications for Canadian mineral-production levels, and that these implications have been usually (though not always) positive, in the sense that they have created jobs, generated tax revenues, and earned foreign exchange. In a broader strategic sense, these policies have been instrumental in the development of a "defence industrial base" in minerals that has contributed to the economic and military strength of the NATO alliance.

The high volume of mineral trade between Canada and the United States is well known, and need not require any further elaboration here, although one can overstate the degree of US mineral dependence upon Canada.[77] Less well known are the two policy initiatives that have been developed to try to assure what the workings of interdependence might not be capable of guaranteeing: continued supply of minerals during periods of national emergency or war. The Korean War served as the precipitating factor for both, although stockpiling legislation was on the American books for a few years prior to that war. The DPA was employed by Washington to stimulate, through a variety of mechanisms, both domestic and foreign productive capacity of certain strategic minerals, among the most important of which was nickel. Hundreds of millions of dollars in US government subsidies went in the 1950s to assist Canadian nickel companies — primarily Falconbridge and Sherritt Gordon — in developing capacity.[78]

The Stockpiling Act of 1946 required, as did so much of post-War US security initiatives in other areas, the shock of the Korean War to enter into fairly active use as a policy measure designed to cope with minerals vulnerability. President Eisenhower was particularly concerned that raw-material constraints might seriously hamper American mobilization efforts, and he was never loath to express these concerns in public. As one historian has noted,

> "Press conference questions on the point regularly elicited presidential lectures on the critical importance of foreign manganese, cobalt, tin, and tungsten, in terms both worthy of and gratifying to future New Left critics of American capitalism." [79]

As was the case with the DPA, so it was that with the US stockpiling effort came opportunities for both the expansion of Canadian productive capacity and Canadian exports in minerals; for notwithstanding the existence of the Buy American Act, strategic-stockpiling purchases during the 1950s were largely of foreign (often Canadian) materials. For example, only four of the 64 stockpiled materials came entirely from domestic US sources, and only an additional six had domestic content exceeding 50 per cent.[80] Moreover, for the entire period from the early 1950s to the early 1970s, after which time US nonfuel mineral stockpiling declined dramatically from its peak level of activity, Canada remained one of the relatively few (a dozen or so) leading sources of foreign material destined for the government holdings.[81]

How likely will it be that either, or both, of these US policy levers might again be employed in such a manner as to generate increased sales for Canadian mineral producers? Judging from recent and current trends, not very likely at all, and this for a few reasons. To begin with, there is much uncertainty over whether, in the current mood of fiscal restraint in Washington, the vaunted National Defense Stockpile itself may continue to exist as anything other than a shadow of its current self. A battle is now going on between the administration and some important members of Congress on the future shape of the stockpile: the administration would like to scale the holdings down from the 1986 inventory of 10.1 billion dollars (G USD) (against a declared goal of 16.1 G USD, to less than 700 M USD, and bases its case for

constriction on a study undertaken by the National Security Council between late 1983 and mid 1985.[82] It is impossible to determine which side will emerge from the battle victorious, although it would be unwise to underestimate the ability of Congress to stymie the administration's "modernization" efforts — efforts that appear, to some on Capitol Hill, as attempts to raid the stockpile, and mortgage national security, for the purposes of deficit reduction.[83] One veteran stockpile watcher explained to me,

> "although there is a lot of talk about streamlining the stockpile, you must remember that there is a big difference between planning and reality. Congress is reality." [84]

One thing seems clear, amid all the uncertainty surrounding the stockpile: Canada stands to be affected negatively should the "modernization" take place, while should the status quo continue, there may be at best only occasional, relatively minor, purchases of Canadian minerals for the stockpile in coming years. Unlike the earlier years of stockpiling, since the 1980s there have not been many purchases of Canadian minerals by the US government — in fact, only fairly small amounts of nickel, cobalt, and tantalum have been sourced from Canada.[85] But should the president's proposal ever be enacted, significant quantities of minerals that Canada happens to produce could end up being placed on the market, a prospect that cannot inspire much rejoicing at Inco, Falconbridge, Cominco, and other Canadian companies. Not all of the redundant materials would be dumped on the market at once, but for the Fiscal Year 1987, it might be interesting to note that the administration has proposed to dispose of some 250 M USD worth of materials, among which are the following minerals of significance to Canada: *lead* (5.2 M USD), *nickel* (16 M USD), *cobalt* (9.6 M USD), *PGM* (20.8 M USD), *silver* (43.6 M USD), *tungsten* (6.3 M USD), and *zinc* (31.8 M USD). Over the next five years, the president proposes to sell off 2.5 G USD in "surplus" materials from the stockpile.[86]

One encounters, from time to time, arguments that Western countries should, individually or collectively, involve themselves much more intensively in stockpiling, to the extent of creating what have been termed "economic" or "interruption" stockpiles, at least in a limited range of the most problematical minerals.[87] But as we have seen in our earlier discussion of stockpiling, this option has nowhere been pursued as energetically as in the United States, and lately it appears that even the grand master of stockpiling is losing its appetite for the practice. Although it can be and is persuasively argued that the best time to stockpile is precisely when markets are flat and prices are low, the fiscal reality facing most industrialized countries makes it extremely difficult to justify expensive stock building at a time when stocks seem scarcely needed — let alone justifiable.

Are there other policy options that might achieve for dependent consuming countries some measure of vulnerability reduction? As I indicated at the outset of this concluding section, several non-stockpile options exist, among the most important of which is import diversification. Given the previous discussion of the imputed "political value added" often held to be associated with mineral exports from reasonably safe sources of supply, one would think that Canada has a natural advantage waiting to be exploited. The reality, however, is different, in large measure for reasons already given and relating to Canada's relatively slight prospects for expanding productive capacity in the set of minerals implicated in contemporary discussions of vulnerability. Still, somewhat the same kind of argument could have been made during the Korean War, and of course we have seen that with American subsidization programs, productive capacity was enormously expanded, not only for Canadian (and Cuban) nickel, but also for US tungsten deposits.[88] Given that Canada does have deposits of manganese and chromium, to say nothing of its existing reserves of cobalt and PGM, is there any reason to assume that the US would once again employ the DPA to expand Canadian productive capacity — or create some where none now exists? It does not appear that the DPA will figure in any short-term minerals planning in the United States, except perhaps on a trivial scale. Though the Act itself continues to exist and get extended every few years, it has been fairly dormant for nearly two decades. Once again, the problem is in some measure a financial one. One senior official with the Bureau of Mines explained to me that although the United States would "love" to see chromium being produced in Canada and in the United States itself, its love does not translate into the extension of subsidies the way it did in an earlier era. This official illustrated his argument:

> "In the Korean War, I had my hands on 8 G USD in contract money; today the Department of Defense has 10 M USD (i e in DPA funding), the stockpile gets another 185 M USD (from the special National Defense Stockpile Transaction Fund). In 1949 I arranged 1.3 G USD for the stockpile." [89]

The love affair, he concluded wistfully, would remain on a platonic level.

It should not be thought, however, that the United States government has no international programs underway that, at least in part, are motivated by a desire to render American mineral supply less uncertain. There is one initiative that likely will bode no immediate (or even longer term) good for Canadian export interests, because it holds forth the possibility that the United States might become even less of a customer for Canadian minerals than it now is. I refer to

the *Trade and Development Program* (TDP), operated by the US International Development Cooperation Agency. The program has three interrelated goals: the promotion of American prosperity, through the medium of assisting US companies willing to invest in LDC mineral projects; the promotion of American security, by reducing US vulnerability to supply disruption in chromium, cobalt, manganese, and PGM; and the promotion of development in certain Third World countries.

The TDP has been involved in promoting mining ventures in certain Latin American countries, including Brazil. In many ways, Brazil stands to gain from the supply worries of the 1980s in the same sense that Canada did in the 1950s. This is especially the case with manganese, in which Brazil now ranks third among world producers, trailing only the Soviet Union and South Africa.[90] The TDP admittedly has had little to do with the development of Brazil's manganese industry; but it has been involved recently in sponsoring meetings in Washington that bring Brazilian mineral interests together with potential American investors. Nearly all who have studied Brazilian mineral prospects seem to be impressed with the potential of the country to develop into a major actor in international markets, and not just for the raw materials but also for the more processed stages of fabrication, such as ferro-alloys, in which Brazil is now thought to rank third in world production, behind South Africa and Norway. It is expected that Brazil should benefit from further attempts of consuming countries to diversify away from reliance upon South African supply in ores and ferro-alloys: already, the Swedish steelmaker, SSAB, has announced that political considerations have impelled it to cease purchasing South African manganese ore, which is to be replaced by ore from Brazil.[91]

There are a couple of implications for Canada in Brazilian mineral developments. First, and perhaps most obvious, is the dampening effect that the availability of Brazil as an alternative source of supply to South Africa must have on the likelihood of subeconomic Canadian manganese deposits ever being brought into production. But a less obvious implication is that Brazil produces some minerals in which it is a direct competitor with current Canadian production: iron ore, niobium (columbium), titanium, and zinc stand out in this regard.[92] There is the possibility that Brazil and other LDC producers, with the benefit of TDP intermediation, might displace some Canadian mineral exports in the US market, even if such intermediation is intended for purposes completely divorced from this. For example, the TDP has been involved in a project that is designed to stimulate cobalt production in Peru, from the tailings of a magnetite mine operated by Hierro-Peru, the state-owned iron-mining operation. A TDP study done in 1982 proposed that the cobalt from this source — which could amount to some 15 to 20 per cent of US yearly consumption — be shipped to refineries in the United States, with the stipulation that in the event of a national emergency, Washington would have first claim on it.[93] Noted one recent US governmental study: "This cobalt source might provide one of the quickest new supplies, given any disruption in the normal market, because the (Peruvian) iron mining operation and most of the infrastructure required are already in place. Deepwater port loading facilities are available nearby."[94]

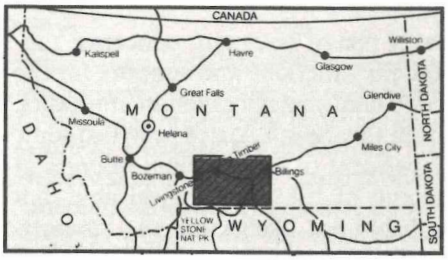
It may turn out that any diversification of US supply to such new sources could redound to the detriment of Canada, and not only in cobalt. There certainly exists a similar possibility in the case of niobium (columbium in the US). Currently, one Quebec operation, Niobec, supplies about 15 per cent of global output.[95] But Brazil is showing itself to be a greater and greater force in production of this commodity, which is used in steelmaking and in the production of superalloys for the aerospace industry, and in 1985 it accounted for some 83 per cent of world production of this mineral.[96] As one official with the TDP observed, noting that Canada is the only other significant producer of niobium,

> "they can easily throttle whatever you have in Canada anytime they want . . . They could totally obliterate anyone. Their Araxa columbium mine is probably the best mine I have ever seen."[97]

The point of the above discussion is not to raise the menace of Latin mineral "warfare"; it is merely to indicate that the United States, in somewhat the same fashion as the European Community, has developed policies and programs that are directed in part toward mineral producers in the developing countries, and that involve some form of bilateral or multilateral assistance that is obviously denied Canadian mineral producers. As is well known the EC has had for some time a set of measures in place, usually in the context of the Lomé conventions, that are intended to assist Third World mineral producers and at the same time partly redress, through diversification, the vulnerability dilemmas of various European countries.[98]

It is apparent that many countries have taken the position that import diversification is a worthy foreign-policy aim, but as the above discussion serves to illustrate, none have developed policies that are specifically aimed at increasing purchases of Canadian minerals. Are there any other vulnerability-reducing options that might have an impact upon Canadian export interests? The domestic-production avenue is not one along which many import-dependent countries can travel, for the good reason that mineral production tends to correlate quite highly with geographical expanse, thus limiting the autarkic solution to all but the largest countries. Still, the domestic-production option merits

*Location map, Stillwater PGM complex, Montana, USA.*




some consideration, given the size of the United States, as well as its importance to Canadian mineral exporters. It is evident that American deposits of a variety of minerals could be brought into production, and that the United States could reduce its import dependence, if subsidies were more freely available to stimulate such production (as they were in the 1950s), *or* if price rises were to elevate some US deposits from the subeconomic into the economic category.

As noted above, the United States does have, in the DPA, the legislative means to funnel subsidies of various kinds to American producers; moreover, American producers and their Congressional supporters have availed themselves of national-security argumentation to press their demands for protection against lower-cost foreign sources of uranium, and other commodities. Both cobalt and chromium were produced in recent decades in the United States, with DPA subsidization assisting in the process; indeed, as recently as 1958 the United States was close to being self-sufficient in cobalt.[99] There are deposits of chromite in several states, and it seems well within the realm of possibility, should Washington deem it worth the effort and expense, that the United States could reduce significantly its current near-total dependence in chromium, and eliminate altogether its dependence in cobalt.[100]

In manganese US possibilities for sustaining significant production are much smaller; and barring the advent of what once filled the Canadian mineral producers with some dread, namely deep-seabed mining, it is most unlikely that the United States could ever go very far in the direction of self-sufficiency in this commodity.[101] Of more immediate potential relevance to Canadian export interests is the recent announcement of the Chevron Corporation, along with the Manville Corporation and LAC Minerals Ltd, to move to the second phase of the Stillwater, Montana, PGM project — which is described as the "only potential primary source of platinum and palladium outside of the Soviet Union and South Africa." Scheduled to begin production in mid 1987, the mine is projected to reach a maximum annual production level by the early 1990s of some 50 000 oz of platinum and 150 000 oz of palladium, amounts that constitute 5 and 12 per cent, respectively, of current US demand for the two metals.[102]

Assuming US consumption of PGM remains at or near the current level, it seems that the Stillwater complex will yield only slight remedy to the problem of American vulnerability in these metals. But there remain two more vulnerability-reducing choices to discuss, *substitution* and *conservation,* before one can reach any conclusions. Each option poses potential challenges to Canadian export interests. Perhaps the most profound potential threat to Canadian interests inheres in the possibility that substitution technologies will ultimately — abetted by contemporary security concerns — displace a share of the current demand for some of Canada's minerals. Copper is often cited in this regard, and with much reason; for this metal has had a fairly long history of being substituted for, in many instances by aluminum, and more recently by fibre optics.[103]

But copper, though it does have its "strategic" applications, is hardly among the problematical minerals of the day;[104] and much more worrisome from the Canadian perspective is the possibility that advanced materials such as ceramics might eventually replace metals, particularly nickel, in many applications.[105] To be sure, it is not the availability of nickel that worries consumers; the supply of this metal is nothing if not diverse, with 44 producers spread out over 26 countries. But there is a sense in which nickel might get caught up in consumers' efforts to reduce vulnerability in some of the more problematical minerals. For instance, high-nickel alloys contain cobalt and chromium. What will happen to nickel markets should substitution technologies succeed in developing alternatives for these alloys? One Canadian nickel expert, reflecting on this, stated:

> "Ceramics is the material I fear. There will be a battle of technologies in the next ten years, between metals and non-metals."[106]

Finally, *conservation* (including recycling) can serve as a buffer against supply disruption. Probably the most impressive conservation gains can be reaped in PGM recovery, in the event from the numerous automobile scrapyards that are to be found in many industrialized states. For more than a decade, the catalytic converter has been the single largest user of PGM in countries such as the United States, where it accounts for more than 30 per cent of all platinum, palladium, and rhodium consumption. A recent US study has aptly referred to the country's automotive fleet as a large "above-the-ground mine" of PGM.[107] Another potential frontier for conservation efforts can be located in the superalloy industry, the largest single user of cobalt. Ever since the great cobalt scare of the late 1970s, industry has been attempting to incorporate techniques that will allow it to minimize wastage. In 1980, for instance, nearly 55 per cent of primary-metal consumption was lost through downgrading or waste in the production of superalloy parts. With the further development of conserving techniques, it is expected that this sector's appetite for cobalt and such other strategic metals as chromium, nickel, and tantalum can be dampened.[108]

## Conclusion

It has been argued that, based on a reading of recent and current trends, Canadian export interests can expect to extract few tangible benefits from the current vogue of uneasiness being experienced by Western import-dependent countries. At least this appears to be the proper conclusion, if one focusses on those minerals that are today held to be most problematical. However, although Canada's ability to capitalize on Western vulnerability concerns might appear to be limited at present, one should not conclude that actual supply disruptions of southern or South African minerals would only affect those few commodities that have been the focus of attention in the past few months. In the case of South Africa, it is not unreasonable to suggest that whatever might disrupt the production and/or export of chromium, manganese, vanadium, and PGM would also likely disrupt the production and/or export of titanium, iron ore, nickel, copper, lead and zinc, silver, tin, thermal coal, and uranium.

Canada is a major producer of all of these minerals, with the exception of tin. Thus it would be difficult to imagine how Canada's production and export of nonfuel minerals outside the core group of strategic minerals would not be affected by massive internal upheaval in South Africa or, indeed, by any sharp departure from current production and export patterns on the part of a future South African government, whether or not that government was an outcome of massive internal upheaval. Although it is still too early to tell whether Western sanctions against South Africa will proceed very far, there is already some reason to argue that an American ban on uranium imports from the Republic might lead to an easing of the protectionist pressure on Canadian uranium in the US market. Indeed, one New Mexico legislator, Congressman Bill Richardson, had been conspicuous in trying to marry two of his major concerns: support for sanctions and support for the state's hard-pressed uranium producers. Given that South Africa provided some 28 per cent of US uranium imports at the end of 1985, it is conceivable (but probably not likely) that the "import-relief" accorded by the US sanctions program might contribute to a diminution in protectionist agitation against Canadian uranium.[109]

Finally, there is at least some reason to ponder whether the "geopolitics" of minerals might yet have the stimulative effect on Canadian production levels that was present in an earlier era, notwithstanding the thrust of most of this paper, which has been directed at showing why Canada likely cannot derive much material benefit from the current turmoil in South Africa. Indeed, simply to put the matter in such a way might seem distasteful, and suggestive of not a little *Schadenfreude.* Deriving gain from others' losses takes on negative, sometimes sinister, connotations in the cold light of specificity; but bathed in the fuzzier tones of abstraction, it is a prospect that can inspire some hope among those who produce and market minerals in this country. The simple reality is that Canadian mineral production *has* in the past been stimulated as a result of hardship, upheaval, even war — unfortunate occurrences that have blighted international politics with regularity in this century. Thus it is worth noting that, of late, some attention has been given by policy makers and policy analysts alike, to the possibility of Canadian producers,of minerals and other industrial items, becoming beneficiaries of a growing attentiveness in the United States to the concept of the "defence industrial base". It would require another paper devoted just to this concept to do justice to the argument, but in brief it can be stated that there has been an increase in concern, over the past half-dozen years, with the possibility that the erosion of America's industrial base might ultimately impose severe constraints from the standpoint of security, both upon the United States and its allies.

Partly, this concern has been a function of the ongoing reassessment in the strategic-studies community of the possibility of non-nuclear global conflict involving the superpowers and their allies; in effect, of a Third World War not being so different from its two predecessors after all. Developments in weapons technologies, coupled with the possibility that meaningful nuclear-disarmament agreements can be concluded, have led some analysts to ponder what, just a decade ago, would have seemed the height of ludicrousness. Observes one such analyst, "it is important to recognize that strategic non-nuclear war is again a proper subject for debate after some thirty years of inattention."[110] An obvious implication of such a debate is that the material basis of state power — what in an earlier age was called "war potential" and later "military potential" — now becomes an item of importance to those either planning to fight a war or planning to *deter* one.

But there is another, perhaps more valid source of disquiet over the defence industrial base — a disquiet born not out of a reassessment of strategic assumptions, but rather one occasioned by a genuine perplexity over the degree to which a country (in the event, the US) can continue to shed productive capacity in a variety of industrial sectors and still remain militarily strong and politically influental.[111] What has become apparent in the domain of minerals over the past decade and a half, namely that interdependence can and often does have troublesome security implications, is now beginning to make itself visible in other sectors of the US economy. Indeed, it is the shedding of productive capacity in some of the "downstream" activities (e g metal manufacturing and fabricating, as opposed to extraction) that is leading to a reconsideration of

the merits of relying on least-cost sources of supply for minerals. For some time, the sorry state of the American ferroalloys sectors has occasioned worry among the US security community; after all, it was argued, how can one reduce vulnerability to mineral-supply disruption through deversification of sources of raw material if one no longer had any "downstream" capability? Recently another sector, the American machine-tools industry has been given protection under a seldom-used national-security trade measure: sec 232 of the Trade Expansion Act of 1962.[112] It is not possible to predict whether this will be a harbinger for other embattled industries in the United States, but one would be rash to discount the possibility, particularly in light of the US Congressional elections of 1986, which have been seen as a setback for the free-trade advocacy in the United States.

There is, then, the possibility that *security* considerations will figure more explicitly in future American trade policy; and it is this prospect that some Canadian minerals analysts — and a few policy makers — have argued might yet bode well for Canadian export interests, should some way be found of convincing Americans to pay more attention to the North American (i e including Canadian) defence industrial base, and purchase far fewer minerals from distant, and presumably less reliable, sources.[113] But stressing the security argument can have its perils, as may be seen with the case of uranium. One cannot do other than speculate on the efficacy of Canada's using security arguments to enhance or ensure access to the American market for minerals and other products, whether in the absence of a bilateral free-trade arrangement or in the eventuality one gets concluded. What can be fairly safely concluded, however, is that there will continue to be a substantial geopolitical content to any discussion of Canadian resource trade with the United States, and other countries.

**Notes:**

[1] The concept of "political value added" received some currency during the oil crises of the 1970s, and in particular in the context of American prospects for diversifying their source of supply away from unstable Middle Eastern countries and toward relatively safer producers in Latin America, such as Mexico. See Richard R Fagen, "Mexican Petroleum and US National Security", *International Security* 4, Summer 1979, pp 39—53; Richard B Mancke, *Mexican Oil and Natural Gas: Political, Strategic, and Economic Implications* (New York: Praeger, 1979); and David Ronfeldt, Richard Hehring and Arturo Gándara, *Mexico's Petroleum and US Policy: Implications for the 1980s,* Executive Summary for the US Department of Energy, Santa Monica, Ca, Rand Corporation, June 1980.

[2] Bruce Russett, "Dimensions of Resource Dependence: Some Elements of Rigor in Concept and Policy Analysis", *International Organization* 38, Summer 1984, pp 481—499.

[3] Robert O Keohane and Joseph S Nye, *Power and Interdependence: World Politics in Transition,* Boston: Little, Brown, 1977, pp 12—13.

[4] David A Baldwin, "Interdependence and Power: A Conceptual Analysis", *International Organization* 34, Autumn 1980, pp 471—506; Kenneth Waltz, "The Myth of National Interdependence", in *Globalism versus Realism: International Relations' Third Debate,* ed Ray Maghroori and Bennett Ramberg, Boulder, Colo, Westview Press, 1982, pp 81—96.

[5] See, for instance, Baldwin, "Interdependence and Power", p 492:

> "In sum, there is a distinction between drug users and drug addicts, between drinkers and alcoholics, between being sensitive to others and being dependent on them, between influence in general and dependence as a special type of influence. It is a distinction that has been recognized and understood by scholars and laymen alike for centuries. It is a distinction that the concept of 'sensitivity interdependence' blurs, but which is captured with precision and parsimony by the Hirschman-Waltz concept of dependence (i e as 'vulnerability interdependence')."

[6] As, to take a recent widely read example, was done by the US Congress, Office of Technology Assessment. *Strategic Materials: Technologies to Reduce US Import Vulnerability,* Washington, May 1985.

[7] For an instance of a (rare) usage of the concept "net import reliance" instead of the more emotive "dependence", see US Bureau of Mines, *Mineral Commodity Summaries, 1986,* Washington: Department of the Interior, 1986.

[8] James A Caporaso, "Dependence, Dependency, and Power in the Global System: A Structural and Behavioral Analysis", *International Organization* 32, Winter 1978, pp 21—22. Cf Kal Holsti's similar stipulations concerning the vulnerability of exporters in "A New International Politics? Diplomacy in Complex Interdependence", *International Organization* 32, Spring 1978, p 516.

[9] Hans H Landsberg and John E Tilton, with Ruth B Haas, "Nonfuel Minerals", in *Current Issues in Natural Resources Policy,* ed Paul R Portney, Washington: Resources for the Future, 1982, pp 91—95.

[10] David G Haglund, "The New Geopolitics of Minerals: An Inquiry into the Changing International Significance of Strategic Minerals", *Political Geography Quarterly* 5, July 1986, pp 221—240.

[11] US General Accounting Office. *Report to the Secretary of the Interior: Federal Encouragement of Mining Investment in Developing Countries for Strategic and Critical Minerals Has Been Only Marginally Effective,* Washington, September 1982, p 3. The LDC share of global nonfuel-mineral production is described and analyzed in Martin O C Kursten, "The Role of Metallic Mineral Resources for Countries of the Third World", *Natural Resources Forum* 7, 1 1983, pp 71—79.

[12] Thomas Atkinson. "Future Strategic Mineral Supplies for the EEC", *Mining Engineer,* April 1979, p 728.

[13] The geopolitical significance of Latin mineral wealth during the run-up to World War II is discussed in David G Haglund, "'Gray Areas' and Raw Materials: Latin American Resources and International Politics in the Pre-World War II Years", *Inter-American Economic Affairs* 36, Winter 1982, pp 23—51.

[14] This is especially the case in copper, but is becoming more evident in nickel as well. See

Energy, Mines and Resources Canada, *Canada's Nonferrous Metals Industry: Nickel and Copper,* Ottawa: Minister of Supply and Services, 1984.

[15] Energy, Mines and Resources Canada, *Mineral Policy: A Discussion Paper,* Ottawa: Minister of Supply and Serices, December 1981, p 146. But cf Roderick G Eggert, "Base and Precious Metals Exploration by Major Corporations", mimeo (undated) for an analysis of trends through the 1970s.

[16] Phillip Crowson, "Trend and Patterns of International Investment in Non-Fuel Minerals", in *Probleme der Rohstoffsicherung,* Bonn: Friedrich Ebert Stiftung, 1981, pp 25—26.

[17] T P Mohide, CL Warden, and J D Mason, *Towards a Nickel Policy for the Province of Ontario,* Mineral Policy Background Paper No 4, December 1977, Toronto: Ontario Ministry of Natural Resources, Division of Mines, 1977, pp 12—13.

[18] Phillip Crowson, "Investment and Future Mineral Production", *Resources Policy* 8, March 1982, pp 7—9. Also see Idem "A Perspective on World Wide Exploration for Minerals", mimeo, February 1984.

[19] Contrasting viewpoints are advanced in Marian Radetzki's self-described "optimistic" paper, *Will the Long-Run Global Supply of Industrial Minerals Be Adequate? A Case Study of Iron, Aluminium and Copper,* Reprint Series No 132, Stockholm, University of Stockholm, Institute for International Economic Studies, 1980; and the more pessimistic article by N A Butt and Thomas Atkinson, "Shortfalls in Minerals Investments", *Resources Policy* 8, 1982, pp 261—276.

[20] See especially *The Resource War in 3-D — Dependency, Diplomacy, Defense,* ed James Arnold Miller, Daniel Fine, and R Daniel McMichael, Pittsburgh, World Affairs Council of Pittsburgh, 1980; and National Strategy Information Center, *The Resource War and the US Business Community: The Case for a Council on Economics and National Security,* Washington, Council on Economics and National Security, 1980.

[21] See John F Shroder, Jr, "The USSR and Afghanistan Mineral Resources", in *International Minerals: A National Perspective,* ed Allen F Agnew, Boulder, Colo, Westview Press, 1983, pp 115—153.

[22] Warren P Baker, "Next: A Resource War?" *Seapower* 23, October 1980, p 55.

[23] W C J van Rensburg, "Political Change in South Africa and the Importance of the Republic of South Africa as a Raw Material Supplier", in *Probleme der Rohstoffsicherung,* p 99.

[24] The radical revisionist case is argued in Harry Magdoff. *The Age of Imperialism: The Economics of US Foreign Policy,* New York: Monthly Review Press, 1969; and Michael Tanzer, *The Race for Resources: Continuing Struggles over Minerals and Fuels,* New York, Monthly Review Press, 1980. An interesting discussion of certain theoretical affinities between left- and right-wing analyses is Ole R Holsti, "The Study of International Politics Makes Strange Bedfellows: Theories of the Radical Right and the Radical Left", *American Political Science Review* 66, March 1974, pp 217—242.

[25] The greater relative importance of interests is stressed by Werner Levi, "Ideology, Interests, and Foreign Policy", *International Studies Quarterly* 14, March 1970, pp 1—31. But for a different assessment, cf Stephen D Krasner, *Defending the National Interest: Raw Materials Investments and US Foreign Policy,* Princeton, Princeton University Press, 1978.

[26] See, for example, Edward Friedland, Paul Seabury, and Aaron Wildavsky, *The Great Détente Disaster: Oil and the Decline of American Foreign Policy,* New York, Basic Books, 1975.

[27] Walter J Levy, "Oil and the Decline of the West". *Foreign Affairs* 58, Summer 1980, p 1015.

[28] See Barry M Blechman, *National Security and Strategic Minerals: An Analysis of US Dependence on Foreign Sources of Cobalt,* Westview Special Studies in National Security and Defense Policy, Boulder, Colo, Westview Press, 1985.

[29] John Orme, "Ore Wars: The Problem of US Dependence on Foreign Minerals", *Fletcher Forum* 6, Summer 1982, p 408.

[30] US Congress, House Committee on Interior and Insular Affairs, Subcommittee on Mines and Mining, *Sub-Sahara Africa: Its Role in Critical Mineral Needs of the Western World,* 96th Cong, 2d sess, Washington, US Government Printing Office, 1980, p vii.

[31] Hans H Landsberg, *Minerals in the Eighties: Issues and Policies,* Oak Ridge, Tenn, Oak Ridge National Laboratory, Program Planning and Analysis, 1982, pp 20—21.

[32] For a discussion of the various interpretations of "strategic" minerals, see David G Haglund, "Strategic Minerals: A Conceptual Analysis", *Resources Policy* 10, September 1984, pp 146—152.

[33] See two articles written by Bergsten: "The Threat from the Third World", *Foreign Policy,* No 11, Summer 1973, pp 102—124; and "The Threat Is Real", *Foreign Policy,* No 14, Spring 1974, pp 84—90.

[34] An interesting discussion of recent changes in international commodity markets is Mark W Zacher, "Trade Gaps, Analytical Gaps: Regime Analysis and International Commodity Trade Regulation", *International Organization* (forthcoming). On the recent travails of tin, see W Keith Buck, "Commodity Agreements versus Study Groups: The Lessons of Tin", *CRS Perspectives,* No 25, September 1986, pp 1—3.

[35] US Congress, House Committee on Foreign Affairs, Subcommittee on Africa, *The Possibility of a Resource War in Southern Africa,* 97th Cong, 1st sess, Washington, US Government Printing Office, 1981, p 67.

[36] I base this remark on conversations I had with minerals analysts in various Western European capitals, and at OECD, EEC, and NATO headquarters in March and April 1983.

[37] Energy, Mines and Resources Canada, *Comecon's Mineral Development Potential and Its Implications for Canada,* prepared by Nickolas M Switucha, Mineral Bulletin MR 183, Ottawa, Minister of Supply and Services, 1979, p 95.

[38] Richard M Levine, "The Mineral Industry of the USSR", in US Bureau of Mines, *Minerals Yearbook 1984,* Vol 3, *Area Reports: International,* Washington, Department of the Interior, 1986, pp 829—864. Also see James S Grichar, Richard M Levine, and Lotfollah Nahai, *The Nonfuel Mineral Outlook for the USSR, through 1990,* Washington, Bureau of Mines, 1981, p 9.

[39] See, for this view, Daniel I Fine, "Mineral Resource Dependency Crisis: Soviet Union

and United States", in *The Resource War in 3-D,* pp 37—56.

[40] Alan C Brownfeld, "The Growing United States'Dependency on Imported Strategic Minerals", *Atlantic Community Quarterly* 20, Spring 1982, p 65.

[41] Michael Shafer, "Mineral Myths", *Foreign Policy* No 47, Summer 1982, p 154.

[42] Ruth W Arad, et al, *Sharing Global Resources,* New York, McGraw-Hill, 1979, p 75.

[43] See, for an example of this argument, Dirk C Neethling, "The Geopolitics of Mineral Supply: Access to and Availability of the Mineral Resources of Southern Africa", in *Southern African Metals and Minerals in a World Context Conference,* ed Trevor Tarring and Wynford Davies, Worcester Park, Eng: Metal Bulletin Congresses, 1981, pp D1—D11. A useful compendium of the geopolitical importance of South African minerals to the industrialized West is L E Andor, comp, *South Africa's Chrome, Manganese, Platinum, and Vanadium: Foreign Views on the Mineral Dependency Issue, 1970—1984,* Bibliographical Series No 13, Brammfontein, South African Institute of International Affairs, 1985.

[44] US Bureau of Mines, *Mineral Commodity Summaries 1986,* passim.

[45] See James M Markham, "The Debate on Sanctions Gets More Intense", *New York Times,* 1986-09-14, p E2; and "Sanctions on South Africa: Double-Edged", *Economist,* 1986-08-16, pp 42—43.

[46] Michael W Klass, James C Burrows, and Steven D Beggs, *International Minerals Cartels and Embargoes: Policy Implications for the United States,* New York, Praeger, 1980, p 29.

[47] Cited in Joseph V Micallef, "Political Risk Assessment", *Columbia Journal of World Business* 16, 1981, p 47.

[48] Energy, Mines and Resources Canada, *Canadian Minerals Yearbook 1985: Review and Outlook,* Ottawa, Minister of Supply and Services, 1986, pp 1.1—1.12.

[49] See David G Haglund, "Protectionism and National Security: The Case of Canadian Uranium Exports to the United States", *Canadian Public Policy,* 12, September 1986, pp 459—472.

[50] Phillip Crowson, *Non-Fuel Minerals and Foreign Policy,* London, Royal Institute of International Affairs, 1977, pp 6—7.

[51] Interview, London, 1983-04-12.

[52] US Congress, OTA, *Strategic Materials,* p 48.

[53] Canada, Department of External Affairs, *Canada's Export Development Plans for Japan,* Ottawa, DEA, 1982, pp 166—167.

[54] Ted Greenwood and Alvin Streeter, Jr, "Uranium", in *Natural Resources in US—Canadian Relations,* Vol 2, *Patterns and Trends in Resource Supplies and Policies,* ed Carl E Beigie and Alfred O Hero, Jr, Boulder Colo, Westview Press, 1980, pp 356—357.

[55] James Miller, quoted in the *Globe and Mail,* 19 October 1981. Miller, one of the advocates of the resource-war thesis discussed above, edits a Washington newsletter, *Alarm,* which focuses on resource politics.

[56] On the Trudeauvian nickel "cartel", see Michael C Webb and Mark W Zacher, "Canada and International Regulation of Primary Commodity Markets: The Case of Minerals", in *Canada and International Trade,* Vol I, *Major Issues of Canadian Trade Policy,* ed John M Curtis and David G Haglund (Montreal, Institute for Research on Public Policy, 1985, pp 337—338.

[57] The principal use of vanadium is as an alloying element in steel; it is not infrequently found as a byproduct or coproduct of uranium (and other minerals). Peter H Kuck, "Vanadium", in US Bureau of Mines, *Minerals Yearbook 1984,* Vol 1, *Metals and Minerals,* Washington, Department of the Interior, 1985, pp 941—955; Idem "Vanadium", US Bureau of Mines Preprint from Bulletin 675, Washington, Department of the Interior, 1985.

[58] Interview, NATO Headquarters, Brussels, 1983-03-29.

[59] United Kingdom, House of Lords, Select Committee on the European Communities, *Strategic Minerals,* sessions 1981—82, 20th Report, London, Her Majesty's Stationery Office, 1982, pp xxii—iii.

[60] Phillip Crowson, "The National Mineral Policies of Germany, France and Japan", *Mining Magazine* 142, June 1980, p 547.

[61] Interview, London, 1983-03-31.

[62] "The Debate on Sanctions Gets More Intense", *New York Times,* 1986-09-14, p E2; Tatiana Karpinsky, "The Mineral Industry of the United Kingdom", in US Bureau of Mines, *Minerals Yearbook 1984,* 3: pp883—884.

[63] Interview, Bonn, 1983-03-25.

[64] Federal Republic of Germany, Bundesanstalt fuer Geowissenschaften und Rohstoffe, *Jahresbericht zur Rohstoffsituation, 1981/82* Hannover, February 1983, p 5; George A Rabchevsky, "The Mineral Industry of the Federal Republic of Germany", in US Bureau of Mines, *Minerals Yearbook 1984,* pp 3:329—331.

[65] John Hataye, "Japanese Begin to Allot Funds for Non-ferrous Stockpiling Program", *American Metal Market,* 1976-02-13.

[66] John C Wu, "The Mineral Industry of Japan", in US Bureau of Mines, *Minerals Yearbook 1984,* pp 3:465—466.

[67] D R Phillips, "Chromium", in *Canadian Minerals Yearbook 1985,* pp 18.1—18.8; Idem "Manganese", in ibid, pp 38.1—38.7; D King, "Vanadium", in ibid, pp 65.1—65.8.

[68] Canadian import dependence in chromium and manganese is discussed in Jock Finlayson, "Canada and Strategic Minerals", *International Perspectives,* September/October 1982, pp 18—21. Good analyses of Canadian import-dependence, and its potential implications, are found in Energy, Mines and Resources Canada, *Vanadium: An Imported Mineral Commodity,* Mineral Bulletin MR 188, Ottawa: Minister of Supply and Services, 1981; and Idem, *Chromium: An Imported Mineral Commodity,* Mineral Bulletin MR 196, Ottawa, Minister of Supply and Services, 1983.

[69] US Bureau of Mines, *Mineral Commodity Summaries, 1986,* p 39.

[70] Ibid, p 119. The platinum group comprises platinum, palladium, iridium, osmium, rhodium, and ruthenium.

[71] Energy, Mines and Resources Canada, *Canadian Minerals Yearbook 1985,* pp 21.1—47.1; "Costly Search for Platinum Paying Off for Equinox", *Financial Post,* 1986-09-27, p 28.

[72] Energy, Mines and Resources Canada, *Chromium,* p 12; *Mineral Policy: A Discussion Paper,* p 34.

[73] Interview, EMR, Ottawa, 1985-02-18; D M Watson, "Chromite Reserves of the Bird River Sill", Winnipeg: Manitoba Energy and Mines, 1985.

[74] R C Annis, D A Cranstone, and M Vallee, *A Survey of Known Mineral Deposits in Canada that Are not Being Mined,* Mineral Bulletin MR 181, Ottawa: Energy, Mines and Resources Canada, 1978, pp 57, 69—70, 90, A1—A4, A6—A7, A9, A28, A30, A38. Also see R Marcotte, *Gites et Indices de Chromite au Québec,* Québec: Ministère de l'Energie et des Ressources, 1980.

[75] Interview, Ministère de l'Energie et des Ressources, Québec, 1985-06-03; Thomas S Jones, "Manganese", US Bureau of Mines Preprint from Bulletin 675, Washington: Department of the Interior, 1985, p 3.

[76] For US concern over the security aspects of dependence in minerals, see Alfred E Eckes, Jr, *The United States and the Global Struggle for Minerals,* Austin: University of Texas Press, 1979.

[77] David G Haglund, "Canadian Strategic Minerals and United States Military Potential", *Journal of Canadian Studies,* 19, Fall 1984, pp 5—31.

[78] John E Cameron, "Nickel", in Beigie and Hero, *Natural Resources in US-Canadian Relations,* p 2:69.

[79] John Lewis Gaddis, *Strategies of Containment: A Critical Appraisal of Postwar American National Security Policy,* New York, Oxford University Press, 1982, p 132. On the broader link between Korea and the enlargement of US security interests, see Walter Lafeber, *America, Russia, and the Cold War, 1945—1980,* 4th ed, New York, John Wiley, 1980, pp 101—127.

[80] Glenn H Snyder, *Stockpiling Strategic Materials: Politics and National Defense,* San Francisco, Chandler, 1966, p 80.

[81] Alfred R Greenwood, "The Reagan Administration Proposes Dramatic Changes to National Defense Stockpile Goals", 86—578 ENR, Washington, Library of Congress, Congressional Research Service, February 1986, p 57.

[82] US General Accounting Office, *National Defense Stockpile: Adequacy of National Security Council Study for Setting Stockpile Goals,* GAO/NSIAD-86-177BR, Washington, August 1986.

[83] Interview, Washington, 1985-06-25; John H Cushman, Jr, "What to Stockpile — and How Much?", *New York Times,* 1987-04-26, p E4.

[84] Interview, Washington, 1985-06-19. The two most influential defenders of an ample stockpile are James A McClure, recently Chairman of the Senate's Committee on Energy and Natural Resources; and Charles E Bennett, Chairman of the House Committee on Armed Services' Subcommittee on Seapower and Strategic and Critical Materials.

[85] Interview, Washington, 1985-06-07; US Federal Emergency Management Agency, *Stockpile Report to the Congress, April—September 1985,* Washington, December 1985, p 20.

[86] Alfred R Greenwood, "National Defense Stockpile Policy — The Congressional Debate", 86-863 ENR, Washington, Library of Congress, Congressional Research Service, August 1986, Appendices A and B.

[87] Arguments to this effect include: Raymond F Mikesell, "Economic Stockpiles for Dealing with Vulnerability to Disruption of Foreign Supplies of Minerals", *Materials and Society* 9,1, 1985, pp 59—128; Hanns W Maull, *Raw Materials, Energy and Western Security,* Studies in International Security: 22, London, Macmillan, International Institute for Strategic Studies, 1984, pp 339—349, 385—388; and Idem, "French and European Community Policies for Securing the Supply of Primary Commodities", in *Probleme der Rohstoffsicherung,* pp 193—198.

[88] Percy W Bidwell, *Raw Materials: A Study of American Policy,* New York, Council on Foreign Relations, Harper & Bros, 1958, p 160; US Congress, OTA, *Strategic Materials,* p 113.

[89] Interview, Washington, 1985-06-18.

[90] US Bureau of Mines, *Mineral Commodity Summaries, 1986,* p 99.

[91] "Ferro-Alloys Sector Surging Ahead", *Latin American Commodities Report,* 1986-09-04, p 2.

[92] H Robert Ensminger, "The Mineral Industry of Brazil", in US Bureau of Mines, *Minerals Yearbook 1984,* pp3:131—145.

[93] US International Development Cooperation Agency, Trade and Development Program, *The Marcona Iron Mine: A Potential New Source of Cobalt in Peru,* Washington, November 1982.

[94] US Congress, OTA, *Strategic Materials,* p 166.

[95] Harold R Newman, "The Mineral Industry of Canada", in US Bureau of Mines, *Minerals Yearbook 1983,* p 3:166.

[96] US Bureau of Mines, *Mineral Commodity Summaries 1986,* p 41.

[97] Interview, Washington, 1985-06-27.

[98] House of Lords, *Strategic Minerals,* pp viii—ix.

[99] US Congress, OTA, *Strategic Minerals,* pp 167—168.

[100] For a discussion of the mineral potential of just one state, Alaska, see James C Barker et al, *Critical and Strategic Minerals in Alaska: Cobalt, the Platinum-Group Metals, and Chromite,* Bureau of Mines Information Circular 8869, Washington, Department of the Interior, 1981.

[101] Canada's worry was not that the United States would become a producer of manganese; it was that the US would, in exploiting the "manganese nodules" of the seabed, also develop into a significant producer of nickel, one of the leading metallic constituents of the nodules. See W E Cundiff, *Nodule Shock? Seabed Mining and the Future of the Canadian Nickel Industry,* Occasional Paper No 1, Montreal, Institute for Research on Public Policy, 1978. Current prospects for deep-seabed mining are discussed in Elisabeth Mann Borgese, "Law of the Sea: Crossroads Again", *International Perspectives,* July/August 1986, pp 12—14. Also see, for a discussion of possible exploitation of cobalt-rich crusts lying within the US exclusive economic zone, FT Manheim, "Marine Cobalt Resources", *Science* 232, 1986-05-02, pp 600—608.

[102] Information contained in a letter to the author from R K Doran, Chevron Resources Co, 1986-09-29.

[103] Energy, Mines and Resources Canada,*Canada's Nonferrous Metals Industry,* p 3. On post-World War II substitution pressures, especially from aluminum, see Theodore H Moran, *Multinational Corporations and the Politics of Dependence: Copper in*

*Chile,* Princeton University Press, 1974, pp 45—49.

[104] The strategic aspect of copper is stressed in Louis J Sousa, *The US Copper Industry: Problems, Issues, and Outlook.* Mineral issues: An Analytical Series, Washington, Department of the Interior, Bureau of Mines, October 1981, p 3.

[105] The prospect of ceramics and composites ultimately replacing some strategic minerals is discussed in W Wendell Fletcher and Kirsten U Oldenburg, "Strategic Materials: How Technology Can Reduce US Import Vulnerability", *Issues in Science and Technology* 2, Summer 1986, pp 83—84. Also see Joel P Clark and Frank R Field, "How Critical are Critical Materials?", *Technology Review 88,* August/September 1985, pp 38—47.

[106] Interview, Toronto, 1985-05-24.

[107] US Congress, OTA, *Strategic Materials,* p 239.

[108] Ibid, p 219.

[109] Interview, Washington, 1985-06-25.

[110] Carl H Builder, "The Prospects and Implications of Non-Nuclear Means for Strategic Conflict", *Adelphi Papers,* No 200, London: International Institute for Strategic Studies, 1985, p 31.

[111] Paul Seabury, "Industrial Policy and National Defense", *Journal of Contemporary Studies* 6, Spring 1985: 5—15. Also see US Congress, House Committee on Armed Services, *The Ailing Defense Industrial Base: Unready for Crisis,* 96th Cong, 2d sess, Washington: US Government Printing Office, 1980.

[112] "Reagan to Seek Cutbacks on Machine-Tool Imports", *Washington Post,* 1986-05-21, p G1.

[113] See the address by Paul Lafleur, until recently a Counsellor (Commercial) at the Canadian Embassy in Washington, delivered to the National Defense Executive Reserve, in Phoenix, Arizona on 1984-09-23. Entitled "Strategic Materials in the Context of US—Canada Trade", "Lafleur's talk was published in *Alarm,* No 93, October 1984.