Privatization, Globalization, and Raw Materials-Based Development: The Aluminum Industry in the Brazilian Amazon

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ABSTRACT

This paper examines the role of raw materials-based development via the aluminum industry in Brazil and especially the Amazon region. The paper first outlines the historical development of the Brazilian industry as the product of a complex interaction between the globalization of the industry, the strategies of the aluminum TNCs and Brazilian firms, and the development strategies of the Brazilian state. The paper focuses its analysis on the most recent phase of the globalization of the aluminum industry and on how the Amazon has become a major location for the industry. Over the past twenty years, an increasingly global search for new sources of bauxite and hydroelectricity, the growth of Japanese aluminum firms, the entry of new firms based in the periphery and semiperiphery into the industry, the concentration of aluminum industry among a smaller number of much larger firms, and the shift in state development strategies in many nations to the neoliberal model of privatization and market opening have transformed the industry. In the Brazilian Amazon, the combination of large scale, high quality resources of bauxite and hydroelectricity and several decades of experience of Brazilian and TNC aluminum firms in southern Brazil made the region a focal point of the global industry and the Brazilian state for the past three decades.

In the Amazonian aluminum industry in recent years, these trends have produced a difficult and contradictory situation that calls into
question the economic, social and environmental sustainability of this industry. The privatization of CVRD, one of the world’s largest aluminum companies, is transforming the aluminum industry in the Brazilian Amazon. In the context of concentration and globalization in the industry, CVRD faces an increasingly competitive global environment that threatens the future of its operations. At the same time, electricity shortages deriving from a drought in much of Brazil and a lack of state investment by the regional electric utility that has been effectively bankrupt for two decades due to state support for export-led industrialization, in combination with a conflict-filled and slow process of electricity privatization and opening to generation by major power consumers, threatens to curtail or even eliminate the industry. This paper examines these changes in the aluminum industry in the Brazilian Amazon and their impacts on the communities dependent on these operations.
I. INTRODUCTION

The Brazilian aluminum industry was founded in the early 1940s, fifty years after the industry began in the U.S. and Western Europe. By the 1990s, the Brazilian aluminum industry was the sixth largest in the world. This rapid growth, the resulting importance of the aluminum industry in the Brazilian economy, and the socioeconomic and environmental impacts of this development pattern are the focus of an ongoing research project.

In an earlier paper (Ciccantell 2000a), four distinct phases of globalization since the late 1800s were identified. That paper also analyzed the articulation of these phases with the evolution of transnational corporations' (TNCs’) competitive strategies and the three major development strategies employed by peripheral and semiperipheral states to promote economic growth, import-substitution industrialization (ISI), export-led industrialization (ELI), and economic restructuring, and explained how state development strategies in peripheral and semiperipheral nations are formulated and implemented in the context of this wider process of globalization and of the strategies of core and domestic firms and core states to accomplish their own goals. The aluminum industry was used as a case study of this process.

Another paper extended that line of analysis by focusing on the development of the aluminum industries of Brazil and Venezuela through the late 1990s (Ciccantell 2000b). During the first three phases of globalization, state-led development strategies in these and many other nations focused on vertically linked natural resource-based industries for domestic consumption and for export. During the latest phase of globalization since the mid-1980s, restructuring and privatization are
transforming Latin America and exposing these industries to competition and pressures to reduce costs, and these changes have had profound impacts in Brazil and Venezuela (Ciccantell 2000b). The present paper will focus on the past few years of the current era and the socioeconomic and environmental sustainability of this pattern of development in the Brazilian Amazon.

The analysis presented in this paper utilizes a variety of data sources. Data sets were constructed from published and unpublished data from the Associacao Brasileira do Aluminio (Brazilian Aluminum Association, ABAL), the Departamento Nacional da Producao Mineral of the government of Brazil, the United States Bureau of Mines and Geological Survey, the American Bureau of Metal Statistics, the World Bureau of Metal Statistics, the International Monetary Fund, and the United Nations. Secondary analysis of corporate publications and archival documents, trade publications, newspaper accounts, and other histories and analyses of the Brazilian aluminum industry was conducted. These data were complemented by interviews conducted during earlier phases of the research with executives and employees of the aluminum firms operating in Brazil and of the electric utilities serving the aluminum industry, as well as field visits to aluminum industry facilities and the communities dependent on these facilities.

Following a summary of the model of the articulation of the phases of globalization with state development strategies and the application of this model to the aluminum industry in Brazil drawn from Ciccantell (2000a and 2000b), the paper focuses on the fourth phase of globalization in the Brazilian aluminum industry and particularly the last few years of the industry in the Brazilian Amazon.
II. GLOBALIZATION, DEVELOPMENT STRATEGY, & ALUMINUM IN BRAZIL, 1940-1970

The starting point for this analysis is the widely used concept of globalization: "the intensification of economic, political, social, and cultural relations across borders" (Holm and Sorenson 1995:4). A central element of this process is the compression of time and space. This process is not, however, a smooth process of eliminating national and sectoral differences, but instead is inherently an uneven process geographically and sectorally (Holm and Sorenson 1995:4; Harvey 1995; Harvey 1996; Hershberg 1998), with globalization taking place at vastly different rates in different nations and industrial sectors, having very different impacts on core, peripheral and semiperipheral nations (Boxill 1994:8), and being inherently conflictual (Robertson and Khondker 1998:29). In a broad sense, globalization is an inherent characteristic of the capitalist world economy, with broadening and deepening crossnational linkages progressively incorporating territories and social groups into the world economy (see, e.g., Sunkel 1995; Boxill 1994; Woods 1998; Arrighi 1998; Amin 1996; Harvey 1995). The nature of globalization has, however, changed dramatically over the past century as global firms and production networks have emerged, beginning in the late 1800s (Ciccantell 2000a).

The first phase of globalization in the late 1800s and the first half of the 1900s had three chief components: a search for new markets for core industrial products; an intense search in increasingly remote regions for raw materials to supply core industries; and the development of increasingly global transnational corporations (Barnet and Muller 1974; Hymer 1979; Jenkins 1987; Ciccantell 2000a).

The creation of the oligopolistic structure of the aluminum industry
during the first phase of globalization resulted from control over aluminum smelting patents by three aluminum TNCs (Barham 1994) that were able to keep out competitors until just before World War I (cf. Wallace 1937; Marlio 1947; Carr 1952; Smith 1988; Barham 1994). These firms and their customers developed a variety of uses for this newly available light, strong, and malleable material, most notably in transportation, munitions, and consumer goods during the first three decades of the industry. These uses made the strategic value of aluminum clear to national governments in Europe, resulting in government support for national aluminum companies in Britain, Germany and Italy; these core states’ efforts promoted ISI to guarantee access to this militarily critical material (Ciccantell 2000a).

Alcoa, Pechiney, Alusuisse, and Alcan were the first of six large, vertically integrated, core based aluminum majors who made up the aluminum oligopoly (joined by Reynolds and Kaiser in the 1940s). Since the early 1900s, the major aluminum firms were forced by a need to find new markets for production from increasingly large scale plants and a need for raw materials from other nations to begin thinking in terms of global sourcing and marketing strategies. The aluminum majors were pioneers of globalization, combining intrafirm trade and transnational investment strategies to meet these needs (Ciccantell 2000a).

The second phase of globalization began with the end of World War II and the ensuing process of decolonization. U.S. economic and political hegemony from the late 1940s through the late 1960s was manifested internationally by transnational firms based in the U.S. These TNCs' major strategies during this period were: to expand globally to sell U.S.-made products in other nations; to invest in local production
facilities to supply local markets when necessary and repatriate profits to the U.S. headquarters; to export products from these facilities to U.S. markets; and to export raw materials to the U.S. (Barnet and Muller 1974; Hymer 1979; Jenkins 1987; Chase-Dunn 1989; Ciccantell 2000a).

Of these characteristics, the phrase "when necessary" is critical. The most significant change during this phase of globalization was the increasing willingness and ability of governments around the world to force U.S. and other TNCs to invest locally in ISI facilities (Furtado 1970; Sunkel 1995:48-49). Access to local markets was frequently conditioned on investment in local production facilities; in nations with large, growing domestic markets like Brazil (Evans 1979; Teitel and Thoumi 1986), these efforts were quite effective. In raw materials industries in the post-World War II era, raw materials wealth presented a developmental path that many peripheral nations sought to follow. Based on the model of linkages propounded by Hirschman (1958) and the logic of growth poles (Perroux 1955; Bunker 1989), a number of nations followed the prescriptions of resource-based industrialization (Roemer 1977; Auty 1990; see also Roberts 1995 on the Carajás program in the Brazilian Amazon). For some nations, this was a major contributor to upward mobility in the global social structure, moving from the periphery to the semiperiphery of the world economy (Ciccantell 1994, 2000a).

After World War II, three factors combined to produce dramatic growth in aluminum production and in the number of firms in the industry during the second phase of globalization. First, rapid world economic growth led to the expansion of the markets for aluminum. Second, this rapid growth of aluminum consumption provided an excellent opportunity for the entry of new firms into the aluminum industry. Finally, the
independence of former colonial areas and the major economic expansions in long-independent areas of the periphery, especially Latin America, resulted in the availability of bauxite deposits, hydroelectric sites, and new markets for both the major firms and new entrants in the industry. The availability of these resources and markets was crucially conditioned by the efforts to promote economic development through ISI in many nations of the periphery (Ciccantell 2000a).

The efforts of the six aluminum majors to control the costs and risks associated with the rapidly growing globalization of the industry and to accommodate these ISI development strategies (which often called for the involvement of local firms) led to increased reliance on joint ventures in all three stages of the industry. The aluminum industry was a pioneer of this strategy for sharing risks, costs, technology and expertise in a globalizing industry. These cooperative joint ventures gave each of the majors added strength in the direct competition with their chief rivals, the other majors. This strength resulted from cost savings due to sharing the burden of the increasing scale of investment in bauxite mines, alumina refineries and aluminum smelters. Moreover, these joint ventures reduced the risks to a major firm of making large investments in the periphery and semiperiphery, and their smaller partners could absorb a share of production. Finally, these new smaller firms enhanced the bargaining power of the firms involved in projects relative to the governments of both the host nation and of the firms' home nations; this increased bargaining power allowed firms to drive better bargains with host nations (Ciccantell 2000a).

The most important long term result of the majors' joint venture strategy during the second phase of globalization was a sharp reduction
in the majors’ control over all three stages of the industry. The six aluminum majors’ share of world bauxite capacity fell from 88% in 1955 to only 57% by 1971, their share of world alumina capacity fell from 90% to 79%, and their share of world aluminum capacity fell from 86% to 56% over the same period (Ciccantell 2000a), a trend that has continued over the last three decades. The number of competitors for the six majors increased from only fourteen in 1940 to 34 in 1970 (Ciccantell 2000a).

The Brazilian aluminum industry was founded by an independent Brazilian firm, but this firm was forced out of business by competition from the aluminum TNCs in the late 1940s. Alcan and the other aluminum TNCs, joined in the 1950s by another independent Brazilian firm, created a vertically integrated ISI-based aluminum industry during this era (Ciccantell 2000b).

The macroeconomic impacts of the aluminum industry during the second phase of globalization and ISI were quite dramatic. Brazilian aluminum production grew rapidly and imports were constrained by this growth and eventually fell during the 1970s. Brazilian aluminum production rose from 3,000 tons in 1955 to 121,000 tons in 1975 (UNCTAD Commodity Yearbook Various Years). One of the most important intended developmental impacts of ISI was the creation of high paying industrial production jobs, something that aluminum ISI in Brazil did quite well. Over 68,000 jobs in aluminum production and processing had been created by ISI policies by 1983, the first year for which comprehensive data are available.

One of the most frequently cited criticisms of ISI strategies is the inefficiencies that are argued to result from this form of government intervention. ISI in aluminum ingot production provided four million
dollars per year in foreign exchange savings during the 1950s, 20-50 million dollars per year during the 1960s, and over 150 million dollars per year in foreign exchange savings by 1975 (Ciccantell In Progress, calculated from ABAL data). The cost of protecting domestic industries via higher domestic prices was also surprisingly modest on an annual basis.

ISI in aluminum in Brazil clearly accomplished its central goals of saving foreign exchange and generating billions of dollars a year in linked economic activities. In short, the articulation of the second phase of globalization and the aluminum TNCs’ investment strategies with Brazilian ISI policies resulted in significant gains for both the firms involved and for the Brazilian economy.

The initial impetus for the development of the aluminum industry in the Brazilian Amazon during the second phase of globalization came from the discovery of a number of bauxite deposits in the region from the 1960s onward after the military government opened the region's mineral resources to exploration and development by raw materials TNCs. Raw materials depletion in the core led globalizing aluminum firms to search in ever more remote regions for bauxite needed for their operations. Alcan took the lead in exploring for bauxite resources in the Amazon region; these efforts led to the discovery of the Trombetas deposit, which eventually became one of the world’s largest bauxite mines during the third phase of globalization.

III. THE THIRD PHASE OF GLOBALIZATION & THE BRAZILIAN ALUMINUM INDUSTRY

In the mid-1970s, a third phase of globalization began. Cheaper and faster transportation technologies and systems linked firms and markets
around the globe (Bunker and Ciccantell 1995; Sassen 1995; Harvey 1995), and the employment of these transport technologies and systems in the core nations in turn forced other nations to develop compatible transport infrastructures in order to remain competitive in the increasingly integrated world economy. Improved communications technologies and infrastructures allowed firms to coordinate and control operations scattered in dozens of countries (Sassen 1995). The growth of world trade via intrafirm transfers intensified and became more complex (Tussie 1998:37), with a growing share in the form of transfers between joint ventures, partners to long term contracts, and other mechanisms that link firms (Harvey 1995), rather than transfers from wholly-owned subsidiaries to parent companies. In conjunction with these changes in the operation of transnational corporations has been an increasing role of firms based in Japan and Europe in foreign direct investment relative to U.S.-based firms (Dunning 1998:55-56; see also Arrighi 1998:72 on Japan), with Japanese and European firms particularly willing to use joint ventures and other forms of interfirm cooperation. In Brazil, TNCs established under ISI became leaders of the ELI process (Evans 1979; Alarcon and McKinley 1992), but Japanese firms have also become important actors in the aluminum and other industries as well. In Venezuela, a consortium of Japanese aluminum firms played a leading role in the rapid expansion of the industry (Ciccantell 2000a).

Peripheral and semiperipheral states' development strategies shifted to export promotion via ELI policies since the mid-1970s (Gereffi 1992:91-93; Barrett and Chin 1987; Lee 1997; Cason and White 1998). These states continued to play large direct and indirect roles in their national economies, but the goals shifted from supplying domestic markets
to exporting to world markets to earn hard currency revenues and repay foreign debts and to increasing domestic productivity by exposing firms to highly competitive world markets (Deyo 1987; Ciccantell 2000a).

Japanese joint ventures in aluminum smelting projects with semiperipheral state-owned firms in Brazil, Venezuela and Indonesia were the first to make extensive use of a joint venture structure in which the firms from the core nations held only a minority ownership share rather than a majority position. These projects have helped to create the current situation of excess capacity in aluminum smelting, dramatically increased the role of semiperipheral and peripheral state-owned firms in the aluminum industry (Ciccantell 1994), and further eroded the aluminum majors’ oligopolistic control over the industry (Ciccantell 2000a). The aluminum majors’ control over the industry declined at all stages of the industry, with their share of world bauxite capacity falling from 57% in 1971 to 45% in 1979, of alumina capacity falling from 79% to 74%, and of aluminum capacity falling from 56% to 54% (Ciccantell 2000a). The number of competitors to the six majors increased from 34 in 1970 to 45 in 1980, including ten new state-owned firms in the periphery and semiperiphery that were created or diversified their operations into the aluminum industry as part of these ELI development policies (Ciccantell 2000a). In Brazil, after Alcan halted the development of the Trombetas bauxite mine in the early 1970s because of a global oversupply of bauxite, the Brazilian government revoked Alcan's rights over the deposit and transferred leadership of the project to the state-owned mining firm CVRD; CVRD lacked experience in the aluminum industry but had been very successful in the iron ore mining industry. Two years of negotiations ensued, and in 1974 a new agreement was reached for a US$390 million
joint venture mine, Mineracao Rio do Norte (MRN), with a capacity of 3.3 million tpy. Majority ownership was shared by two Brazilian firms, CVRD and CBA, and the rest by the aluminum TNCs Alcan, Reynolds, Norsk Hydro, Aardol og Sunndall, Aluminio Espanhola, and Billiton (Machado 1985:162-167). The MRN bauxite mine began production in 1979 and capacity was expanded to 8.5 million tons per year in 1990 (Ciccantell 1994) and to 12 million tons per year by the mid-1990s (AMM August 30, 1994). The beginning of production by MRN was responsible for a dramatic shift in Brazilian bauxite production and exports. Bauxite production increased from 969,000 tons in 1975 to 5.8 million tons in 1985 and doubled again by 1990 (calculated from ABAL data). Bauxite exports increased from 18,000 tons in 1975 to 3.3 million tons in 1985 and to 5.5 million tons by 1990 (ABAL data). The value of these exports rose from US$700,000 in 1975 to US$95 million in 1985 and US$149 million in 1990 (ABAL data). Almost all of these exports came from the MRN mine.

From the perspective of Alcan and the other aluminum TNCs, the opportunity to gain long term access to this high quality bauxite at a low cost and minimal risk (since most of the cost would be paid by CVRD and Brazilian government loans) in the context of rapidly growing world demand for bauxite and aluminum proved far too attractive to cause them to object to CVRD's leadership of the project and majority Brazilian ownership. In the context of extreme resource nationalism in many noncore nations at the time, the Brazilian government's proposals were relatively moderate and posed no major challenge to the incorporation of Amazonian bauxite into the capitalist world economy at a profit to these TNC investors.

The story of the development of this deposit illustrates the role of
world market factors and firm strategies in determining the course and terms of a region's incorporation into the capitalist world economy. However, the response of the Brazilian state as part of its overall strategy of export promotion, direct state investment in productive activities, and its plans to use Amazonian natural resources as the basis for development makes it clear that the traditional story in much of the dependency literature and the literature on natural resources and TNCs that focuses on the tremendous power of TNCs and the weakness of peripheral and semiperipheral states, at least in the Brazilian context since the 1960s, is deeply flawed. The Brazilian government in fact directly challenged one of the nation's leading foreign investors and revoked its property rights over a major economic asset. The ensuing negotiations reached an accommodation by providing Alcan with access to a portion of the mine's production in return for sharing part of the investment risk and permitting Alcan to continue to expand its other operations in Brazil, while the Brazilian government was able to push forward the development of the mine and guarantee a market for its output. The interests of domestic capital were accommodated via the incorporation of CBA as a partner in the project, ensuring Brazilian majority ownership and control over the project, an important political legitimacy statement in the context of resource nationalism during the 1970s. The incorporation of other TNC partners served to lessen the investment risk of CVRD, CBA and Alcan and was an example of a major trend in the world aluminum industry and in other natural resource industries since the 1950s of sharing the risks of major projects in the periphery and semiperiphery among a number of TNCs and a state-owned firm (Ciccantell 1994b).
Perhaps most importantly, the restructuring of the MRN project illustrates the major role of peripheral and semiperipheral states as actors in the capitalist world economy in the third phase of globalization. The ability of the Brazilian government to force a renegotiation of the terms of the incorporation of this bauxite deposit into the world economy in a way that accommodated both the Brazilian government's development goals and the corporate strategies and needs of TNCs and Brazilian capital highlights the alternatively conflictual and cooperative nature of relations among the partners. An accommodation was eventually achieved, but only after protracted negotiations and conflict. This historical example also makes it clear that there was significant room for maneuver for states and firms within the structure of opportunities and constraints (Moran 1974) during the third phase of globalization.

The next key element of the third phase of globalization of the Brazilian aluminum industry in the mid-1970s was an ISI project, the Valesul aluminum smelter near Rio de Janeiro, but it was organized as a joint venture, with majority ownership held by a Brazilian state-owned firm, Companhia Vale do Rio Doce (CVRD), with a TNC partner (Ciccantell 1994; Marques 1994b). One part of the reason the Brazilian government decided to build this smelter in southern Brazil was the same import substitution logic that motivated government support for the construction of other smelters in the region; Valesul's entry into production made Brazil self-sufficient in primary aluminum ingot. An even more powerful reason for the construction of the smelter was the desire of the Brazilian state to prove that it could build and operate an aluminum smelter without the Japanese investors with whom it was engaged in
protracted, difficult negotiations over the terms of the construction of another smelter, Albras, in the Amazon, an example of the new ELI efforts characteristic of the third phase of globalization.

The third phase of globalization and the development of ELI aluminum smelting and alumina refining joint ventures in the Amazon dramatically transformed the Brazilian aluminum industry. The early development of bauxite mining in the Amazon was led by the firms that were involved in the industry in southern Brazil, but these TNCs were not willing to undertake the massive investments and risks required to process alumina and aluminum in this remote region. A new element entered the industry in the Amazon: a consortium consisting of the Japanese state and Japanese firms in search of low cost hydroelectricity to produce aluminum for export to Japan. This Japanese consortium was representative of the intensified efforts during the third phase of globalization to supply Japan's rapidly growing demand for raw materials through the creation of joint ventures in a number of countries around the world. The transformation of the Brazilian aluminum industry from a successful import substituting industry into a major export industry fundamentally altered the Brazilian aluminum industry's links to the capitalist world economy and contributed to the breakdown of the aluminum oligopoly (see Marques 1994a on Brazil’s goal of joining the oligopoly). It exposed the Brazilian aluminum industry and the Brazilian state to the major risks associated with the volatility of world markets since the 1970s, risks that have in recent years resulted in huge macroeconomic and microeconomic problems for the industry and for the Brazilian state.

Why were these Japanese firms and the Japanese state interested in investing in a region judged unsuitable by the aluminum TNCs? The rapid
growth of the Japanese economy was creating a very rapidly growing demand for aluminum in Japan. The Japanese were also attempting to reduce their dependence on the aluminum oligopoly for aluminum supplies (and on TNCs in other raw materials industries) because of concerns over supply vulnerability, particularly after the "Nixon Shock".

The state-owned firms in the noncore nations that were being created in the resource nationalist climate of the 1960s and 1970s were, for the Japanese, potential new partners outside the aluminum oligopoly who could reduce the total investment cost and political risk of investing outside the core (Bunker 1994; Ciccantell 1994). The lack of an open market for aluminum (the London Metal Exchange did not begin trading in aluminum until 1977) made Japanese investment in aluminum smelting the best option available for escaping the control of the aluminum oligopoly.

After the first oil price shock of 1973-74, Japanese negotiations with Brazil and other potential aluminum industry partners became even more urgent because, since Japan was very highly dependent on electricity generated by oil-fired power plants, the cost of producing aluminum in Japan had begun a long term rise that would be further aggravated by the second oil price shock of 1979-80. Given these strategic concerns over future supply of aluminum, the major Japanese aluminum producing and consuming firms, trading companies, and the Japanese government began negotiations with a number of noncore nations over the development of aluminum production facilities that would export all or part of their aluminum ingot production to Japan (Bunker 1994; Ciccantell 1994; Marques 1994a).

Japanese strategies and interests were quite different from those of the aluminum TNCs involved in Brazil. The aluminum TNCs during the early
1970s were concerned only with bauxite extraction for export from the Amazon, as was the case throughout most of the periphery and semiperiphery. Only in areas with large and protected domestic markets, such as southern Brazil, had the aluminum TNCs invested in vertically integrated aluminum production facilities from mines and hydroelectric dams to consumer goods. While the Japanese sometimes discussed bauxite mining, hydroelectric facilities, and alumina refineries as part of aluminum smelter projects (as was initially the case in the Brazilian Amazon) (see Ciccantell 1994 for a history of the evolution of Japanese interests and bargaining strategies), their main interest was in the production of aluminum ingot at low cost for export to Japan; local markets and local vertical integration were of no interest to the Japanese, despite their negotiating partners' interests in promoting economic development.

These Japanese aluminum smelter projects were, however, typically presented as part of a larger government to government set of proposals for expanding trade relations between the potential aluminum exporter and Japan. Given Japan's rapid rise in the world economy, Japan appeared as a valuable alternative source of trade and investment flows to peripheral and semiperipheral governments concerned with strengthening their autonomy from the core nations of the U.S. and Europe, a course of action that appeared to offer both economic and political legitimacy rewards. Japan was, in the aluminum industry and in a number of other major raw materials industries (Bunker and O'Hearn 1992; Bunker 1994; Bunker and Ciccantell 1994), in the process of restructuring its relationship with the world economy via the creation of new links with raw materials rich nations of the periphery and semiperiphery. The government to government
nature of negotiations and the ability to offer a variety of other projects in addition to aluminum smelters gave the Japanese a distinct advantage in the negotiations over the terms of the aluminum projects, since the perceived benefits from other projects could be seen to outweigh the potential problems of less than ideal aluminum project agreements from the perspective of the noncore government. This allowed the Japanese to reach agreements on these aluminum projects on terms that noncore governments likely would not have accepted in negotiations with aluminum TNCs just over the aluminum project itself.

The Japanese were able to use these negotiating advantages very successfully during the protracted negotiations over the Albras aluminum smelter and Alunorte alumina refinery joint venture that lasted from 1973 until 1982. The Japanese repeatedly retreated from earlier negotiating positions, first scaling back what would have been the world’s largest integrated aluminum smelter, alumina refinery and hydroelectric dam that would have been financed and built by the Brazilian-Japanese consortium, leaving the Brazilian government to bear the entire cost of the Tucurui hydroelectric dam. The Japanese partners then scaled back and later froze their participation in the alumina refinery, Alunorte, leaving the Albras aluminum smelter without its domestic source of alumina for a decade and forcing Albras to import hundreds of thousands of tons of alumina while literally watching bauxite ore from Trombetas sail past its gates on the way down the Amazon for export (see Ciccantell 1994 and Machado 1985 for analyses of these negotiations). This absurd and very costly situation would not be resolved until the mid-1990s during the fourth phase of globalization, as will be discussed below.

The long, conflict-filled history of the negotiations over and
construction of Albras and Alunorte reveal a number of critical problems with Brazilian government efforts to use Amazonian natural resources as the basis for ELI development in the region. The Japanese presented in the early 1970s what was perceived by the Brazilian government as an important opportunity to develop a new trade and investment partnership and, in fact, in some industries this partnership has provided some significant benefits to Brazil. However, Japan's highly coordinated negotiating strategy in terms of raw materials acquisition within and across a number of industries has meant that these gains have been much less than anticipated by the Brazilian government, particularly since the Japanese have successfully played off one raw materials supplier against another since the 1970s (Bunker and O'Hearn 1992; Bunker 1994; Bunker and Ciccantell 1994; Machado 1994). The Japanese' lack of interest in Brazilian markets has significantly weakened the Brazilian government's negotiating power with the Japanese, in contrast to its relatively more successful negotiations with other TNCs in southern Brazil and in the Amazon. Japan's strategies for raw materials access have not proven in the long term to have particularly positive effects on the raw materials extraction regions that have become dependent on Japanese markets.

The history of Albras and Alunorte also illustrate the tremendous impact that trends and events in the capitalist world economy outside the control of any peripheral or semiperipheral state can have on raw materials based development efforts. Japan's rise to challenge U.S. hegemony and rising energy prices because of OPEC's actions in the 1970s created structural opportunities for the development of the Amazon aluminum industry via production for the Japanese market, but these opportunities were severely constrained by Japanese government and firm
strategies and by changes in the world aluminum industry and in the world economy. The Brazilian government got stuck with the bill for the infrastructure and electricity generation portions of the project, while the Japanese are able to buy low cost aluminum ingot. The ability of the Japanese firms and the Japanese state to adjust to changing world conditions has made it possible for them to obtain far more favorable results from the Albras project than is the case for the Brazilian government.

The history of the other aluminum smelter in the Brazilian Amazon, the Alumar smelter/refinery complex, is quite different from that of the Albras/Alunorte project. Alcoa had only recently entered the Brazilian aluminum industry; its Brazilian subsidiary, Alcoa Aluminio, was a joint venture between Alcoa (68%) and Hanna Mining (32%), a U.S. mining TNC with large investments in other Brazilian raw materials industries. Although the size of Alcoa's operations in southern Brazil was limited by the small amount of bauxite available in its reserves, Alcoa in 1977 identified Brazil, along with Australia, as the focal point for its international investments based on the availability of bauxite and energy in the two nations. In July of 1979, Alcoa began studying potential sites for a 400-500,000 ton per year smelter (Machado 1985:272-274). The facility was eventually built at Sao Luiz on the Atlantic coast of Maranhao. Alumar refined bauxite from Trombetas at a 1 million ton per year alumina refinery and 350,000 ton per year aluminum smelter (Mining Magazine 1993).

The key to building one of the world's largest aluminum smelters on the edge of the Amazon region was Alcoa's ability to obtain during 1980 a US$750 million loan from a consortium of 28 banks coordinated by
Citibank. Alcoa's immense size made it possible to obtain such a large loan for a project in a relatively poor area of Brazil. In September 1980, Alumar signed contracts with Eletronorte for the supply of electricity to the project at a 10% discount on the normal industrial electricity rate (De Sa 1994) and the maximum tariff was set at 20% of the world market price for aluminum. The government supplied a variety of tax incentives to the project (Machado 1985:274-277). The principal reasons for Alcoa's decision at the beginning of 1980 to build its alumina-aluminum complex at Sao Luis were: "closeness of the Amazonia bauxite reserves; availability of electric power following the construction of the Tucurui hydroelectric power station; port for receiving bauxite and exporting aluminum, suitably located with reference to the sources of bauxite and the ports of destination of the aluminum; inexpensive labour force; (and) existence of fiscal incentives during a fixed time" (Penedo Borges 1990:14). The project began production on schedule and under budget on 2 July 1984.

The development of the Alumar complex took place in part in response to Alcoa's global corporate strategic needs: the search for low cost electricity on which to base new smelting capacity to replace, old high cost facilities in the U.S.; the desire to increase sales in the Brazilian market and in the world market; and the opportunity to invest during a downward cycle in the industry that would allow Alcoa to take early advantage of the cyclical upswing to follow by being the first online with new capacity to meet rising demand. However, the Brazilian state was also able to fulfill a number of its strategic goals via the Alumar project: increased foreign exchange earnings; a massive inflow of foreign investment; a major customer for the underutilized Tucurui
hydroelectric dam; and a major economic development project in the poor region on the border between the Amazon and northeastern Brazil. The Brazilian government, in response to Alcoa's search for a new plant site in a location with the potential for a large scale port throughout Brazil, used development incentives and Alcoa's already large existing investments in Brazil and its interest in the Brazilian market to force Alcoa to invest in northern Brazil, even though Alcoa initially preferred to invest in southern Brazil. Alcoa's financial strength as a TNC allowed it to easily acquire financing for the project, an important strength in the bargaining process, as was its incorporation of a private Brazilian firm into its operations, since this strengthened Alcoa's political position in Brazil.

Overall, the development of Albras and Alumar under these ELI policies did turn Brazil into one of the world’s leading exporters of aluminum and provided huge net foreign exchange earnings. Aluminum export revenues rose from only US$1.1 million in 1975 to US$310 million in 1985 and US$1.1 billion in 1990, and, even after subtracting the cost of imported inputs, the net foreign exchange benefits of aluminum ELI rose from US$-3.9 million in 1975 to US$287 million in 1985 and US$1.04 billion in 1990 (Ciccantell In Progress; calculated from ABAL data).

IV. THE FOURTH PHASE OF GLOBALIZATION & THE BRAZILIAN ALUMINUM INDUSTRY

Since the mid-1980s, a fourth phase of globalization has emerged, marked by a combination of the further intensification of the processes of the third phase with three new elements. First, a broad trend toward reducing trade barriers both globally (GATT, WTO) and regionally (NAFTA, EU, Mercosur) has expanded rapidly. Second, many major institutional
actors in the economic, political, and social spheres have fundamentally altered how they think and operate: “the globe is the essential unit of operation of some human activity, and where this activity is ideally conducted in terms of single, universal, systems of thought, techniques and modes of communication” (Hobsbawm 1998:1). Third, state development strategies throughout the world economy have shifted toward a neoliberal project of economic restructuring since the mid-1980s. Outside the core nations, by the mid-1980s debt relief conditionality began to call for export promotion, constriction of domestic demand, reduction of the economic role of the state, and opening to foreign investment (Cox 1996:22; Biersteker 1998:21; Sunkel 1995:45). The role of peripheral and semiperipheral states has thus changed dramatically. The economic role of these states, particularly as driving forces of development strategies, has been eroded, commonly leaving a role as a promoter of national territory as a site for foreign investment in competition with other political jurisdictions around the world, and a role of the provider of a governance framework to support this new phase of globalization (Sassen 1995:41-46; Sunkel 1995:54; Harvey 1995).

Privatization and economic restructuring, key elements of neoliberal restructuring, have created tremendous investment opportunities for transnational raw materials firms (Ciccantell 2000a).

The fourth phase of globalization has also led to a chronic overcapacity in aluminum smelting, intense global competition (with an increase in the share of world aluminum production entering international trade growing from 37% in 1980 to 56% in 1993), and highly unstable but generally very low prices for aluminum, all of which have sharply constrained the returns to firms and states of involvement in this
industry (Ciccantell 2000a). The slow, gradual increase in aluminum prices that characterized most of the history of the aluminum industry was dramatically altered in 1975 by a sharp increase in prices due to rapid increase in energy prices and raw materials shortages. In the fourth phase of globalization since the mid-1980s, aluminum prices have become extremely unstable, fluctuating wildly between US$0.55 and US$1.10 per pound. Stability and predictability of returns, hallmarks of the industry during its first 90 years and the first two phases of globalization, have been replaced by a severe boom and bust cycle (Ciccantell 2000a).

For the aluminum majors, this phase led to the collapse of the oligopoly, with the six majors’ share of world bauxite capacity declining from 45% in 1979 to 37% in 1997, of world alumina capacity from 74% in 1979 to 54% in 1991, and of world aluminum capacity from 54% in 1979 to 41% in 1996 (Ciccantell 2000a). The number of competitors to the aluminum majors increased from 45 in 1980 to 56 in 1991 (Ciccantell 2000a), and the share of joint ventures in world aluminum smelting capacity increased from 32% in 1974 to 49% in 1996 (Ciccantell 2000a).

Due to the shift of economic development strategies by many semiperipheral and peripheral states to economic restructuring and privatization, massive investments in bauxite mining, alumina refining, aluminum smelting, and many other industries are being sold to domestic and foreign firms at steeply discounted prices. The privatization of CVRD, a formerly Brazilian state-owned firm that is an important bauxite mining, alumina refining and aluminum smelting firm (as well as the world’s largest iron ore exporting firm), is one prominent example of this process, as are the ongoing (but so far unsuccessful) efforts to
privatize two major aluminum smelters, an alumina refinery and a bauxite mine in Venezuela and to attract several major TNC aluminum smelting projects to Venezuela. Most nations of the former Second World, particularly the former Soviet Union, have been incorporated into the world aluminum industry as major exporters and a process of privatization is underway that makes available a significant number of large aluminum smelters to domestic and foreign firms. This is an important investment opportunity for many aluminum firms, but the incorporation of the former Second World and the new projects brought into production during this fourth phase of globalization have further contributed to excess capacity and unstable prices. Privatization and restructuring also represent a significant economic loss for national governments and a sharp loss of control over economic and social development for these governments (Ciccantell 2000a).

The aluminum majors’ loss of control over production, investment and prices has had serious negative implications for aluminum firms’ profits, with the aluminum majors earning only historically low profits or even losing money regularly since the mid-1980s (Ciccantell 2000a). The erosion of the dominance of the majors thus created an extremely unstable environment, especially in the price for aluminum ingot. The new structure of the industry emerging from this environmental and competitive turbulence is highly unstable, with mergers and acquisitions and bankruptcies increasing in frequency. This vertical disintegration, increased turbulence, and downward pressure on profits of raw materials extracting firms and exporting regions are paralleled in other natural resource-based industries since the mid-1980s (Ciccantell 2000a).

Restructuring of the role of the Brazilian state has been a central
element in the changes underway during the fourth phase of globalization in the Brazilian aluminum industry. Restructuring began under the Collor government in the early 1990s and accelerated under the Cardoso government. The Brazilian congress in 1995 opened many mining, energy and transport industries to foreign investment in privatized operations and joint ventures, reducing the direct role of Brazilian state-owned firms in these sectors (Baer, Haddad and Hewings 1998). Even highly profitable CVRD, the iron ore mining and aluminum mining and processing firm, was privatized in 1997, eliminating direct state intervention in these economically critical activities that constitute a significant share of Brazilian exports. The state-owned steel firms were also privatized in the early 1990s, despite massive public protests (Montero 1998), and a few electric utilities have been privatized in the late 1990s (The Economist 1997:57). These privatizations have reduced employment levels in these industries significantly, attracted new foreign investment to Brazil (Baer, Haddad and Hewings 1998), and helped financed the nation’s trade deficit (The Economist 1997:57), strengthening the model of dependent development that began under ISI and evolved into ELI (Cardoso 1973; Evans 1979; Rocha 1994). For the Brazilian aluminum industry, the privatization of CVRD has meant the transfer of MRN, Albras and Valesul to the hands of private investors and the de facto ending of CVRD’s efforts to serve as a regional development agency.

The fourth phase of globalization has also been marked by the economic resurgence of the U.S., including the return of U.S.-based TNCs to leading roles in many industries, including aluminum. One example of the resurgence of U.S. TNCs in the world and Brazilian aluminum
industries was the construction of Brazil’s first aluminum can plant by a Reynolds-led joint venture in the late 1980s (Kepp 1989). This investment has captured a major share of the Brazilian aluminum and packaging market and has been repeatedly expanded to keep up with growth in this market.

Alcoa and its partner in the Alumar smelter and refinery, Billiton, sought in the late 1980s and early 1990s to build their own bauxite mine on a deposit adjacent to the MRN mine in the Amazon, but encountered strong resistance from the Brazilian government. Alcoa and Billiton engaged in negotiations with MRN to obtain a share of that mine, even after the announcement of plans for their own mine. Finally, after more than ten years of repeated efforts, the bauxite reserves were merged with those of MRN and Alcoa took a 12.5% share in MRN (about half of Alcan's share, whose new share was 12.5%) and Billiton increased its share of MRN to 12.5% from 10%. As part of the arrangement, CVRD's share was reduced from 46% to 40% and CBA increased its share to 12.5%; the shares of Reynolds and Norsk Hydro remained unchanged at 5% each. Alcan received a 10% share of the Alumar alumina refinery, with its share including the right to participate in the planned future expansion of the refinery and to take a proportionate share of the refinery's output (American Metal Market 31 December 1991:12; Metal Bulletin 6 January 1992:9; Metals Week 6 January 1992:1; Mining Journal 14 February 1992:113).

The fourth phase of globalization has also brought a resolution to the problem of the Alunorte alumina refinery that had been sitting partially built adjacent to the Albras smelter since the mid-1980s. The failure to complete this refinery at the same time that Albras was finished in the mid-1980s was one of the most important problems
confronting the aluminum industry in the Brazilian Amazon (Ciccantell 1994; Machado 1994). Repeated renegotiations between CVRD and its Japanese partners failed to reach an agreement to restart construction in the late 1980s and early 1990s (Ciccantell 1994; Marques 1994a). CVRD embarked on a lengthy search for a new partner to finish the refinery. Alcan was one such potential partner, given the firm's traditionally alumina-short position, but the MRN-Alumar ownership trade with Alcoa eliminated Alcan as a potential partner. The failure to construct this alumina refinery had resulted for a decade in the export of the bulk of Trombetas' ore in unprocessed form and the import of alumina to supply the Albras smelter, an inherently illogical and extremely frustrating situation for CVRD and the Brazilian government. The completion of the 1.1 million ton per year, US$875 million (Kepp 1995) refinery in 1995 with the MRN joint venture and Brazilian private aluminum company CBA as partners with CVRD (with a small stake still held by the Japanese consortium because of its earlier investments) ended this illogical situation and meant that the majority of MRN’s bauxite is now processed in Brazil rather than being exported as ore (Kepp 1996a), capturing a much larger share of the potential value added from the industry and eliminating the cost of importing alumina for Albras and Valesul. Alunorte now exports alumina (Kepp 1996b), something Brazil had not been able to do on a large scale previously. Alunorte’s entry into production in 1995 completely ended the massive drain on the Brazilian economy of importing alumina and turned the industry into a major exporter.

The fourth phase of globalization may also provide an opportunity to resolve the largest macroeconomic problem with the Brazilian aluminum industry, the Tucurui hydroelectric dam. The dam was built to supply the
aluminum industry, but the combination of aluminum price-based electricity price discounts and the failure to utilize all of the power generated by the first stage of Tucurui have made the dam a financial black hole for the regional government-owned electric utility, Eletronorte, and for the Brazilian economy (see Ciccantell 1994: Chapter 11).

The high cost of Tucurui, in part the result of relatively unfavorable natural conditions, has also constrained the expansion of aluminum smelting in the region. The high total cost of production at Tucurui makes the region relatively unattractive to aluminum TNCs as a site for investment; however, this total cost of production is less than is assumed in Brazil or in the aluminum industry (see Ciccantell 1994: Chapter 11). In fact, the Brazilian Amazon continues to be a relatively competitive location for the building of aluminum smelters, especially when the second stage of Tucurui is completed, increasing capacity to 8,000 megawatts for a relatively small additional estimate of US$1.5 billion (Eletronorte n.d.). State restructuring in the fourth phase of globalization is ending the subsidies to electricity-intensive industries such as aluminum as part of readying Eletrobras and its subsidiaries, including Eletronorte, for privatization. However, full utilization of Tucurui’s capacity would sharply lower the marginal cost of its electricity, since it already has 1,000 megawatts of capacity that are not being used, and allow the development of major consumers in the region, such as aluminum smelters. The Kyoto global warming accords that call for dramatic reductions in thermal power generation are likely to substantially increase electricity costs around the world, making the Amazon even more attractive for aluminum smelting.
However, the failure to utilize Tucurui has made the complex as a whole in the Amazon a net burden on the national economy and federal treasury, as well as the source of considerable political anger at government subsidies for the benefit of TNCs (see Ciccantell 1994: Chapter 11). Eletronorte has been operating at a loss throughout its 25-year existence, mainly due to the fact that 60-70% of its revenues each year are devoted to paying the costs of loan amortization and depreciation (see, e.g., Eletronorte Relatorio Anual 1997 balance sheet). The aluminum industry, including Alcoa and the Alunorte alumina refinery, have already helped to finance the construction of transmission lines to their facilities, a form of cooperation characteristic of the fourth phase of globalization. The opening of future generating plant projects to private investment in cooperation with Eletronorte is a further step along the path of restructuring and partial privatization, mainly because the huge debts and ongoing losses of Eletronorte make it unlikely for a private investor to be interested in purchasing the firm in its current condition.

High electricity costs in Brazil threatened to halt the rapid expansion of the Brazilian aluminum industry during the 1990s (de Sa 1994), but investment in bauxite and alumina refining has continued, the privatization of the electricity sector that began in 1998, including allowing foreign firms to produce power for their own consumption, and the construction of power lines in the northern Amazon to allow the export of electricity from Venezuela to the northern Amazon may lower costs enough to make new investment in smelting viable.

Overall, the fourth phase of globalization and economic restructuring have led to large but extremely unstable export revenues
for the Brazilian aluminum industry and the closing of an important gap in the Amazon region’s aluminum commodity chain. Tucurui remains a huge financial drain with only limited chances for resolution, so on balance this phase of globalization has made only limited impact on resolving the problems created by the shift to ELI during the third phase of globalization. The aluminum industry has the potential to contribute to future economic development, but at present that potential is not very likely to be realized.

V. RECENT DEVELOPMENTS IN THE BRAZILIAN AMAZON ALUMINUM INDUSTRY

In the Amazonian aluminum industry in recent years, these trends have produced a difficult and contradictory situation that calls into question the economic, social and environmental sustainability of this industry. The privatization of CVRD, one of the world’s largest aluminum companies, is transforming the aluminum industry in the Brazilian Amazon. CVRD has, since the 1970s, played the role of regional development agency around its major operations, channeling a small part of its commercial earnings into the provision of infrastructure and a higher quality of life for those directly linked to these projects (see Ciccantell 1999 for an analysis of the aluminum-related communities in the region). However, these benefits were not available to those living in the boom towns in the region that developed around these large projects, and quality of life was typically quite low in these communities. Although at least one recent loan from the BNDES required a significant investment in social development (Financial Times April 12, 2001), this is not likely to be the norm. CVRD, is the world’s largest iron exporting firm and one of
the world’s largest aluminum exporters. Both are highly competitive global industries often plagued by excess production capacity and low prices. As a result, CVRD cannot afford to focus a significant share of its resources on social development projects that do not produce a commercial return on investment and still be able to remain competitive with other firms that do not make the same sorts of investments. This intense global competition also constrains wages for CVRD’s workers, further curtailing the quality of life in these communities.

In the context of concentration and globalization in the aluminum industry, CVRD faces an increasingly competitive global environment that threatens the future of its operations. Canada has become the lowest cost site for locating new aluminum smelting capacity, and the global aluminum firms, particularly in light of the electricity problems discussed below, no longer view Brazil as a potential site for major new investments. CVRD’s Albras smelter in the Amazon and its smaller Valesul smelter near Rio de Janeiro, as well as the Alumar refinery and smelter owned by Alcoa and Billiton that depends on electricity from Tucurui, are all squeezed by electricity shortages (all smelters are major electricity consumers and have been required to reduce consumption by 25% in southern Brazil and 15% in the Amazon region to help deal with the current energy crisis in Brazil) and the potential for large increases in electricity costs in the near future makes the continued operation of these facilities difficult, unless these firms can build or buy their own generating facilities. All of the major Brazilian and foreign aluminum firms operating in Brazil are seeking to build or expand their own generating facilities, but this is an expensive and often long term undertaking. CVRD is planning six hydroelectric projects at a total cost
of US$320 million, Alcoa plans to invest US$1.1 billion in four dams, and Alcan is considering investing US$170 million in hydroelectric projects and participating in the privatization of Eletronorte and Chesf (Eletrobras n.d.). CVRD, Alcoa, and Brazilian aluminum firm CBA were partners in winning bids for two new dams to be built in central and southern Brazil (Financial Times June 29, 2001).

If these smelters become uncompetitive and close, the negative impacts will be felt not just in the immediate area but also in the region’s economy and communities dependent on electricity generation and on other industrial uses of electricity, since the loss of these large power consumers and the limited amount of transmission infrastructure to carry power to the rest of Brazil will mean that remaining industrial and residential consumers will have to make up the revenue lost to the closure of the smelters. Private firms have recently been awarded contracts to build and operate transmission projects that will increase the ability to export electricity from the soon-to-be 8,000 megawatt Tucurui dam (Brazil 2001), but this expansion will not be sufficient to replace Albras and Alumar as customers. As a result, a region with one of the world’s largest hydroelectric potentials and one of the largest dams in the world could soon have some of the highest electricity costs in the world.

At the same time, electricity shortages deriving from a drought in much of Brazil and a lack of state investment by the regional electric utility that has been effectively bankrupt for two decades due to state support for export-led industrialization, in combination with a conflict-filled and slow process of electricity privatization and opening to generation by major power consumers, threatens to curtail or even
eliminate the aluminum industry. Eletronorte had been effectively bankrupted by the high cost of Tucurui and the ongoing losses generated by the below-cost sales of electricity to the aluminum smelters and the failure to utilize half of the installed capacity of the dam because of a lack of transmission lines (Ciccantell 1994b); Eletrobras estimates Eletronorte’s annual losses from electricity sales to the two aluminum smelters and a silicon plant owned by Camargo Correa at US$200 million per year currently (Eletrobras n.d.). Eletronorte had long been planned for inclusion in the process of privatizing the Brazilian electricity sector, but privatization of Tucurui and the rest of the Eletronorte system has been repeatedly delayed (Eletrobras n.d.). The Brazilian government had reduced funding for the electric sector nationally from US$6.2 billion in 1997 to only US$3.1 billion in 2001 in order to repay foreign debts, almost 100,000 workers were fired, and consumer electricity prices rose from US$35 per megawatt hour in 1995 to US$80, with the highest costs in areas supplied by private firms (Rapoza 2001:A20). The effective bankruptcy, ongoing uncertainty over Eletronorte’s future, and the agreement with the International Monetary Fund that state-owned firms would not invest in more infrastructure prior to privatization (O Globo June 5, 2001; Rohrer 2001:A4) meant that Eletronorte had very limited ability to ship electricity to southern Brazil as the drought and hydroelectric energy shortage worsened during 2001. Power rationing in recent months has cut production at Albras and Alumar significantly (Alumar has cut annual output by 63,000 tons per year (Arimura 2001)) as the Brazilian government has sought to increase electricity exports to northeastern and southern Brazil from the Amazon.

The communities dependent on the aluminum industry in the Amazon
face a very uncertain future, given the current difficult situation. When the low cost power contracts for the Albras and Alumar aluminum smelters expire in 2004 in the context of likely continued electricity supply difficulties and high costs in Brazil, the private firm (or, given the difficulties of privatization, state-owned firm) that negotiates the cost of electricity for the smelters will certainly demand a much higher price. However, energy-intensive industries like aluminum cannot pay rates even close to the current industrial or especially residential rates in Brazil, let alone the much higher rates that will be needed to pay for a much larger electricity generation and transmission infrastructure and to attract the foreign investment to pay for this infrastructure under the model of privatization and the declining role of the state in the economy. Under such conditions, if the major aluminum companies have not developed enough electricity generating capacity to supply their needs, then these smelters are likely to close, devastating the communities dependent on the industry and shifting bauxite production from partial vertical integration that exports a much higher value added product of aluminum metal into a pure raw materials extraction for export industry in the Amazon.

The economic impacts of a declining aluminum industry will not be limited to these communities, but will have major national impacts as well. Electric shortages and rationing in southern Brazil by mid-2001 had already created an important trade deficit as imports of aluminum and steel products increased (O Globo June 12, 2001), and long term reductions in aluminum production will have major impacts on the nation’s economy, since aluminum is 4% of the nation’s exports and 3% of gross industrial product (Mining Journal May 14, 2001:352). The aluminum
industry’s overall trade surplus of US$1.6 billion in 2000 (Gazeta Mercantil April 4, 2001) will not be repeated in 2001, worsening Brazil’s foreign trade balance.

Another major response to the electricity shortage in Brazil is the plan to build the 11,000 megawatt Belo Monte dam (Eletrobras n.d.; Financial Times February 20, 2001). This is a revived dam project at Altamira on the Xingu River that had been halted by indigenous and environmental opposition in Brazil and internationally a decade ago. Eletronorte is working in partnership with the BNDES, Eletrobras, CVRD, and the Odebrecht construction firm in developing this project (Mining Journal May 11, 2001:352) with a projected cost of US$3 billion (Gazeta Mercantil April 25, 2001). The consortium has been obtaining funding and completing viability studies for a dam that will dwarf the Tucurui dam in terms of power generation and social and environmental impacts, while exporting the vast majority of its production to the rest of Brazil.

Research on the social and environmental impacts of the Tucurui dam and reservoir has finally begun to accumulate in recent years, highlighting the high social costs of ecosystem changes, population dislocation, increasing malaria incidence, and changing uses of natural resources, as well as the environmental and health impacts of building huge lakes that produce methane and other greenhouse gases that contribute to global warming (in contrast to the “green” reputation of hydroelectric power), disrupting local hydrologic systems, and, in combination with upstream gold mining, and increasing concentrations of mercury in water and fish (see Ciccantell 1994b; Aula, Braunschweiler, and Malin 1995; Leino and Lodenius 1995; and Fearnside 1997, 1999, 2001). Despite the protections of the environment and of indigenous rights
guaranteed in Brazilian law, the urgency of the current energy crisis appears likely to provide the justification for constructing this potentially devastating dam. For example, the Brazilian government estimates that Tucurui has saved US$30 billion in oil imports in the past decade and a half (Olmos 2000); Belo Monte and other dam projects that have been on the drawing boards of Eletronorte since the 1980s (Ciccantell 1994b) provide even greater opportunities for import savings and resolving the current electricity crisis. Despite significant political opposition to privatization, including from the leaders of Brazil’s Senate, Jader Barbalho of Para and Chamber of Deputies, Aercio Neves of Minas Gerais, (Correa 2001), the Partido dos Trabalhadores (PT) and its leader, Luiz Ignacio da Silva (O Globo June 5, 2001), and large public protests (Agence France Presse June 28, 2001), privatization has been presented internally and externally as the only potential solution to the current crisis by the Cardoso government, most large firms, and the IMF, among others (Osava 2001).

VI. CONCLUSION

This paper examined the role of raw materials-based development via the aluminum industry in Brazil and especially the Amazon region. The paper outlined the historical development of the Brazilian industry as the product of a complex interaction between the globalization of the industry, the strategies of the aluminum TNCs and Brazilian firms, and the development strategies of the Brazilian state. The paper then analyzed the most recent phase of the globalization of the aluminum industry and how the Amazon became a major location for the industry. Over the past twenty years, an increasingly global search for new sources
of bauxite and hydroelectricity, the growth of Japanese aluminum firms, the entry of new firms based in the periphery and semiperiphery into the industry, the concentration of aluminum industry among a smaller number of much larger firms, and the shift in state development strategies in many nations to the neoliberal model of privatization and market opening have transformed the industry. In the Brazilian Amazon, the combination of large scale, high quality resources of bauxite and hydroelectricity and several decades of experience of Brazilian and TNC aluminum firms in southern Brazil made the region a focal point of the global industry and the Brazilian state for the past three decades.

In the Amazonian aluminum industry in recent years, these trends have produced a difficult and contradictory situation that calls into question the economic, social and environmental sustainability of this industry. The privatization of CVRD is transforming the aluminum industry in the Brazilian Amazon. In the context of concentration and globalization in the industry, CVRD faces an increasingly competitive global environment that threatens the future of its operations. At the same time, electricity shortages deriving from a drought in much of Brazil and a lack of state investment by the regional electric utility that has been effectively bankrupt for two decades, in combination with a conflict-filled and slow process of electricity privatization and opening to generation by major power consumers, threatens to curtail or even eliminate the industry. The communities dependent on this industry in the Amazon face a very uncertain future, given the current difficult situation, and the national economy may be damaged as well.
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PRIVATIZATION, GLOBALIZATION AND RAW MATERIALS-BASED DEVELOPMENT:

Aluminum in the Brazilian Amazon

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