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RESTRUCTURING MARKETS, REORGANIZING NATURE: AN EXAMINATION OF JAPANESE STRATEGIES FOR ACCESS TO RAW MATERIALS

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I. INTRODUCTION

Theorists of hegemony combine a concern with the causes of war and peace with questions of dominant trade regimes. While this combination addresses issues of central importance for studies of international relations, it may somewhat confound the role of hegemony studies within a world systems perspective. The power of the world systems perspective lies in the consideration of entire worlds, not simply as the appropriate unit of analysis, but as integrated units of production and exchange. Hierarchy within this system reflects not simply politically enforced relations of unequal exchange, but the subordination of production in different parts of the world to regimes constructed and manipulated by core

powers to their own economic and political advantage. The processes that create the power of the core and the processes by which the core subordinates the periphery constitute the critical questions within this perspective. Part, but only part, of the answer lies in the superior productive capacity and efficiency of the core, and resulting ability to dominate trade. Another part, and we believe this is primary, lies in the ways that, in order to become so productive and so efficient, economies rising to core status must organize other economies and international transport systems to assure the increasing, secure, cheap supplies of the raw materials that support productive efficiency and economic growth.

In order to ascend within a world system hierarchy, economies must organize themselves in such a way as to create, directly or indirectly, and then coordinate (or core-dinate) multiple raw materials production systems within their own political boundaries and, more importantly, in other noncore areas whose basic characteristics are substantially molded by the physical and topographic features and the location of the raw materials that

they export. Just as productive efficiency of firms within a single industrial economy depends on a socially built environment constructed by capital that reduces the cost of material and informational flows to and within sites valorized by capital (Harvey 1982), so too the productive efficiency of a core nation requires a globally built environment that reduces the costs of material flows to that economy from raw materials extracting

regions. We argue that the organizational forms, knowledge, and technologies that a rising economy must develop in order to satisfy its growing and changing raw materials requirements themselves constitute the capacities needed for world system dominance, both in terms of production and in terms of strategic relations aimed at achieving secured raw materials flows at minimal cost.

Because a rising hegemon must organize complex productive systems across space to procure raw materials, the critical moments of creating and transforming a world system occur during ascent. The requirements of raw material procurement fundamentally mold the economic organization of the core power itself and structure its relations to its own periphery. The core state and firms negotiate or impose systems of bilateral relations with peripheral states which control raw materials sites whose products are in demand in the core economy.

The creation and maintenance of these systems of bilateral relations by the rising core power are critical to capital accumulation in the core economy and to its military security. Hegemony _per se_ is far less illuminating of world-system process than the material processes defined in space involving the appropriation of nature by core states and firms that precede and create it. Intercore conflict and competition thus become one of the avenues to understanding how core powers organize themselves and how they organize the areas that become peripheral and semiperipheral. From this perspective, whether there have been

three hegemons or five or seven, and which the next one will be, is ultimately less important than the strategies that different ascendant core economies follow to achieve dominance, whether or not they succeed in some absolute sense, and what impact these strategies have on the organization of the world economy.

This paper briefly summarizes our research on Japanese strategies to assure access to several industrially critical minerals. We use case materials to examine two linked propositions: 1) that successful access strategies are constrained by the physical characteristics of the natural resource itself and of the locations in which it is found, and 2) that the access strategies of an ascendant economy require innovative responses both to the constraints of these physical characteristics, and to the established political and economic relations which govern the international commerce in raw materials. We consider Japanese strategies to secure access to coal, iron, copper, and aluminum.

This paper examines Japan's ascendence into the core and its hegemonic rivalry with the U.S. in the post-World War II era based on the development of Japan's raw materials and transport industries. Raw materials industries (most notably steel but also copper and aluminum) and transport industries (most notably shipbuilding and shipping) were leading sectors of the Japanese economy throughout most of the post-World War II era. These industries created the economic, physical and social infrastructure on which all other economic sectors in Japan depend. In order for

Japan to follow this path of ascendence, regions which were rich in raw materials in many areas of the world had to be closely linked to Japan via networks of transport, trade and investment. As this paper will demonstrate, Japanese firms and the Japanese state have structured these networks in ways which have guaranteed access to large supplies of low cost raw materials outside the control of transnational raw materials firms based in its hegemonic rival, the United States.

II. A MODEL OF HEGEMONY AND RAW MATERIALS ACCESS STRATEGIES

Ascendant national economies require expanding access to cheap and secure sources of raw materials to sustain their challenge to established industrial economies. Lowering raw materials costs is critical to competition in international markets, and is particularly important to the ascendant economy because it is also extending productive and transport infrastructure faster than the average of the established economies. Stability of supply is required for operating plants at full capacity; this is particularly important in the heavy industries in an ascendant economy because these industries involve higher than average fixed capital investments and inflexible sunk costs. Because the states and firms of established industrial economies have often already succeeded in structuring global raw material markets to their own

advantage, the state and firms of the ascendant nation may have to restructure these markets in order to compete effectively. Such restructuring, however, may collide with environmental and spatial constraints imposed by the physical characteristics of the raw materials and the location of their sources. Previously ascendant, and still dominant, economies will have organized raw materials markets in such a way as to reduce their own costs and increase their own security of supply. The established market systems are therefore likely to accommodate the organization and location of extraction, processing, and transport to the natural features and locations of natural resources and their raw material forms.

The ascendant economy must therefore find new ways to accommodate to natural characteristics, and to use these so as to loosen or restructure markets already built around these natural features. Historically, ascendant economies have done this via several strategies. The first strategy is to incorporate new

technologies that effectively change established relations between economy and environment. These can include new forms or expanded scale of mining, processing, and transport. The second strategy is to induce host countries to assume a significant share of the cost of reorganizing world markets, introducing new technologies, and developing new transport routes. The third strategy is direct conquest of resource-rich peripheries, followed by wars or diplomatic actions that impede access by the established economies.

These three major strategies have evolved historically to

allow ascendant economies to continue their advance. The first strategy has been employed in a number of instances. The adoption of James Watt's vastly improved steam engine to remove water from coal mines in Great Britain during the last twenty years of the eighteenth century, for example, made huge reserves of deeply buried coal that had previously been unextractable both technologically and economically suddenly available on a large scale at low cost to power Britain's Industrial Revolution (Mathias 1969:134-135; Rosenberg and Birdzell 1986:150- 151). Britain's relatively early industrialization based on low cost coal was an essential element of Britain's rise as a hegemonic core power. Similarly, the rapid expansion of a domestic transportation infrastructure in the United States in the mid-nineteenth century based on the newly developed technology of railroads served to link the United States' widely dispersed raw materials and agriculture producing peripheries to markets and industrial centers in the East(Stover 1961; Chandler 1965; Douglas 1992). This creation of a low cost transport network was a central part of the United States' rapid industrialization, the key to U.S. ascendence in the world economy.

The second strategy has a similarly long history in the capitalist world economy. Raw materials producing nations have long been induced (and sometimes forced) by ascendent core powers to pay a significant share of the costs of reorganizing world markets, introducing new technologies, and developing new transport

routes. Imperial core powers, for example, taxed their colonies to support armies to control indigenous populations and used corvee labor to construct infrastructure. Even in non-imperial situations, ascendent core powers have been able to induce raw materials extracting peripheries to finance the construction of railroads, for example, often justified in terms of economic development but mainly benefitting foreign investors and raw materials consumers. Numerous examples of the employment of this strategy by Britain occurred in Latin America during the nineteenth

century (Coatsworth 1981; Duncan 1932; Lewis 1983). Similarly, British and North American rubber buyers and consumers were able to induce members of the economic elite in the Brazilian Amazon to

finance the expansion of the wild rubber industry in the region to supply the core's industrial plants in the late nineteenth century (Bunker 1985; Barham and Coomes 1994a and 1994b). This strategy dramatically reduces both the costs to and risks assumed by the ascendent core economy's firms and state in the raw materials extracting region.

The third strategy has an extremely long history, predating the emergence of the capitalist world economy. Direct imperial conquest of resource rich peripheries and the defense of these formal and/or de facto annexations by force and/or diplomatic actions, such as Belgium's conquest of the copper-rich Congo region of Africa (Packenham 1991), have, however, become increasingly difficult and expensive to carry out and maintain. As we will

demonstrate in this paper, Japan has utilized all three of these strategies at various points during its history.

Because these propositions relate to the location of the extraction, processing, and ultimate transformation of huge amounts of matter and energy, they have implications for both the global environment and a large number of specifically local environments, as well as for the economic activities of human populations. Because a key component of any national raw material access strategy involves the construction of efficient transport networks on a global scale, successful strategies to restructure global raw materials markets also reorganize the global environment. Finally, these strategies may bear directly on the benefits and prejudices to human populations in natural resource exporting societies.

Raw materials access strategies have attracted a significant amount of attention from some theorists of hegemony. Raymond Vernon (1983) remarked that the access strategies of the United States and Japan were quite similar across different minerals despite great differences in their physical characteristics, locations, and technical exigencies. Vernon believed this was so because, like Krasner (1976) and Keohane (1984), he focused on the institutional and political frames around relations between domestic firms and the national state. Huber Stephens and Stephens (1985) and Norman Girvan (1976) have both suggested that the capability of different countries' states and dominant classes to bargain effectively for capture of revenues and linkages from

minerals in their ground varies both between minerals and between social and economic characteristics of the exporting countries. Secure access to minerals requires some form of hegemonic trading regime (Keohane 1984; Bunker and O'Hearn 1992), and this requirement rests on the acquiescence and cooperation of host countries (Bunker 1992).

These studies all suggest that raw materials access strategies

vary along multiple dimensions besides political and institutional

ones. Position in the world system hierarchy and the direction and rate of change in that position impinge directly on strategic needs and strategic capabilities. Intensity of use (tons consumed per unit of GNP) of different metals varies by country and over time, as do the absolute volumes of different materials used in the world and national economies, directly affecting strategies across different minerals. Location, relative concentration of resources in space, and the structure of firm and state control over raw materials sites all affect security of access. The chemical and physical composition of the natural resources themselves constrain technological and transport options and requirements, and determine where in the chain of extraction, processing, and production the major barriers to entry occur.

Because of the need for raw materials consuming countries to secure cheap and stable access, oligopolies often emerge around dominant firms and hegemonic systems among states in the trade of materials that are industrially or militarily critical. The

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increasing remoteness of new raw materials sources and the increasing scale of extraction, processing, and transport have meant and increasingly mean that hegemonic systems can only function with the acquiescence of the host country. This results from the host country's control over the transport systems, its ability to guarantee loans, its ability to supply labor, and its willingness to enter into competition over rents. These arrangements between hegemon and periphery will vary with the economic and political conditions in both the host and the importing countries as well as with the uses, technologies, location, and volume of the specific raw material and with the characteristics of specific sites from which it is extracted and processed.

Hegemonic trading regimes emerge out of the interaction of all of these processes in ways that foster their relative stability, but these regimes also reflect the tensions between importing and exporting states and firms, as well as competition between groups of importers and groups of exporters. Rising economies must respond to the same set of constraints, but must also rearrange them in counter-hegemonic strategies that exacerbate and then solve some of these tensions in ways that weaken the previous regime and create space for a new one.

Charles Bettelheim (1972), in his comments on Arghiri Emmanuel's (1972) Unequal Exchange, pointed out that relations of unequal exchange are not in the first instance systemic but emerge

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out of binary relations. Philip McMichael (1984), writing about the establishment of British hegemony over a system of free trade,

noted that trade relations between the British core and various peripheral trading partners were tailored first to the specific countries involved. The development of hegemony emerges out of the multiplicity of these binary relations, and then becomes the frame within which these relations are carried out and renegotiated. This frame also constitutes in important ways the international commodities and financial markets within which trade occurs, affecting and restructuring those binary relations.

In this sense, the binary relations established are structured

simultaneously by the political and economic conditions of the countries involved, by the point on the product moment trajectory of the material in question, and by the number and types of other economies exporting it. In this study we examine the ways that relations between individual countries, and the quite distinct conditions of different countries, are fashioned within a successful counterhegemonic strategy by a country that was still not the major importer, and far from the major consumer, of these raw materials. Japan's raw materials access strategies were fashioned from a minority position in the market, but, as we will demonstrate, had enormous impact on the market.

Access strategies have changed over time and space in ways that require both ecological and political economic explanations. Historically, increased mass and diversity of materials consumed,

economies of scale in extraction and processing, and the progressive depletion of the sources most accessible to industrial centers have combined with the absolute spatial fixity of most mineral resources to increase mean distances between natural resource extraction and industrial production. These increased mean distances have heightened potential scale economies in transport. These scale economies in turn reinforce the technologically driven increases in the scale of extraction, because larger ships, larger ports, and longer rail lines can only return sunk investments-- frequently dedicated to a single extractive enterprise-- with larger shipments sustained over longer periods of time. These dynamics restrict greenfield mining projects to large deposits, of which there are relatively few. This further reinforces the tendency towards increased distance between extraction and consumption. It also increases the proportion of raw materials transported across national boundaries prior to transformation, and the likelihood that extractive enterprises dominate the economy and politics of the regions, and sometime the nations, in which they are located.

As distance and scale increase, mines tend to locate in areas with sparse populations and little effective integration into capitalist political, economic, and legal systems and with limited access to technical information required for effective rent bargains or for environmental or social regulation. Isolated exporting nations compete against each other in negotiations with

well-informed importing firms and states. The results are that raw materials rents and prices remain low, and that damages to environments are omitted from contract costs. Increased scale and distance, however, also raise the strategic stakes for consuming firms and the states of industrial societies. Particularly in periods of shifting hierarchy between dominant industrial nations, competitive strategies may induce excess extractive capacity, destabilizing markets and increasing environmental impact beyond the technological minimum required to satisfy world demand. Japan's rise to challenge U.S. hegemony has resulted in excess capacity, unstable markets, and increased environmental damages in many raw materials extracting peripheries.

III. JAPANESE RAW MATERIALS ACCESS STRATEGIES

Japan's ascendence from the periphery to the core of the capitalist world economy began during the Meiji period in the last third of the nineteenth century. Japanese efforts to industrialize and build a strong military paid early dividends in the form of victory in the Russo-Japanese War at the beginning of the twentieth century. Much of Japan's success was, however, due to its ability to export light industrial products such as silk and to use the proceeds to import both ships and steel plate for building military and trading ships (Chida and Davies 1990). Efforts to deepen industrialization in Japan during the first third of the twentieth

century, most notably through expanding the steel, copper and shipbuilding industries and through the creation of a domestic aluminum industry, rapidly depleted Japan's limited coal, iron ore, and copper reserves. Domestic depletion led Japan to adopt the third strategy for continuing its ascendence in the world economy: direct imperial conquest of neighboring resource-rich areas of China, East Asia, and Southeast Asia. Japan's defeat in World War II, however, foreclosed this ascendence and development strategy.

In order to support a rapid industrialization drive in the years between the first and second world wars, the Japanese state and Japanese firms sought to gain access to raw materials that were being rapidly depleted in Japan via a strategy of imperial military conquest in East and Southeast Asia. However, this raw materials access strategy brought Japan into direct military conflict with the United States, Great Britain, the Soviet Union, and China. The results of this conflict were the defeat of Japan in World War II, the dismemberment of Japan's empire, and severe economic and political crises in Japan in the war's aftermath.

From the end of the war in 1945 until late 1947, the U.S.-led occupation of Japan headed by the Supreme Commander for the Allied Powers (SCAP), General Douglas MacArthur, had a number of mandates, including purging of Japan's wartime leaders from positions of military, economic and political power and breaking up the giant zaibatsu industrial holding companies (U.S. State Department 1949; Pauley 1945). U.S. policy toward its defeated enemy focused on the

creation of a democratic, self-sufficient society in Japan that would not be able to threaten its neighbors militarily again.

A fundamental flaw in these U.S. efforts, however was that the Japanese government bureaucracy was left virtually intact by the occupation forces. Japanese economic and political elites were able to defeat, delay, and subvert many of these SCAP efforts because SCAP was forced to work through the structure of the Japanese government bureaucracy (Maki 1947). As Chitoshi Yanaga (1968) argued in an influential book, "the most important functions of the bureaucracy involve the protection and promotion of business and industry, in whose behalf it formulates long- term economic plans, makes forecasts, sets goals, and establishes priorities" (Yanaga 1968:28). The three closely linked bases of the Japanese political system, organized business, the party government, and the administrative bureaucracy (Yanaga 1968:28) have acted in coordination to guarantee long term access to increasing supplies of raw materials to Japanese industry.

Beginning in late 1947, a dramatic "Reverse Course" of U.S. policy toward Japan took place that undid many of the efforts of the initial occupation period. This resulted from the perceived geopolitical threat to U.S. hegemony in the region presented by communist regimes in the Soviet Union and, after 1949, in China. Additionally, there was also tremendous opposition from U.S. business interests which had ties to zaibatsu prior to the war, and which saw Japan as a prime location for foreign investment and

sales (Bisson 1949:95-99; Ball 1949; Bisson 1954:41-43; Hadley 1970:144-146).

The combination of obstructionism by Japanese political and economic elites and this "Reverse Course" decision restored to political and economic power in Japan the elite leadership that had planned and carried out Japan's imperial strategy in the 1930s and 1940s (Bisson 1949:95-99; Ball 1949; Bisson 1954:41-43; Hadley 1970:144-146). Industrialization and the maintenance of the existing economic and political order were once again the central foci of Japanese government and Japanese firms' strategies. However, imperial conquest had been foreclosed as a raw materials access strategy by Japan's defeat and the prohibitions on Japan's military imposed by the SCAP-written constitution.

However, new raw materials access strategies were formulated in the late 1940s through the coordinated efforts of the SCAP and the Japanese economic and political elites and government bureaucracy. SCAP and the Japanese leadership in the late 1940s and early 1950s carried out extensive efforts to assess Japan's domestic raw materials resources and their potential to meet the needs of the rapidly growing but severely impoverished Japanese population. The results of these efforts indicated that, out of the 40 minerals considered of major importance to industrial

production at that time, Japan had domestic resources of only eleven adequate to its needs for the foreseeable future, including coal for electricity generation. Copper and three other minerals

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were considered to be available domestically in substantial amounts, although at a relatively high price. Eight minerals were in deficient supply domestically, including iron, manganese and tin, while 17 minerals were strongly deficient or completely lacking in terms of domestic resources, including aluminum (Ackerman 1953:303). High quality coking coal was also almost completely unavailable in Japan, forcing Japan to rely on imports of high quality coking coal which was then typically mixed with low quality Japanese coal in steelmaking. Northern China had supplied coking coal to the Japanese steel industry prior to 1945, but the geopolitical foreclosure of this supply option meant that the U.S. had become Japan's dominant coking coal supplier after 1945, even though these imports had to be paid for in scarce dollars (Ackerman

1953:182). The search for alternative sources of coking coal would

become the pioneering effort in establishing Japan's raw materials access strategies based on state-firm cooperation. This paper will

now turn to an examination of the evolution of Japanese access strategies for coking coal and iron ore, two raw materials that Japan lacked domestically but which are the critical inputs for the

steel industry, a leading sector of the Japanese economy in the post-World War II era.

IV. COAL

The steel industry was selected by SCAP and the Japanese

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government in the late 1940s as one of the two leading sectors of the Japanese economy on which the Japanese state and Japanese firms would focus their limited economic resources (Hein 1990; Chida and Davies 1990). The electric power and shipbuilding industries were added to the list of leading sectors by the Japanese state and organized business during the 1950s and became major pillars of Japanese economic development (Hein 1990; Chida and Davies 1990).

The organizational forms, knowledge, and technologies that a rising economy must develop in order to satisfy its growing and changing raw materials requirements themselves constitute the capacities needed for world system dominance, both in terms of production and in terms of strategic relations aimed at achieving secured raw materials flows at minimal cost. The rationalization and modernization of the steel and shipbuilding industries during the 1950s and 1960s was based on the importation of methods of organizing production developed in U.S. steel mills and shipyards, the training of Japanese engineers, managers and workers by U.S. firms and experts, and the transfer of advanced technologies from

the U.S. to Japan in these industries (Hein 1990; Chida and Davies 1990), including the now famous W. Edwards Deming's ideas about quality. However, Japan's shortage of domestic raw materials meant

that new international forms of organization and trade relations had to be established to supply these rapidly modernizing industries with essential raw materials. In this arena as well, the SCAP occupation provided a foundation on which the Japanese

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state and Japanese firms could develop a model for gaining access to raw materials in other areas of the world, particularly in Australia.

There was no well-developed world market for metallurgical or steam coal in the late 1940s and early 1950s on which Japan could rely for spot purchases of rapidly growing amounts of coal, nor was

there sufficient exploration and planning for new mines anywhere in

the world to meet Japan's growing coal needs. There was also no shipping technology adequate to move tens of millions of tons of coal and iron ore thousands of miles to Japan. The Allied Occupation Forces in the late 1940s and the Japanese government from the early 1950s onwards recognized the essential importance of

securing adequate raw materials for Japanese industrialization and economic growth. U.S. Cold War-related opposition to Japanese raw materials purchases from China and the U.S.S.R. was maintained after the end of the Korean War, and forced the U.S. and Japanese governments to look farther afield for sources of raw materials for

steel production. These efforts also faced two other important constraints. Japan's actions in World War II had made Japan extremely unpopular with other Pacific Rim nations, making nations in the region unwilling to allow either Japanese direct investment or trade with Japan. Additionally, from the end of World War II until the early 1970s, Japanese firms and the Japanese economy as a whole lacked the capital resources necessary to supply large scale foreign investment in raw materials extraction, with strict

government controls on foreign exchange and investment activities in place throughout the period.

At the same time, in the early 1950s Australian firms and state agencies were searching for ways to increase steam coal exports to generate export revenues, economic growth, and employment (Panda 1982). However, the Australians had no plans to export metallurgical coal, the type of coal critical to Japan's steel industry and therefore its heavy industry-based development plans. From 1951 onward, U.S. government officials in Australia sought to promote the idea of exporting metallurgical coal to Japan, supported by World Bank loans (Priest 1993:13- 14). These early U.S.-led efforts to gain access to Australian metallurgical coal eventually did help lead to the first Australian metallurgical

coal exports to Japan in the second half of 1953. These exports of 100,000 tons of coking coal were contracted for by the Japanese Procurement Agency, a part of the U.S. Army occupation government of Japan (Priest 1993:22).

This export of metallurgical coal in 1953 set an important precedent for Australian metallurgical coal exports to Japan. Mining firms had become willing to consider exports to Japan because of decreasing domestic demand for black coal due to the substitution of petroleum in electricity generation, locomotive power, and furnace oil (Priest 1993:30-32). Changing technological and economic conditions in a resource-rich nation, Australia, thus helped to pave the way for the establishment of a long term

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metallurgical and steam coal supply relationship between Japan and Australia. Exports to Japan expanded very rapidly from the mid-1950s onward, with exports to Japan increasing from a mere 8,976 long tons in 1955-56 to 7.7 million tons in 1965-66. During this ten-year period, Japan's share of total Australian coal exports increased from a mere 4.4% to 94.4% (Raggat 1968:335), making Australia extraordinarily dependent on Japan as the purchaser of almost all of Australia's coal exports.

The key to the expansion of metallurgical coal trade between Australia and Japan was the formalization of this trade relationship that began under SCAP's guidance in the form of long term contracts (LTCs) between the Japanese steel mills and Australian and transnational coal producing firms. The first long term supply contract was signed at the end of the 1950s; a number of other metallurgical coal mines were also developed during the 1960s, 1970s and 1980s to supply the Japanese market (Koerner 1993:77; Panda 1982:94; Frost 1984:51; Scott 1979:15). As a result of this capacity expansion, Australian metallurgical coal exports to Japan increased from 7.7 million tons in 1966 to 27 million tons in 1977. This metallurgical coal trade relationship between Australia and Japan has thus become an essential pillar to support the dramatic expansion of the Japanese steel industry.

These long term contracts (LTCs) were for all or the majority of a mine's annual production, and were signed after a coal deposit had been explored and a mine proposal developed. The LTC was then

used to obtain financing, often with partial funding from Japanese banks and the Japanese government, but typically with the majority of loan funds coming from major U.S. and European banks. The Japanese trading companies which often arranged transport and sometimes the sale of coal and the Japanese steel mills which consumed the coal supplied little or none of the equity capital required to open the mine, simultaneously avoiding the problems of capital shortage for foreign investment and transferring the risk of the project to the transnational mining firm(s) which own the mine and to the banks which supplied credit. Japanese capital investment in mining operations was limited to at most small "good

faith" investments in joint ventures and loans which would be repaid by sales under these long term contracts.

Japanese steel mills, with the assistance first of SCAP and later of the Japanese state, had thus devised a model to guarantee long term secure access to metallurgical coal from Australia. The Japanese steel mills developed a new model of LTCs, rather than using the wholly-owned foreign direct investment model utilized by U.S. and European steel firms to gain access to foreign raw materials sources. This new model also accommodated the resource nationalism of host nations such as Australia. Metallurgical coal was extracted by Australian and transnational firms, and then transported by Australian state-owned railroads to typically state-owned ports where it was loaded on Japanese ships for the trip to Japan. This transport pattern allowed Japanese steel mills

and shipping firms to take advantage of the tremendous economies of scale available in bulk shipping to dramatically reduce production costs of steel in Japan. This organizational innovation of the use of LTCs, coupled with technological innovations in transport, combined to allow Japanese steel firms to gain access to raw materials outside the control of the existing major steel firms, allowing the Japanese firms to compete very effectively with these previously dominant firms. By taking advantage of the naturally provided coal and, later, iron ore resources of Australia, the interests of the Australian state and TNC mining firms profited from Japan's economic growth. Meanwhile, facilitated by the changing technologies of transport and steel production, the Japanese steel industry developed into a leading sector of the Japanese economy.

While this pattern was well suited to Japanese needs and initially allowed Japan to resume trade with Australia despite Australian antipathy toward Japan, this transfer of risk to exporting firms and nations has often proven to be quite deleterious to these firms' and nations' interests in the long term, even though the original idea for these LTC arrangements came from the Australians (Priest 1993:20-25). For example, Koerner (1993) found that "Pacific metallurgical coal markets have suffered significant distortion as a result of the resource procurement strategies of the Japanese steel industry establishment" (Koerner 1993:79). On the demand side, the Japanese steel mills' joint

negotiating strategy resulted in a bilateral monopoly, precluding competition on the demand side, while on the import side Japan's diversification strategy led to destructive competition between firms, state governments and coal exporting nations. Additionally,

"the substantial transport component of delivered cost creates a situation of bilateral monopoly bargaining over the distribution of

locational rents" (Koerner 1993:79), while the knowledge asymmetry between Japanese and suppliers' negotiators has similarly favored Japanese interests. The sum total of these advantages, Koerner argues, can be seen in the producer surplus lost to Australian coal

producers on the 365 million tons of metallurgical coal exported to

Japan since the early 1960s at US$3.6 billion in 1987 dollars (Koerner 1993:79).

Another dimension of the burden imposed on raw materials exporting regions by this Japanese metallurgical coal access strategy is the cost of transport infrastructure to move coal from mines to ports. Huge investments in railroad and port facilities, typically undertaken by national and state governments in areas such as Australia, Canada and the United States, have been essential to making coal available at competitive prices to Japanese consumers; without these investments, it simply would have

been impossible for Japan to acquire enough metallurgical coal to permit the rate of growth of its steel industry in the post-World War II era. While the governments and state-owned firms in raw materials regions have collected taxes and revenues from these

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exports, and domestic and transnational firms have typically been able to profit from these exports, these firms and governments have also been forced to bear a disproportionate share of the risks involved in making possible Japan's tremendous post-World War II economic growth. From the point of view of a particular firm or state organization, bearing risk is a potential cost which ought to require a larger return on its investments as compensation for accepting this risk; in the case of LTCs between the JSM and coal exporting firms in Australia, Canada and the U.S., however, there is little evidence that these risks and rewards were proportionately distributed. The Japanese steel mills were able to transfer a large share of the burden for meeting their coal needs to the raw materials-extracting periphery, allowing the Japanese steel mills to devote their resources to modernizing their own plants in order to compete (very effectively) in the world market.

V. IRON ORE

Japanese steel mills and the Japanese state have used a similar strategy to gain access to supplies of imported iron ore. Prior to World War II the Japanese had been interested in establishing a trade relationship with Australia for the export of iron ore to Japan. The key to these efforts had been a major foreign investment by the Nippon Mining Company in 1936 of 450,000 British pounds in the Yampi Sound Mining Company to develop the

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Koolan Island iron ore deposits in Western Australia, with the ore to be shipped to Japan in Japanese ships. However, on May 19, 1938, the Australian government ordered a total embargo on iron ore exports from Australia to any other nation. While the publicly

stated reason was concern over the limited amount of Australian iron ore resources for its domestic steel industry, the major reason was Australian concern over Japan's imperial expansion plans which were feared to include southward expansion to include Australia (Panda 1982:60- 61).

This sudden elimination of a major potential source of iron ore forced the Japanese government to focus on exploration and development of iron ore within the boundaries of the Japanese empire, including in the Yangtze region of China, the Philippines, French Indochina, Malaya, Korea, and particularly Manchukuo, and in Japan itself. These sources, plus scrap iron, were to provide the major sources of steel raw materials during World War II (Panda 1982:59- 62).

After World War II, given Japan's limited domestic iron ore resources, new foreign sources had to be found to permit the expansion of the Japanese steel industry. During the early and mid-1950s, East and Southeast Asia were Japan's major sources of iron ore. Long term supply agreements were established with mining companies in the Philippines, the state of Orissa in India, and Hong Kong; however, the cost of transporting iron ore from these areas to Japan were very high. By the end of the 1950s, Japanese

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steel firms had also begun to acquire iron ore from even more distant sources, including Peru, Chile and Brazil. Control over the shipping of their iron ore imports allowed the Japanese steel firms to take advantage of the economies of scale that were becoming available in bulk shipping on Japanese-built and Japanese-owned ships, typically owned and operated by companies belonging to the same industrial group (Panda 1982:63-67). As was the case in metallurgical coal, the combination of LTCs with foreign mining firms and Japanese firms' control over the transport of these raw materials to Japan allowed Japanese steel mills to gain access to growing volumes of iron ore imports at competitive costs.

However, the most important change in Japan's post-World War II iron ore importing situation occurred with the lifting of the Australian embargo on iron ore exports in December 1960. The lifting of the ban stimulated a tremendous boom in exploration for iron ore in Australia, because Australian and TNC mining firms would now be able to profit from extraction for export. In the early 1960s, Australian iron ore producers focused on exporting iron ore to Europe, but the long distance and resulting high transport costs made this trade extremely expensive and largely uncompetitive. In the mid-1960s, Australian iron ore exporting firms began to turn to the Japanese market because of its relative proximity and rapidly growing demand for iron ore. The Japanese steel mills signed LTCs with several major Australian iron ore

mines. These ten to sixteen year contracts provided a guaranteed market which made possible the rapid expansion of iron ore mining in Western Australia and other parts of Australia. As a result of

these LTCs, Australian iron ore exports to Japan increased from 200,000 tons in 1965 to 47.8 million tons in 1977 (Panda 1982:64-73).

Also during the late 1960s, the Japanese steel firms continued their efforts to diversify their sources of iron ore and reduce their iron ore costs through negotiations and exploration in Alaska, Guinea, South Africa and Chile. These efforts to develop new sources of iron ore outside the control of U.S. and European steel firms resulted in the establishment of long term contracts with Chile and Brazil (Panda 1982:63).

The Japanese steel firms and the Japanese state have developed a raw materials access strategy that guarantees long term access to large volumes of iron ore from distant raw materials rich regions which have become highly dependent on trade with Japan. Control over shipping by Japanese importers has allowed the benefits of the increasing scale of ocean shipping to accrue to Japanese iron ore consuming firms. Further, in order to reduce the shipping costs on

long hauls from Brazil and Australia, many Japanese steel and shipping firms have developed triangular trading patterns, often involving crude oil transport in ships known as combination carriers or ore-bulk-oil carriers (which means that these ships can carry a variety of bulk raw materials, ranging from minerals and

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grains to liquid petroleum). These triangular trading patterns reduce the amount of time that large bulk carriers spend sailing empty, thereby reducing the cost per ton of transporting iron ore and other cargoes (Penfold 1984). Organizational and technological innovations have allowed the Japanese steel firms to become competitive in world markets, despite lacking domestic sources of huge volumes of raw materials.

However, as was the case in metallurgical coal, there have been negative consequences for exporting regions from Japanese raw materials access strategies in iron ore. The tremendous bargaining advantage conferred by the combination of coordination between Japanese steel firms, the diversification of their supply sources, and their dominant position as a purchaser results in quite favorable terms of long term contracts governing iron ore sales to Japan. In Australia in particular, Japan's single largest source of iron ore, this is exacerbated by competition between Australian states, between Australian state and federal governments, and between iron ore producing firms for contracts with Japan. The result has been severe downward pressure on iron ore prices, further benefitting the Japanese steel firms (Panda 1982:79-86). Similar inequalities in relative strengths of bargaining positions between the Japanese steel firms and other iron ore exporting firms

and nations, including Brazil, have produced similarly favorable results for the Japanese steel firms.

Examination of changing patterns of international trade in

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iron and coal, with particular attention to Japanese investments in

these materials and in their associated transport, show that another major component of the success of the Japanese steel industry has been the development of large ports not only in Japan but also in the countries from which it imports these materials. Much of the capital risk has been assumed by the exporting nations, though the transport efficiencies achieved have also required major relocation of the steel industry around large deep water ports in Japan. The organization of efficient transport is the major Japanese accommodation to the physical characteristics of coal and iron--its very great weight and volume to value. On the other hand, Japanese investment strategies in both iron and coal also defy these physical characteristics. In order to achieve stability of supply, Japanese steel mills and the Japanese state have promoted joint ventures and long term contracts with mines in very diverse places, including Canada and Brazil, as well as the more proximate Indian, Australian, and Malayan sources. In Australia and Canada particularly, governments and firms have both accused the Japanese of deliberately fostering overcapacity, and in both places the Japanese steel mills have refused to honor the longterm contracts that originally guaranteed the loans for the development of the mines. The Japanese steel mills continue, however, to balance proximate sources with more distant ones, using the efficiency of transport to diminish the extra costs of diversifying supply.

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VI. TRANSPORT

It is most dramatically in transport, and in the association of shipbuilding with the steel industry in Japan, that the clear link between Japanese raw materials access strategies and its effect on the world economy emerges. Transport has played a variety of roles as a component of Japan's post-World War II raw materials access strategy, and of its broader economic development strategy. By 1984 Japan accounted for 17% of total world seaborne imports in terms of volume because of the huge volume of raw materials imports needed to supply Japan's rapid economic growth, making Japan by far the world's most important importing nation (Stopford 1988:141).

The transport dimension of Japan's raw materials access strategy has focused on making possible the tremendous expansion of raw materials imports at competitive cost levels necessary for Japan's industrial expansion since World War II. Petroleum, iron ore and coal have been the most important imports in terms of volume, although bauxite, alumina, aluminum, copper concentrates, liquefied natural gas, and a host of other minerals have also been imported in increasing volumes during this period. The key elements of transport as a raw materials access strategy have included research and development on the construction of larger petroleum tankers and bulk carriers, and the construction of large

shipyards capable of building such large ships. These large ships are owned and operated by Japanese shipping firms associated with the major industrial groups; these Japanese industrial groups control ocean shipping of raw materials on an FOB raw materials exporting port basis, so that any reductions in transport costs caused by technological improvements or changes in world shipping market conditions are captured by Japanese importers. The construction of large scale port and railroad infrastructures in raw materials exporting regions paid for by extractive region governments and/or raw materials TNCs is based on long term contracts for raw materials supply with Japanese importing firms to allow the efficient use of these large ships. Additionally, the Japanese government provides subsidies for the construction of Maritime Industrial Areas in Japanese ports, which eliminate the need for internal transshipment in Japan of raw materials imports.

The volume of raw materials in transmaritime trade has quadrupled at least since 1960, in large part as the result of Japan's economic growth, and the available economies of scale have increased proportionately. Capturing economies of scale in transport requires the construction of massive port systems, capable not only of accommodating large boats but also of loading them and unloading them quickly enough to prevent incurring the huge costs of stranding the capital intensive ships for long periods of time in harbor. The costs of building such ports have enhanced a feature of all constructed transport systems, that is,

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that to the extent that exporting and importing systems must be physically compatible to take advantage of cost-saving technologies, importers can tie exporters to their markets by fomenting mutually compatible port systems at both ends of the voyage. One of the clearest indications of the increasing power of Japan and, to a lesser extent, the EC in the world system is their much more rapid construction of such systems, both at home and in selected parts of the periphery and semiperiphery. Japan's topography favors such port systems, but the state and heavy industrial firms have collaborated in reshaping the domestic and the international environment in such a way as to maximize these advantages.

Shipbuilding and the steel industry constituted two of the Japanese government's linchpins for planned development in the post- World War II era. The two industries sustained each other in critical ways. An efficient shipping sector was critical for the importation of the raw materials that would be essential to Japan's successful competition in the world market, while steel was the critical input for shipbuilding. The Japanese strategy for developing a competitive steel industry was based on promoting plants that maximized scale economies, and then assuring that they ran at full capacity. During the apogee of the shipbuilding industry it absorbed as much as 35 percent of steel output, and it

also fostered a number of ancillary industries that eventually became autonomous. The efficiency of shipbuilding depended on

cheap steel, and cheap steel depended on cheap transport. The Japanese dominated the shipbuilding industry, achieving economies of scale sustained by their exports, while the steel industry benefitted from the huge ports and large boats that the shipbuilding industry provided. Tremendous synergies emerged between the two industries, with the growth of each contributing to the other's growth as well.

Steel and shipbuilding enjoyed subsidies and tax breaks which were far greater than almost any other sector, reflecting the role of these two industries and motor vehicles as the three pillars of post-World War II Japanese economic development strategy and the state- firm cooperation that has guided Japan's development. The cumulative result of various forms of state support were to provide these large scale, capital intensive industries with low cost capital which permitted the massive initial investments and continual investments in expansion and modernization which allowed these industries to become world leaders during the period.

VII. COPPER

At the end of World War II, Japan had a small domestic supply of copper and a long-established domestic copper mining and processing industry. The post-war assessment of Japan's domestic raw materials supplies indicated that sufficient amounts of copper were available to meet Japanese industrial demand for the

foreseeable future, but only at a relatively high cost (Ackerman 1953:303). Rapid economic growth in the 1950s combined with increasing depletion of domestic resources to lead Japanese copper firms to search for foreign sources of copper ore. By 1955, Japan was already dependent on imports of copper ore and concentrates (copper ore which had undergone a relatively technologically simple

and inexpensive processing step to reduce the amount of waste included in the ore) for 37.7% of its copper needs (Vernon 1983:131).

The earliest Japanese direct investments in overseas metals appear to have been in copper mines, and were motivated, according to Vernon (1983:100), primarily by the instability of copper prices

on the London Metals Exchange. Japanese direct involvement in foreign copper mines began in 1953 in the Philippines. Several mines were developed in the Philippines to export copper ore and concentrates to Japan in the 1950s and 1960s. However, by the end of 1972 Canada had become Japan's largest supplier as the result of

minority equity participation in and long term contracts with new major copper mines, particularly in western Canada (USBM 1972:484).

Additionally, in the early 1970s LTCs and equity participation from

Japanese copper firms also brought a number of other major new copper mines onstream which produced copper ores and concentrates for export to Japan. These projects were located in a number of raw materials extracting peripheries, including Papua New Guinea, Indonesia, Zaire, Iran, and Malaysia (USBM 1972:484-485). Japan

accounts for about 60% of the expanding world trade in copper concentrate, a clear indicator of Japan's dominance of this trade.

However, by the mid-1970s in the wake of the first oil price shock and the resulting worldwide recession, a very unusual pattern emerged in Japanese copper firms' search for supplies of copper concentrates, supported by the Japanese state. While continuing to explore for new sources of copper in many parts of the world, to negotiate new long term contracts, and to form new joint ventures with new suppliers of copper concentrates, Japanese copper firms also engaged in renegotiating price and volume terms of existing long term contracts with mines in which they did not hold equity stakes. During 1974, for example, Japanese copper firms signed agreements to explore for or to develop copper deposits in Papua New Guinea, Saudi Arabia, Australia, Zaire, Chile, Peru, and Panama (USBM 1974:543). At the same time, Japanese copper firms had negotiated for and won cutbacks in long term contract volumes with mines in Papua New Guinea, Canada, and the Philippines (USBM 1974:543). This pattern of continuing to search for new sources of copper concentrates even in periods of stagnant demand and falling prices, while simultaneously seeking to impose price and volume cuts on existing suppliers in which Japanese copper firms did not have equity participation, has characterized Japan's copper concentrate supply strategy over the last twenty years.

The Philippines retained their second position as a copper concentrate supplier to Japan until the end of 1984, when the U.S.

became Japan's second largest copper ore supplier (USBM Various Years; Metallgesellschaft Various Years). The tightening of environmental regulations in the United States, and the high cost of meeting these requirements at many old U.S. copper smelters and refineries, combined to make significant volumes of U.S. copper ore and concentrates available for sale to Japan from several U.S. copper firms in the early and mid-1980s. This has transformed a large part of the U.S. copper industry from a vertically integrated oligopoly supplying the U.S. and world markets for copper-based products, into a supplier of raw materials to the Japanese copper industry.

This Japanese copper access strategy also led to a major change in the structure of the copper industry between 1950 and 1988 that is most evident in the degree of territorial integration or decentralization of the stages of processing. Copper smelting historically has occurred close to the mine. Copper smelting is relatively simple technically and involves relatively low fixed costs in comparison with many other metal processing plants, while

the relatively low grade of most copper ores means that there are large transport economies to be achieved by smelting near the mine.

However, since the 1950s increasing copper concentrate exports have led to an increasing spatial separation of the stages of the copper industry, despite the natural, technological and economic factors favoring integration.

This shift is remarkable, given the cost disadvantages of

transporting concentrate (which usually have only about 30% copper content) instead of blister or anode copper. Japanese copper firms have solved this problem by economies of scale in shipping and in processing. By concentrating the copper smelters and refineries spatially in Japan, they have also achieved economies of scale that allow for the capture of potentially polluting byproducts that are too expensive to process in small batches and too costly to transport over long distances. Thus, sulphur dioxide is transformed into sulfuric acid, while the cadmium, lead, arsenic and other minerals commonly associated with copper ores are used instead of being dispersed into the environment. Japanese copper firms use long term contracts to stabilize supplies, and so can also be assured that they can stabilize the types and grades of ores imported. This means that they can use the capacity required for by-product capture on a regular basis, without having to adjust to the variable mineral and chemical composition of ores from different sources.

Efficient transport and adaptation to the diversity of chemical and mineral ore composition allowed the Japanese state and copper firms to overcome the physical and spatial logic that had dictated spatial integration of the industry, helping to destroy the existing copper oligopoly in the process and making large supplies of low cost copper available for Japanese industry.

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VIII. ALUMINUM

The case of aluminum is more complex than that of copper, since Japanese aluminum firms and the Japanese state used joint ventures to overcome oligopolistic control of the world aluminum market and in the process radically changed the environmental and spatial logic of that market. This was done by transferring capital risk and cost to resource-rich countries.

The Japanese strategies to gain access to aluminum constitute the mirror image of their strategies in copper. Unlike copper, the physical characteristics of aluminum-- relatively homogeneous ore of high grade and easily transported-- early on fostered spatial dispersal of the levels of processing. Smelted copper may weigh as little as 2 percent of the weight of the ore from which it

has been reduced, and even processing into ore concentrate achieves

more than a three to one reduction of weight. The reduction of bauxite to alumina involves only about a 50 percent reduction of bulk, while alumina must be protected from moisture and is therefore by weight more costly to transport. The high capital barriers to alumina refining in relation to the small gains in transport cost had constituted a major barrier to those bauxite-rich countries that aspired to in-country processing. Japanese aluminum firms and the Japanese state, acting in coordinated consortia, played to these aspirations by offering joint ventures in smelters to bauxite and hydro-electric rich

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nations. They thus created an incentive to get host government support of hydroelectric dams and other infrastructure. The Japanese consortia fostered spatial integration to break the vertical integration of the oligopoly. In the process, they created large amounts of excess capacity in the world, leading to long term decline and continued instability of prices. They managed to devolve much of the cost of this on the bauxite-rich nations, whose investment decisions would have made sense under the price stabilizing oligopoly but were disastrous under the highly competitive market conditions that the Japanese aluminum firms helped create.

The Japanese consortia did not invent joint ventures, nor were

they the first to use them in aluminum smelting. The first significant joint ventures in aluminum smelting were negotiated in the 1960s, and in bauxite extraction as early as the 1950s. The joint ventures of the late 1960s and early 1970s somewhat diluted the six-firm oligopoly's control of extraction and refining, but the only concession on the part of the North American and European aluminum oligopolists on the more critical supply of primary aluminum--that is, control over smelting--was to Australian, Japanese, Mexican, and Venezuelan smelters too small to supply more

than domestic markets.

Japanese consortia have used joint ventures in aluminum in a very different manner. Rather than treating joint ventures as special concessions made to gain access to protected markets or to

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share control with other firms likely to adhere to oligopolistic price regulation, the Japanese consortia sought to reduce their direct investment, taking minority positions with Brazilian, Venezuelan, and Indonesian state-owned firms and with Australian, New Zealand, and Canadian private firms. Also, Japanese coordinated public and private investment has been aimed at lowering prices and stabilizing supply by increasing and diversifying sources, rather than stabilizing prices by deterring entrants and restricting sources.

The experiences of the so-called "Nixon Shock" (an embargo on soy exports from the United States), together with the fright of

OPEC and the first oil shock, enhanced fears of dependence on other core firms for raw materials and enhanced official support for "resource diplomacy" and the creation of either tied sales with exporting countries or some form of equity investment. Japan itself did not have sufficient capital for foreign direct investment in all of the resources required, nor were many potential host countries well disposed to fully financed foreign direct investment. However, the huge surplus of finance capital available after the first oil shock combined with the aspirations of many countries to control the exploitation of their own minerals to create optimal conditions for the kinds of joint ventures that ultimately opened up the international market in aluminum and created a price-lowering surplus capacity.

There was no attempt to regulate prices upward. On the

contrary, the Japanese consortia investments often included end consumers and fabricators as well as primary producers in agreements mediated by MITI, Keidanren, and various sogo shosha (Japanese trading companies), with the declared purpose of assuring cheap and stable supplies. The Japanese EXIM Bank intervened in at least one case of shareholder concern that the prices of aluminum would be too low to compensate their investment, reducing its interest rates sufficiently to keep the Japanese smelters in the consortium with Brazil. In Indonesia, the Japanese consortium negotiated to reduce their share in equity. Where possible, the Japanese joint ventures were restricted to the smelters themselves, and the national state invested in the associated infrastructure of dams, transmission lines, roads, and ports. The Japanese consortia have also tended to invest further downstream than the joint ventures of the majors, eschewing mines and refineries and concentrating on smelters.

While there are key differences between Japanese and earlier major joint ventures, both types of expansion have converged in the creation of uncontrolled excess capacity. Average smelter size more than doubled between 1954 and 1974, and more than tripled between 1954 and 1989. The increased scale of investment itself necessarily makes supply less sensitive to demand, as investment becomes increasingly lumpy. Even partnerships between major firms with a common interest in regulating prices may impede quick decisions in response to market downturns (Author's Interview with

Alcoa Executives in June 1990). At the same time, the number of firms in the aluminum industry nearly doubled from 1954 to 1969, increased by almost as much again in the next five years, and by 1989 was three times what it had been 35 years earlier (Ciccantell

1993). Clearly, even before the massive expansion of Japanese smelting capacity from 1969 to 1979 the oligopoly was losing control over world capacity and the ability to regulate prices.

This loss of control became most evident in 1977, when aluminum was quoted for the first time on the London Metals Exchange, reflecting the emergence of a significant spot market. Such a market could not exist as long as a few companies dominated supply and managed sales through long-term contracts or intra-firm transfers. This loss of control, or at least its full implications, were not immediately evident to the major firms or even to the smaller ones at the time, however, and many of them continued to make investment decisions based on the assumption that prices would remain stable or increase. In Brazil, for example, a Japanese consortium had induced the Brazilian government to assume fully the costs of building a hydroelectric dam and transmission lines to support a joint venture in smelting between the Japanese and a Brazilian state company, and thus increased world capacity at relatively little cost to the Japanese partners. When Alcoa responded by building a second smelter nearby, it enhanced the capacity expansion without in any sense increasing or protecting its own market control, and thus effectively played into the

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Japanese interest in a diversified competitive market for this raw material.

Aluminum has, over this period, tended towards somewhat increased amounts of territorial integration, with the more refined product increasing its share of total world trade (Table 1).

TABLE 1

CHANGING PROPORTIONS OF LEVEL OF PROCESSING IN THE WORLD ALUMINUM TRADE

BAUXITE (1), ALUMINA (2), AND ALUMINUM (3)
(OOO tons in total exports)

	1962	1975	1988
1.	16,980,220	27,950,470	27,781,130
2.	1,101,203	9,460,968	12,169,070
3.	958,961	2,940,328	8,785,369

In terms of contained aluminum, bauxite constituted over 70% of total trade in 1962, less than 45% by 1975, and less than 30% in 1988. In the same time, aluminum constituted about 20% in 1962, just over 20% in 1975, but by 1988 accounted for over 40%. In terms of value, the changes are even more dramatic.

In short, we see a significant growth of the proportion of

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alumina in trade between 1962 and 1975, and then major growth in the proportion of aluminum traded between 1975 and 1988. This is quite remarkable, as bauxite and alumina are both far more readily transportable than is copper concentrate. The more transportable

of the two industries is moving toward spatial concentration, while the less transportable commodity is being traded more. While there were a greater number of forces leading to the spatial integration of aluminum than there were leading to the spatial dispersal of copper, the Japanese aluminum firms in conjunction with the Japanese state played a major role in restructuring the aluminum industry. The huge excess capacity in that industry, even before the massive entry of former Soviet smelters into the market, was in large measure a product of these strategies to supply Japan with aluminum.

IX. CONCLUSION

U.S. strategies to secure access to minerals during its rise to industrial and military preeminence responded to the political organization of the world in the early and middle 20th century. In the 1920s and 1930s, the Council on Foreign Relations elaborated geopolitical schemes for securing access to critical and strategic materials and proposed international financial institutions to stabilize investment flows and costs. World War II and the Bretton Woods Conference created the conditions for the concrete

realization of these schemes. As Britain had in the 1820s, the U.S. in the 1940s and 1950s manipulated nationalist aspirations to secure access to resources under European colonial control. It also used Europe's desperate need for capital to coerce access through the threat of withholding Marshall Aid (Bunker and O'Hearn 1992). The World Bank and the IMF have served to palliate the economic distortions of U.S. political and economic intervention in raw materials exporting countries, and to ensure that exports continue despite economic crises.

Japanese firms and the Japanese state confronted a very different situation as they began their industrial ascent in the 1950s. The U.S. had faced a weakened imperial system run by decapitalized industrial powers already in relative decline. Japan faced a politically and economically vibrant and still expansive core competitor that directly controlled the majority of natural resources through direct investment and ownership. The U.S. government, both during the Occupation period and during the 1950s, supplied significant assistance to initial Japanese efforts to gain access to new raw materials sources, but the bulk of the responsibility for creating new raw materials supply systems fell to Japanese raw materials firms and the Japanese government. Japan had far less capital at its disposal than the U.S. had after World War II. In the intervening years, the scale of extractive, processing, and transport technology in most minerals had increased and many underdeveloped but resource-rich nations were far more

exigent in their resource contracts than they had been. Japan also had to confront the most dramatic manifestation of these exigencies in the middle phase of their ascent when OPEC pushed up oil prices in 1973 and 1979, greatly raising energy costs for industrial

processes and for raw materials transport.

Japan has turned some of these obstacles to its own advantage. They have solved the problems of increased investment scale in extraction and processing, and of nationalist demands for control over and development from mineral extraction, by exploiting indirectly the large surpluses of finance capital that resulted from the oil shocks of the 1970s through the development of new forms of investment--joint ventures with poor and indebted states willing to assume even greater levels of debt. In some cases, however, the host country participation was driven by a desire to achieve sovereign and technical control over their own resources and to construct downstream linkages around extractive revenues and infrastructure. This has been clearest in the case of aluminum, where national aspirations to forward linkages from mine and further deepening of industrial transformation has inspired states with extensive experience of import substitution industrialization to commit large sums of public money to infrastructures and industrial plants, including smelters. In other cases, host country participation seems to have been driven more by desire for access to revenues and rents. These countries, poorer and less developed, have been host to investments in copper mining without

the forward processing capacity to add value domestically, and therefore dependent on the existence of smelting and refining capacity elsewhere.

In contrast to aluminum and copper, Japanese strategies to secure access to iron and coal, both with much lower value to volume ratios and both consumed in much greater volumes, have focused on long-term contracts with host countries and placed most of their efforts on the development of highly efficient large-scale transport systems, including integrated rail, port, and shipping systems. Drastic reduction of transport costs to Japan, and then coordinated efforts between the Ministry of International Trade and Industry (MITI) and the steel and copper industries to locate processors with large economies of scale close to ports and to downstream fabricators, have overcome the competitive disadvantages of Japan's distance from its raw materials suppliers.

If we look at the timing, the location, and the type of investment in raw materials, Japanese strategies vary as much between commodities as they differ from U.S. strategies. In both iron ore and coal, Japanese firms have supplied only a limited number of small equity stakes, depending almost exclusively on long term contracts with North American, European and Australian mining firms for supplies of these raw materials. These raw materials are overwhelmingly supplied by industrially advanced nations, including Australia, Canada, the United States, Brazil, and South Africa. In copper, by contrast, Japanese firms and consortia have invested

primarily in mining in industrially less developed nations such as Papua New Guinea and Zaire, and have preferred to import the least

processed form of the raw material practical in world trade. In aluminum, meanwhile, Japanese investors have eschewed mines and have instead chosen to invest further along the processing chain. They have favored smelters in industrially more developed countries like Brazil, Venezuela, New Zealand, and Australia. Imports are now dominated by ingots, the third stage in processing.

Japanese investment in the United States and Canada follows the same pattern. Japanese firms have invested in United States mines that will export copper concentrate to Japan, largely from previously integrated mines whose smelters have been closed due to increased pollution control regulations. Japan imports processed aluminum from both countries. What this means effectively is that Japanese strategies have been to invest in the phase of the industry with the highest entry barriers--mines in iron ore, coal and copper, and smelters in aluminum, but to do so with a relatively low share of equity in association with host country states and firms.

The key to Japanese access strategies in all of these major raw materials has been to invert the existing predominant raw materials supply arrangements of North American and European raw materials TNCs. In iron ore and coal, this entailed the creation of worldwide transport networks which dramatically reduced the cost of moving huge bulks of raw materials to Japan. In copper, where

smelting and refining had historically taken place close to the mine, Japanese firms and the Japanese state promoted the development of mines without associated smelters and refineries and for which the major market was in Japan. In the case of aluminum, in which aluminum had historically been smelted close to markets, the Japanese consortia inverted this situation during the last two decades of high energy costs and moved the smelting industry to energy-rich regions and exported aluminum ingot to the Japanese markets.

Publicly and formally, government and industry officials in Canada and Australia have complained that the Japanese deliberately enticed them into joint ventures and long term contracts that created excess capacity in the world market (Anderson 1987). Shipping analysts have alleged a parallel strategy in world bulk shipping capacity. Brazilian analysts have claimed similar intent in the creation of aluminum overcapacity (Machado 1988; Bomsel et al. 1990). Mainstream U.S. and British resource economists have generally, however, dismissed these allegations, stating that Japanese firms and state planners simply overestimated future demand and had to adjust their contracts accordingly. We believe, however, that once the very different physical characteristics of the different raw materials are taken into account, there is an extraordinary central tendency to increased Japanese advantage in diversification of supplies and creation of excess capacity at quite different times in each of these raw materials. Japanese

steel mills abrogated long term contracts in iron and coal well before the economic downturn of the early 1980s, and continued to seek diversified sources even after it was reducing takes from earlier contracts. The Japanese consortium strongly resisted Indonesian attempts to reduce aluminum shipments to Japan even when other Japanese consortia were reducing their commitments in Brazil and Venezuela. In Australia, Brazil and Canada, as well as in Indonesia and in the Philippines, access to raw materials has been integrated in multiple ways with influence on expenditures in transport, including investment in railways, shipping, and harbors, as well as in other kinds of primary goods, including timber.

These coordinated ventures, to which the Japanese trading companies (sogo shosha) seem particularly well adapted, go well beyond any explanation of exporting in order to pay for imports. At the very least, they indicate that Japanese firms and the Japanese state have been able to respond more quickly and effectively to the new market structures that they themselves were stimulating than have other core powers. We believe, however, that the high degree of consonance of Japanese access strategies across time, space and materials indicates a strategy of control that goes beyond the particular materials. Unlike British strategies, based on an alternation between naval dominance, claims to free trade, and empire-building (see McMichael 1984), and unlike the U.S. strategies based on foreign direct investment guaranteed by military and diplomatic force, Japanese raw materials access

strategies have been aimed at undermining established oligopolies and creating highly competitive, overcapitalized industries with high levels of technical, financial and transport dependence on Japan.

Japanese success in these strategies has effectively changed the world market for multiple basic goods and services. The destruction of established raw materials oligopolies based in North America and Western Europe in steel, copper and aluminum has created a worldwide raw materials extraction, processing and trade network that has dramatically lowered the cost to firms in raw materials-poor Japan of obtaining the inputs for the Japanese steel, shipbuilding, and automobile industries that have been the leading sectors of the Japanese economy in the post-World War II era. Without these raw materials access strategies to reduce the cost of these inputs, economic growth in Japan on the tremendous scale of the second half of the twentieth century would not have been possible. These economic and geopolitical raw materials access strategies freed Japan from the dominance of existing core powers and core firms, allowing Japan to rise to challenge U.S. hegemony. Acceptance of the U.S.-dominated Bretton Woods and GATT trade regimes would not have allowed Japan to develop so rapidly or completely; only by creating a new Japan-focused raw materials trade network could Japanese firms and the Japanese government have the essential low cost raw materials imports to successfully engineer Japan's challenge to U.S. hegemony.

Japanese raw materials access strategies have also changed the distribution of rents from natural resources and from the natural environment modified by sunk investments. These strategies work differently than do those identified as hegemonic in earlier periods, but they are hegemonic nonetheless. Like earlier hegemonic strategies, they will engender resistance both from the core and from the periphery, but the forms of resistance will respond to the peculiarities of Japanese strategies. In the meantime, the structures which these Japanese access strategies have helped create in these raw materials markets will continue to favor, and thus to strengthen, the Japanese position in these markets. Japanese firms already have considerable control over the access to raw materials of the industrializing East Asian economies. This control must facilitate their entry into or influence on other sectors of these economies. The emergence of Tokyo as a major financial center can only fortify these tendencies.

Holland and Britain both established the bases for hegemony in their search for raw materials, and we believe that the Japanese followed that pattern. This is not necessarily deliberate; it is rather the effect of the close ties between the raw materials and transport requirements of a rising economy and its need to subordinate peripheral regions in order to satisfy those requirements. The kinds of control achieved in successful raw materials access strategies provide critical means to other kinds

of economic and political power. Once the organizational, informational, technical, and infrastructural forms needed to subordinate and coordinate numerous, spatially diffuse, resource-rich peripheries are established, and experience in manipulating them is accumulated, firms and the state in an ascending economy will use and fortify them to their own advantage.

Hegemony emerges through the accumulation of such advantages, and capital will use these advantages as it can. The establishment of this Japan-focused raw materials network was one of the fundamental building blocks (materially, economically, organizationally and technologically) for Japan's rise to challenge U.S. hegemony. We suspect that the political will that Krasner (1984) and others discuss becomes important only in the face of resistance, usually at the peak of hegemony. So far, the Japanese have displayed not only great political will, but also an alacrity of collaboration between firms and between firms and the state. There is an ample literature on Japanese perceptions of resource dependency and vulnerability. We would guess that Japan will tenaciously pursue and defend its carefully constructed advantages, but we also have seen and heard evidence of growing resentment, if not yet resistance, to the ways the Japanese have restructured markets and reorganized global environments.

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