

# ALUMINUM ORE

## THE POLITICAL ECONOMY OF THE GLOBAL BAUXITE INDUSTRY

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# Contents

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Illustrations / vii

Acknowledgments / ix

Abbreviations / x

Introduction – Opening Pandora’s Bauxite: A Raw Materials  
Perspective on Globalization Processes in the Twentieth  
Century / 1

MATS INGULSTAD, ESPEN STORLI, AND ROBIN S. GENDRON

1 The Global Race for Bauxite, 1900-40 / 24

ESPEN STORLI

2 “Of the Highest Imperial Importance”: British Strategic Priorities  
and the Politics of Colonial Bauxite, ca. 1916–ca. 1958 / 53

ANDREW PERCHARD

3 Nazi Germany’s Pursuit of Bauxite and Alumina / 79

HANS OTTO FRØLAND

4 National Security Business? The United States and the Creation  
of the Jamaican Bauxite Industry / 107

MATS INGULSTAD

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- 5 The Soviet Union’s “Bauxite Problem” / 138  
STEPHEN FORTESCUE
- 6 “Greece Has Been Endowed by Nature with This Precious Material”: The Economic History of Bauxite in the European Periphery, 1920s-70s / 158  
LEDA PAPASTEFANAKI
- 7 The Volta River Project and Decolonization, 1945-57: The Rise and Fall of an Integrated Aluminum Project / 185  
JON OLAV HOVE
- 8 Canada and the Nationalization of Alcan’s Bauxite Operations in Guinea and Guyana / 211  
ROBIN S. GENDRON
- 9 Transnational Restructuring and the Jamaican Bauxite Industry: The Swinging Pendulum of Bargaining Power / 238  
LOU ANNE BARCLAY AND NORMAN GIRVAN
- 10 Issues of Governance, Liberalization, Policy Space, and the Challenges of Development: Reflections from the Guinean Bauxite-Aluminum Sector / 268  
BONNIE CAMPBELL
- 11 White Metal: Bauxite, Labour, and the Land under Alcan in Twentieth-Century Guyana, Jamaica, and Australia / 302  
BRADLEY CROSS
- 12 Battles over Bauxite in East India: The Khondalite Mountains of Khondistan / 328  
SAMARENDRA DAS AND FELIX PADEL
- 13 Success without Bauxite: Norsk Hydro’s Long Wait to Achieve Backward Integration / 353  
PÅL THONSTAD SANDVIK

Contributors / 373

Index / 378

# Illustrations

---

## Figures

- 0.1 Major bauxite producers / 8
- 0.2 Mining waste generated from aluminum production / 15
- 6.1 Principal mineralized areas of bauxite in Greece / 162
- 6.2 Output-exports of Greek bauxite ore, 1951-72 / 175
- 6.3 Employment in the Greek bauxite mines, 1954-72 / 176
- 6.4 Greek alumina output-exports, 1966-72 / 177
- 6.5 Greek aluminum output-exports, 1962-72 / 178
- 9.1 Production of bauxite and alumina in Jamaica, 1980-2010 / 243
- 9.2 Jamaica's share in global bauxite production, 1980-2010 / 245
- 9.3 Jamaica's share in global alumina production, 1980-2010 / 245
- 9.4 Destination of Jamaica's bauxite exports, 1980-2010 / 248
- 9.5 Destination of Jamaica's alumina exports, 1980-2010 / 249

## Tables

- 3.1 Four-Year-Plan expansion program for alumina / 83
- 3.2 Bauxite production, 1936-40 / 86
- 3.3 Germany's imports of bauxite, 1936-40 / 87
- 3.4 The Norwegian expansion program / 89

- 3.5 The Göring Plan for Europe / 90
- 3.6 Bauxite production, 1941-45 / 92
- 3.7 German imports of bauxite from main countries of origin, 1941-45 / 93
- 3.8 Norwegian bauxite and alumina imports, 1940-44 / 94
- 3.9 Division of bauxite fields for German firms in Croatia / 100
- 6.1 Greek bauxite output, 1935-39 / 166
- 6.2 Greek bauxite sales, 1935-39 / 166
- 6.3 Exports of Greek bauxite, 1936-38 / 166
- 6.4 Bauxite mines in Greece, early 1950s / 173
- 6.5 Mining loans from American aid for bauxite, 1949-52 / 174
- 9.1 Contribution of bauxite-alumina industry to fiscal revenues, 1988-2007 / 255

## Abbreviations

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Alpart	Alumina Partners of Jamaica
Aluérc	Aluminiumérc Bánya és Ipar Rt.
BACo	British Aluminium Company
BATCO	Bauxite and Alumina Trading Company
CAP	Clarendon Alumina Production
CBG	Compagnie des Bauxites de Guinée
CPP	Convention People's Party
Demba	Demerara Bauxite Company
ECA	Economic Cooperation Administration
EITI	Extractive Industries Transparency Initiative
FDI	Foreign Direct Investment
GG	Gebrüder Giuliani
IMF	International Monetary Fund
Jamalco	Jamaica Alumina Company
JBM	Jamaica Bauxite Mining
MNC	multinational corporation
Nalco	National Aluminium Company
PPP	People's Progressive Party
VAW	Vereinigte Aluminium Werke

## INTRODUCTION

# Opening Pandora's Bauxite

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## A Raw Materials Perspective on Globalization Processes in the Twentieth Century

MATS INGULSTAD, ESPEN STORLI, AND ROBIN S. GENDRON

At a town meeting in Jamaica's Manchester Parish in 1945, a demagogue fired up his audience by asking, "What do you want, bauxite or corn? ... Do you want yams or bauxite?"<sup>1</sup> Today, it is hard to imagine that the politician who couched the question in these stark terms actually favoured inviting American mining companies to extract bauxite from the Jamaican people's lands. It is even more difficult to believe that an audience of farmers responded by roundly abusing the few who suggested that corn and yams were also important for the livelihood of the community. Three decades later, the sons of these farmers, like bauxite miners elsewhere, were going on strike to demand more food and higher wages.<sup>2</sup> Today, as the grandsons of the enthusiastic attendees have come of age, their concerns have shifted toward environmental problems, struggling as they are to farm small plots of land on the properties abandoned by multinational mining companies. The history of bauxite, it seems, has come full circle even if society, the economy, and the environment have been irrevocably transformed in the process.

Bauxite is a heterogeneous mineral that is difficult to define accurately. It occurs in many different forms, and its physical properties vary greatly, even within single ore beds. The societal and economic impacts of bauxite extraction have been equally complex and multi-faceted over the course of the last century. For the aluminum companies, it has been the raw material on which they have based their production, and they have considered control over bauxite a *sine qua non* for business success. For the great powers in the

international system, bauxite has been a strategic raw material, the supply of which could possibly decide the outcome of wars to their advantage. For bauxite-rich states, the mineral has embodied a promise of development, but it has also served as a powerful symbol of exploitation by colonial governments and multinational companies. And finally, for local populations, the mining of bauxite has brought employment opportunities but also the destruction of the environment and their traditional way of life.

The transformation of the bauxite industry over the last century has been staggering. In 1890, two years after the process for extracting aluminum oxide from bauxite was first patented, the total world output of bauxite was less than 22,000 tons.<sup>3</sup> This figure has increased ten-thousand-fold over the last 120 years, and today global production hovers around 211 million tons annually. The history of bauxite extraction and processing is not adequately elucidated by the sheer scale of its expansion, however. In 1890, the United States produced 1,900 tons of bauxite for its domestic consumption, with France accounting for the remaining 90 percent of world production. Today, Australia, Brazil, China, Guinea, and India are the main producers of bauxite, while China, Russia, Canada, Australia, and the United States are the largest producers of aluminum.<sup>4</sup> With so much of the bauxite being turned into aluminum in a country other than where it was mined, the history of the bauxite industry is also essentially a history of economic globalization.

Despite its importance as the key ingredient in the production of aluminum, bauxite has been largely neglected by scholars. Although there are numerous books on the aluminum industry, they overwhelmingly focus on the smelting and processing that takes place downstream in the value chain, on R&D and management practices at the company level, industry concentration, or the role of governments in supplying cheap electricity as a way to secure competitiveness.<sup>5</sup> In this volume we wade upstream in the value chain by making bauxite the focal point of our analyses of economic, social, and political developments over the last century. By delving into different cases, using analytical tools from a range of disciplines, certain themes and patterns become discernible in the development of the international political economy of raw materials since the turn of the nineteenth century.

### **Bauxite: Its History, Geology, and Industrial Processing**

Bauxite was first discovered by French geologist Pierre Berthier in 1821, near the village Les Baux-de-Provence in the French Alpilles. Bauxite is composed mainly of aluminum oxide bound in different forms, along with iron oxide, silica, and other impurities. Since the composition of bauxite varies



widely both between ore beds and within a single deposit, the different forms of bauxite are often categorized based on geological age and origin, or chemical and mineral composition.<sup>6</sup> The aluminum in bauxite occurs as hydroxides classified as boehmite, gibbsite, or diasporite. Gibbsite exhibits the least thermodynamic stability, making it the easiest to refine into alumina. Diasporite, on the other hand, is very stable and difficult to process; it therefore accounts for a small percentage of the bauxite utilized by the aluminum industry.<sup>7</sup> Commercially, the terms “trihydrate” and “monohydrate” are often used, referring to the number of water molecules chemically bound to each alumina molecule. “Trihydrate” refers to ores dominated by gibbsite ( $\text{Al}_2\text{O}_3 \cdot 3\text{H}_2\text{O}$ ), whereas “monohydrate” can refer to both boehmite and diasporite (both  $\text{Al}_2\text{O}_3 \cdot \text{H}_2\text{O}$ ), or a mixture of the two.

The formation of bauxite mainly takes place through weathering of aluminosilicate rocks in tropical or subtropical conditions, a process that can take from a few hundred thousand to several million years. The different forms of bauxite are also geographically dispersed. Boehmite occurs largely in Europe and gibbsite chiefly in the tropics, whereas diasporic bauxite can be found in a belt stretching from Greece to China. Caribbean deposits are a combination of gibbsite and boehmite ores referred to as “mixed.” The bauxite is usually mined by open-pit operations after removal of the overburden, which may be up to seventy metres thick. In addition to the amount of overburden, the economic value of a deposit is determined by factors such as the alumina content of the ore, the presence of impurities detrimental to the refining process, and the size of the reserves, as well as infrastructure and transportation costs. It has long been technologically feasible to extract aluminum from other minerals, including alunite and leucite, or aluminum-bearing clays, but these processes are generally not economically viable. Although bauxite has other industrial applications, these are very limited compared with its utilization in the aluminum industry. Approximately 85 percent of the bauxite mined is used to produce aluminum, another 10 percent is used for various forms of alumina, and the final 5 percent is accounted for by non-metallurgical uses.<sup>8</sup>

The production of aluminum from bauxite takes place through one of the longest and most complex refining processes for any known metal. Bauxite is refined to aluminum oxide (alumina) through a complicated process that has remained basically the same since it was patented by Karl Josef Bayer in 1888. The process involves the heating and cooling of finely ground bauxite in caustic soda under pressure. Temperature, caustic concentration, and digestion time are all affected by the composition of the bauxite, causing large

variations in expenditures for processing materials and other operating costs. The impurities are removed by settling and filtering, forming a residue known as “red mud.” The remaining material is then washed and calcined to become smelter-grade aluminum oxide (alumina).<sup>9</sup> This alumina is reduced to aluminum through the electrolytic Hall-Héroult process, requiring large inputs of electrical power. The general rule is that four tons of bauxite are required to make two tons of alumina, which again will yield roughly one ton of aluminum. These are the upstream stages in the aluminum industry value chain. Further processing such as extrusion, rolling, and forging are usually classified as semi-fabrication, which together with final manufacture makes up the downstream stages of the value chain.

### **Flat Earth, Red Mud: Bauxite and Globalization**

Although bauxite is the crux of this project, the contributions should all be understood within a framework of globalization. Globalization was a key – if not the defining – feature of the twentieth century.<sup>10</sup> In the loosest possible sense, the term refers to a form of transcendence of territorial space through which the world is simultaneously being shrunk and flattened. The shrinking takes place as networks are established and expanded, easing the transmission of information and reducing transportation times and costs. Simultaneously, the flattening of the economic playing field occurs through the erosion of natural and political barriers.<sup>11</sup> The bauxite sector is an excellent case study in economic globalization. As Geoffrey Jones has recently argued, “The new global business history needs a more clearly defined research agenda within global frameworks ... a global perspective should move beyond ... national frameworks to look more closely at the nature of the linkages between geographies.”<sup>12</sup> Although this book is interdisciplinary in nature and not confined to the realm of business history, it is the analysis of these precise “linkages” between different regions of the globe, both their creation and their consequences, that is its main objective.

Globalization is unfortunately too often understood as a unidirectional and irreversible process toward further integration of markets and rising interdependence that inevitably weakens the state.<sup>13</sup> But the bauxite industry has involved substantial resistance by both states and societies to the dictates of globalization. In the first half of the century, the great powers considered aluminum production too important to be left in the hands of multinational corporations and so all took measures to protect their bauxite supply, ranging from the pursuit of absolute autarky, or self-sufficiency, through territorial expansion to sponsoring development of substitutes.

During the last half of the twentieth century, a different set of forces have been more palpable, including the emergence of new decision-making centres in the Global South and the empowerment of local indigenous populations, for example, that have made the creation of the global supply chains more complicated.<sup>14</sup> The result is that new legal and political boundaries have been erected even as commercial practices have been harmonized and tariffs reduced through the General Agreement on Tariffs and Trade and the World Trade Organization. Investigating the bauxite industry helps illuminate the complexity of the processes of globalization during the twentieth century.

The contributions in this volume address one or more of four key themes, each one a central feature of the process of globalization in the twentieth century. The first theme is the creation of global value chains; that is, the incorporation of resources from all over the world into a vertically integrated, transnational aluminum industry. The second theme is the response of states to the processes of market integration and their efforts to secure supplies of a strategic material needed to ensure their military capabilities. The third theme is how the raw materials exporting peripheries cast off the yoke of colonialism and challenged their role as raw materials exporters under the political domination of the industrialized North. The fourth theme is that of environmental degradation and its societal impact – a truly global problem that often engenders local resistance to the interests and activities of the international bauxite/aluminum industry. By investigating the mining and processing of bauxite with reference to these four themes, we gain important insights into the driving forces of globalization, the countervailing pressures, and the impact of bauxite mining on states, corporations, societies, and the environment.

### **Global Value Chains and Vertical Integration**

In the second half of the nineteenth century, bauxite became intimately tied to the fortunes of the emerging aluminum industry as its primary raw material. Bauxite is the starting point for the value chain in the aluminum industry and a necessary component for the mass consumption of aluminum in modern society. Bauxite is a bulky material, costly to transport. Consequently, it is often, though not always, refined into alumina close to where it is mined. Since the process of smelting alumina into aluminum requires intensive amounts of energy, there are strong incentives to locate the smelters near sources of cheap and abundant power. Such sites are seldom located close to bauxite deposits. Instead, because of the competition for power

in industrialized areas, aluminum smelters tend to be located on the periphery of the industrialized world. The end markets for aluminum products are found in highly developed economies, where both the final fabrication and the consumption take place. The outcome of these geological and economic factors is that there are strong incentives for multinational companies to create value chains linking together many parts of the globe.<sup>15</sup>

The aluminum industry has always been characterized by an extremely high degree of vertical integration. Yet, the vertical integration in the sector is also asymmetrical in the sense that there is a substantial differentiation between the segments of the value chain. Upstream in the value chain, the industry is global and highly integrated, but downstream, beyond the smelting stage, the aluminum companies are really engaged in multi-domestic businesses because of the diversity of the local markets, high transport costs, strong competition from independent fabricators, and the requirement for intensive customer contact.<sup>16</sup>

The segmentation of the value chain to some extent helps explain the high level of vertical integration by focusing on the properties of the bauxite itself. Bauxite refining is immensely capital intensive and technologically challenging, both of which factors encourage concentration. Another important factor is the high asset specificity of bauxite. Since the mineral is so heterogeneous, alumina refineries are usually tailor-made to process one type of bauxite, and the costs of switching between types are often prohibitive. The producers have therefore always stressed the importance of secure and regular access to a particular type of bauxite, preferably through ownership control. The same kind of industrial logic is also applicable to alumina. Although far less heterogeneous than bauxite, alumina is still produced in different varieties with disparate properties. In order to maximize efficiency, the individual smelters are customized to work with specific types of alumina. The bargaining costs and financial risks associated with these market structures not only account for the relative absence of arm's-length markets but also explain why vertical integration plays a much greater role in the bauxite-aluminum sector than elsewhere.<sup>17</sup>

Although the peculiar characteristics of the value chain in the bauxite-based aluminum industry have conformed to – and indeed been a driving force of – economic globalization, it must be remembered that this has been an uneven historical process. In the early years, the bauxite-aluminum production lines were located in Western Europe and North America. Bauxite was mined in the French countryside and Arkansas, with most of the smelting taking place in the United States, Great Britain, France, Switzerland, and

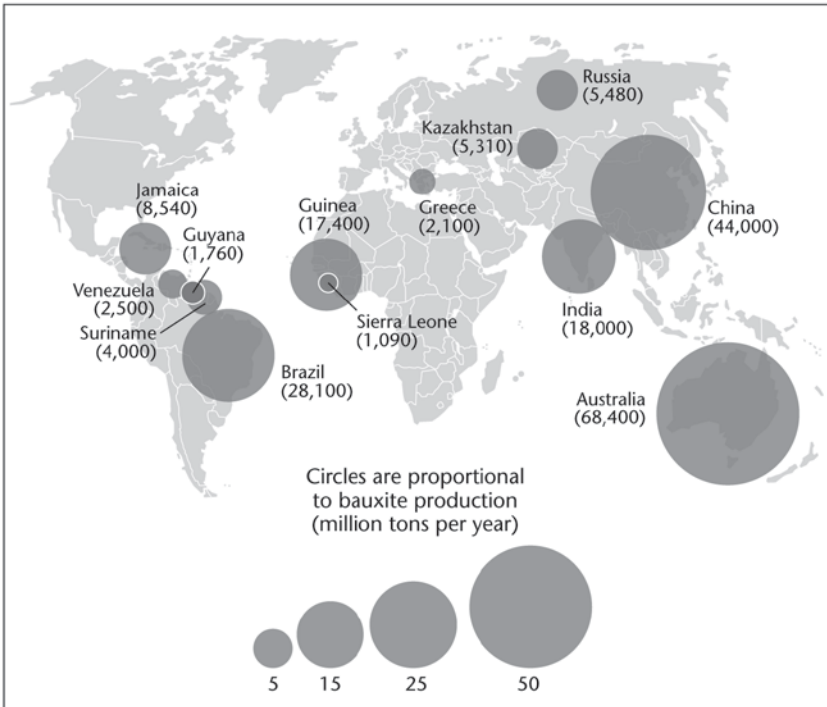
Germany.<sup>18</sup> Consequently, before the First World War, bauxite was used in what must be deemed intraregional, more than truly international, chains of production. In this way, the bauxite industry also departs markedly from the standard narrative of globalization in which technological advances created a strong drive toward globalization in the late nineteenth century that was interrupted by two world wars.

The uneven distribution of bauxite has been a crucial factor in driving the extension of commodity chains around the world. The creation of value chains through the establishment of trade links has always been a key contributor to the globalization processes. However, what is usually referred to as the first wave of globalization was brought to an end by the eruption of the First World War. Following the war, the internationalization of the aluminum industry gained momentum. The need for large amounts of cheap electricity forced the aluminum companies out of their national confines in search of rivers to dam and waterfalls to divert into pipelines, and many new aluminum smelters were built on the periphery of the industrialized world during and after the First World War, be it deep in the woods of Canada or along the Norwegian fiords. Equally importantly, the quest for new bauxite deposits induced aluminum companies and governments to send prospectors into the wildernesses of South America, Africa, Asia, and Australia. The emphasis on locating and securing new sources of bauxite reflects the fact that while a government can always establish a low-cost power regime to subsidize a smelter, mineral deposits cannot simply be legislated into existence.<sup>19</sup> It was the opening of bauxite fields in new continents that transformed the aluminum industry from a business based on intraregional value chains to a truly global industry (see Figure 0.1). This process was driven not only by the attempt to improve profit margins but by the development of aluminum as a strategic material.

### **Bauxite in the Age of Strategic Materials**

The growth of the international aluminum industry, and consequently the appetite for bauxite in industrialized countries, cannot be understood without considering the vital importance of aluminum to fighting and winning modern wars. For much of the twentieth century, bauxite was considered a strategic resource, essential for the maintenance of the military capabilities of the state. As late as the 1990s, military experts insisted that stockpiles of bauxite for aluminum were a vital strategic necessity and that the lack thereof would undermine the military security of the NATO countries.<sup>20</sup> However, bauxite is a difficult material to stockpile, as it is very bulky, and some types

**FIGURE 0.1**  
**Major bauxite producers**



Source: Adapted from GRID-Arendal/United Nations Environmental Programme.

also have to be stored under cover to avoid exposure to moisture. In addition, the great varieties of purity and the different crystal forms of the alumina in the bauxite require that specific grades of bauxite be stockpiled near the refineries that process those specific grades to avoid serious decreases in output during wartime. Naturally, this causes problems for military authorities when a given company changes to a different source of bauxite.<sup>21</sup> The interests and considerations of private businesses and military authorities therefore cannot easily be untangled. This is particularly true since the strategies for coping with dependence on bauxite also have informed the way different states have defined and pursued their geopolitical objectives.

The development of mass-production techniques that made the bauxite-aluminum value chains a reality by the end of the nineteenth century heralded the dawning of the era of industrial warfare.<sup>22</sup> The First World War thus marked a significant turning point in the development of the bauxite

sector. Since the new hallmarks of warfare, such as increased use of fire-power and transportation, and the advent of military aviation, relied on massive amounts of aluminum, the metal came to be seen as a strategic material. As well, the war had erupted just as the aluminum companies were taking their first cautious steps toward sourcing their bauxite internationally but before the international value chains that later characterized the industry had been fully developed. And so, when the French government shut down its bauxite exports at the beginning of the war, other states became acutely aware of the risks entailed in their dependency on foreign sources of bauxite. The resulting fears that the supply of bauxite could be used as a bludgeon against states dependent on imports reverberated through the following decades.

In an international environment that remained inherently unstable and characterized by rising economic nationalism in the interwar years, governments everywhere pursued widely different strategies for securing bauxite. These strategies were inevitably determined by their political philosophies and geopolitical designs and were frequently explicitly directed against the forces of globalization. The volatile Italian leader Benito Mussolini limited exports of bauxite as part of his quest for autarky, which he described as the leitmotif of a new phase in Italian history.<sup>23</sup> The Soviet Union, whose leadership most clearly rejected the tenets of liberal trade philosophy, sought autarky through the substitution of other raw materials for bauxite. The British, retreating from their commitment to free trade, also took steps to consolidate control over raw materials that could be found within their imperial domain.<sup>24</sup> The French Third Republic, in a move widely seen as an attempt to force Nazi Germany to abandon rearmament, introduced limitations on exports of bauxite in the mid-1930s. Imperialist expansion therefore seemed to be the most promising avenue open to the rising powers of Germany and Japan, which lacked not only bauxite but a whole range of other raw materials. For these states, self-sufficiency could come only through the assertion of control over raw materials—producing areas outside their own territory.<sup>25</sup>

The steadily worsening international climate of the interwar years turned the supply of raw materials into a political problem of the first order. As the war clouds gathered after the Italian invasion of Abyssinia in 1935, which in itself sparked new fears of raw materials embargoes, the Anglo-Saxon powers adopted a strategy of promising international trade liberalization to counter the demands of Germany, Italy, and Japan for access to resources.<sup>26</sup> The United States and Great Britain, after all, controlled three-quarters of the world's production of raw materials and could more easily insist that the



international markets should be sufficient for anyone to acquire the strategic materials they needed.<sup>27</sup> This approach was formally adopted as the blueprint for the postwar world order by the United States and Great Britain through the proclamation of the Atlantic Charter in 1941, though with some reluctance on the part of the latter. German submarines for a time posed a grave danger to the supply of bauxite for American, Canadian, and British war industries, but the Allies eventually prevailed. Victory opened up new opportunities to implement the ambitious wartime plans to refashion the international political economy. Expansion of value chains through globalization, not military conquest, was the cure prescribed in Washington to ensure a proper international distribution of strategic raw materials.<sup>28</sup>

### **Decolonization**

The major wars of the first half of the twentieth century stimulated the aluminum industry tremendously, both in terms of generating new markets and of gaining it the support of the state in the quest for deposits of high-quality bauxite. As civilian demand skyrocketed in the early postwar years, the aluminum and bauxite industries appeared to be poised on the threshold of a new era of global prosperity. "We were going to cover the world in aluminum," one Alcoa sales manager later put it.<sup>29</sup> However, before the globe could be wrapped in aluminum foil, the requisite bauxite would have to be acquired somehow. And more and more frequently, states and companies turned to the ample deposits of bauxite in the tropics, thereby extending the value chains across the globe, turning the bauxite-aluminum industry into a global business. The turn toward the tropics was to some extent driven by new prospecting, as some of the largest deposits of bauxite, such as in Ghana, Brazil, and Jamaica, were discovered shortly before or during the Second World War.<sup>30</sup> But far more salient was the role played by colonialism and, later, decolonization in shaping the structure of the industry.

The creation of international value chains in which most of the value added takes place in the North is partly a cruel quirk of geology. The richest bauxite deposits occur mainly in flat, humid areas in the tropics where the generation of large amounts of hydro power is either not possible at all or extremely expensive.<sup>31</sup> But there were political causes for this development as well. Private companies found tropical areas well suited for the mining of bauxite, since they were largely under the control of European colonial governments. The global reach of decision makers in the metropolitan capitals thus appeared to speed up the integration of new territories into the value



chains. Guinea, Ghana, Jamaica, the Guianas, and the Dutch East Indies were all colonies richly endowed with bauxite, where private companies had already established relationships with the colonial governments. The European colonial powers also had an additional reason for supporting the companies. The Second World War had shattered the myth of supremacy and the colonialists increasingly justified their continued rule in terms of support for long-term development. Many of the governments therefore planned development programs and revisions to the mining codes that would provide them with a moral fig leaf and also attract more investment to their colonies.<sup>32</sup>

However, calls for national self-determination engulfed Asia immediately after the Second World War and threatened the constancy and stability offered by the metropolitan governments to private enterprise.<sup>33</sup> In Africa too, the colonial powers failed to suppress nationalist sentiment through paltry development schemes or other measures. As James Hubbard has put it, the Africans by then agreed that “the ragged shirt of independence, indeed, was preferable to the warm blanket of colonialism.”<sup>34</sup> The decolonization process provided a substantial challenge to the private aluminum companies, as they ran the risk of having their assets nationalized, or risked getting embroiled in the turbulence of potential political disintegration. There was also always the risk of conflict as the borders drawn by – and frequently with – rulers in European capitals were being redrawn on the ground level. The bauxite deposits in Jammu and Riasi, for instance, were located in areas disputed by India and Pakistan following independence from the British in 1947. The decolonization process also complicated investment decisions, since new political centres had emerged, and new relationships had to be established with the former colonial subjects that often did not share in the common outlook and cultural background that had enabled civil servants and private business people in the West to work so well together.

Decolonization did not end global integration; rather, it gave a powerful impetus to the globalization process.<sup>35</sup> The proliferation of centres of decision making altered the dynamic of the aluminum industry after mid-century. The replacement of colonial administrations by independent national states also brought with it new opportunities, as formerly economically closed colonial entities were opened to a wider array of sources of foreign investment.<sup>36</sup> There was also the somewhat paradoxical effect of the private companies’ apprehensions about embracing the opportunities to risk their money in the formerly colonial areas. To avoid giving any country

the opportunity to nationalize an integrated bauxite-alumina-aluminum complex, the companies took great pains to keep mining, refining, and smelting operations separate. Although alumina refining or even aluminum smelting in some cases are economically viable in Africa, the corporations preferred to engage in transatlantic cross-hauling in order to avoid putting all of their eggs in one basket. This led to a thickening of international trade flows, even if they were intrafirm or within the boundaries of a consortium, rather than transactions in arm's-length markets. This logic was reinforced by the imposition of higher tariffs in developed countries on the importation of aluminum than on bauxite and alumina, a move calculated to capture the maximum amount of value-added business.<sup>37</sup> However, in later decades, the gradual erosion of tariff barriers, the changing economics of transport, and demands from host countries for further processing within their territories have made the erection of more integrated production complexes more likely.<sup>38</sup>

Post-independence, however, the new nation states found themselves engaged in a familiar struggle to maximize the benefits they received from the exploitation of their bauxite. This struggle was complicated at times by the geopolitical Cold War that encouraged the developed governments of the Eastern and Western blocs to take a more active interest in economic growth in the developing world. The offers of technical and financial assistance by the more developed states also tended to limit, at least to some degree, the room for manoeuvre of governments in the developing states. Indeed, governments in Asia, Africa, Latin America, and the Caribbean quickly began to complain that independence had only marginally improved their ability to give their citizens a better quality of life. They also insisted that the ongoing political and economic influence of developed countries and of multinational corporations like the major aluminum companies amounted to a form of neo-imperialism.<sup>39</sup> Following the example of OPEC, Jamaica took the lead in setting up the International Bauxite Association to allow the host countries to set the terms of resource extraction within their territories.<sup>40</sup> Control of bauxite, as well as the benefits derived from its exploitation, remained a significant "prize" and, as a result, a frequent source of dispute between peoples, governments, corporations, and political and economic systems throughout the twentieth century.

### **Societal and Environmental Impact**

As the faith in the hierarchical order of human beings was being torn down by decolonization, mankind was similarly compelled to reconcile itself with

being a part of, and not above, nature. The environmental problems caused by bauxite extraction have increasingly come into focus in recent years, leading to demonstrations around the world.<sup>41</sup> Although the exploitation of bauxite offers many benefits, including economic and strategic benefits most notably, the significant costs of that exploitation remained hidden for much of the twentieth century. Like most extractive industries, bauxite mining has a significant effect on natural environments, especially those in developing regions where environmental regulations tend to be most lax. Because bauxite reserves are typically found near the earth's surface, bauxite is usually strip-mined, a method that leads to vast open pits of devastated land, significant environmental degradation, and the disruption or even destruction of local wildlife, water flows, and other environmental and ecological processes. Land reclamation projects demanded by the host countries have achieved limited results, and so the arrival of prospectors can also bring about unusual coalitions between farmers and environmentalists in opposition to the corporations. As one farmer recalled from his fruitless struggle against Alcoa in Australia, "I actually supported the bloody greens. I didn't want the bastards here; well, not to build the refinery where they did because it was prime bloody dairy land ... But any rate, we got steamrolled."<sup>42</sup> Environmental damage can galvanize opposition to the agents of globalization, but so can the troublesome health effects of bauxite mining. Although inhalation of bauxite dust is primarily considered an irritant according to medical lexicographers, prolonged exposure can lead to respiratory ailments and a variety of restrictive pulmonary diseases, the severity of which depend to some degree on the chemical composition of the bauxite. This is rather disturbing given that some local communities in the vicinity of bauxite mines are often covered in a film of red dust. There are also emissions from the fuel burned in the process of drying the bauxite, as well as seepage of waste materials into local ecosystems.<sup>43</sup> The bauxite industry is by no means unique in this regard; health problems and environmental damage are currently the major issues in litigation against multinational corporations involved in natural resource extraction.<sup>44</sup>

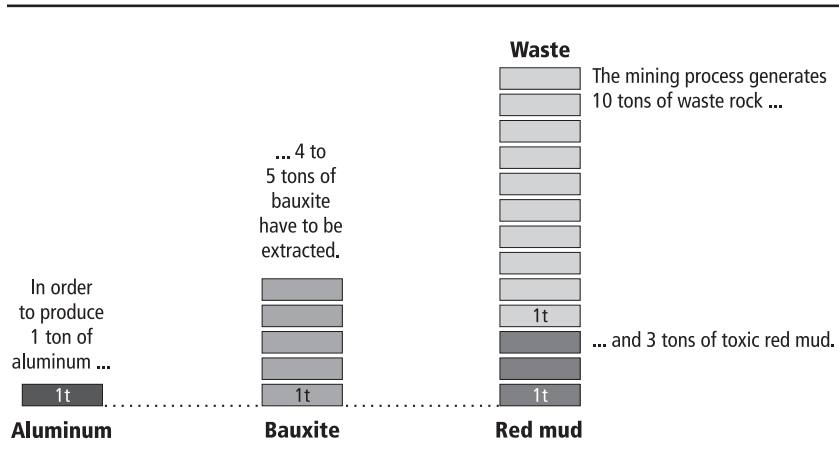
Beyond the localized destruction of the environment and health hazards troubling the nearby communities, there is also a significant risk of industrial accidents, which can have grave consequences that often transcend national borders. One of the by-products of the Bayer process for refining bauxite into alumina is a waste product commonly known as "red mud"; an estimated 2.7 billion tons of red mud are currently stored worldwide, a figure that is growing by 120 million tons every year.<sup>45</sup> Since this toxic mud

cannot easily be disposed of, it is typically allowed to dry in large holding ponds, which pose significant risks to their surroundings. The dangers of this practice were demonstrated dramatically in October 2010 when the wall of a reservoir belonging to the Ajkai Timföldgyár alumina plant in western Hungary collapsed, releasing about a million cubic metres of red mud that flooded the nearby communities of Kolontár and Devecser, causing the deaths of at least 9 people and injuring at least 122 others. As the red sludge made its way toward the already polluted water of the Danube, government officials in the countries further downstream worried about whether the highly alkaline waste would be sufficiently diluted before reaching their territory. Fears of similar transboundary accidents subsequently developed in Southeast Asia, where several large-scale bauxite projects are under development, showcasing how pollution from the bauxite industry is a global, not a local, problem.<sup>46</sup>

On one level at least, the environmental impact of the mining and refining of bauxite is readily apparent in the scars left on the landscape by strip-mining, deforestation, or the holding ponds for red mud. Less tangible, however, are other societal effects of the bauxite industry, such as the dislocation of indigenous peoples unfortunate enough to reside over a valuable mineral resource. Particularly in Australia there have been protracted struggles between Aboriginal peoples and the aluminum producers, and the passage of land rights legislation has only partially alleviated tensions. Nevertheless, there are other problems. Large-scale mining operations lead to town formation and the destruction of the traditional way of life for many indigenous peoples, even as the highly technical nature of work demands qualifications not easily accessible to them, often leaving them trapped in poverty.<sup>47</sup> The dangerous dynamics created by the meeting of multinational companies and indigenous populations also manifested itself clearly in company mining towns. Over the last century, these towns often perpetuated racial and class divisions as Caucasian managers and non-Caucasian workers lived separate lives. The mining towns could thus serve as allegories of the global division of labour between the industrialized North and the Global South.

As the emergence of vast mining companies based in Third World countries has become a more palpable feature of the global economy, the exploitation of bauxite has become a significant source of tension also within their home societies. In a considerable change to the pattern established during the early and middle decades of the twentieth century, emerging powers like Brazil and India have established their own domestic companies to develop

**FIGURE 0.2**  
**Mining waste generated from aluminum production**



Source: Adapted from GRID-Arendal/United Nations Environmental Programme.

their national bauxite reserves. As a result, the lines of conflict over the exploitation of bauxite now often run between national business and/or political elites and other groups within the same society instead of between Western multinational companies and the governments of developing countries. This creates a paradox in that these national giant corporations may be better placed to subvert the national political system for their own ends, thanks to their political networks, a better understanding of the culture, and, in general, being less hampered by the liabilities of foreignness. These corporations may also have been less exposed to criticism from the well-developed networks of protesters in the Western world, though this is rapidly changing as social media provide new means for transmitting information and organizing protests outside branch offices in financial and political centres.

It is clear that during the last century the bauxite industry has had a dramatic impact on states and societies around the world. Sadly, it also conforms to a general trend in commodity value chains: that each step in the processing is associated with environmental and societal costs, not to mention unintended spillover effects, which are not adequately reflected in the price of the final product (see Figure 0.2).<sup>48</sup> This externalization of costs, both in the bauxite mining phase and later stages in the value chain, has lowered the price of aluminum sufficiently to make it the material of

choice for the innumerable end products of modernity. It has thereby been a contributing factor to the emergence of rampant consumerism and materialism. This is just another testament to the fact that a more profound understanding of the globalization of the bauxite industry in the twentieth century must take into consideration not only the economic opportunities it has afforded to peoples and societies but also the full range of its environmental and societal effects as well.

### **The Genesis and Structure of This Book**

The book emerged in the wake of a research project that was carried out under the auspices of the Comparative Aluminium Research Program (CARP), based at the Norwegian University of Science and Technology (NTNU) in Trondheim. The question of why there were no books dealing more with the bauxite industry set the editors on the quest to gather different perspectives of a global industry. The existing network of researchers set up under the auspices of CARP was utilized to launch the new project, and new contributors were also found, often in surprising and roundabout ways. The outlines for the chapters were first presented during a workshop at the Fondation Maison des sciences de l'homme in 2008, with the aid of the Institut pour l'histoire de l'aluminium and the Centre Franco-Norvégien en Sciences Sociales et Humaines.<sup>49</sup> The contributors also met in Utrecht, the Netherlands, during the World Economic History Conference in August 2009.

There has been a rough chronological order to how the four themes outlined above have impacted on the bauxite industry. Naturally, this is also reflected in the order of the chapters.

The opening chapter, by Espen Storli, addresses the question of how bauxite became a global mineral. He shows that the First World War turned bauxite into a strategic material and that the creation of global value chains in the period was made possible through the interplay between government and business. In addition, Storli shows how local entrepreneurs played vital roles in facilitating the expansion of the aluminum companies into bauxite fields abroad, in short, allowing them to put the “multi” into the term “multi-national corporation.”

The following chapter, by Andrew Perchard, picks up the thread of government-business relations and explores the political factors determining British Aluminium Company's access to imperial bauxite reserves. Although the interests of the British government, chiefly those of military supply departments, and aluminum companies periodically converged,

increasingly the relationship was one that in the long run compromised British Aluminium Company's commercial interests. The chapter sheds new light on an important and overlooked part of Britain's military-industrial complex.

The third chapter, by Hans Otto Frøland, outlines how the strategy of the Third Reich for dealing with bauxite shortages was also clearly directed against the multilateral economic world order. Rejecting the thesis that sufficient resources could be available through trade, the leaders of the Third Reich instead embarked on a conscious strategy to expand their control over territory as a measure to reduce their reliance on global markets and vulnerable supply chains.

The fourth chapter, by Mats Ingulstad, outlines how strategic materials concerns could promote globalization and the creation of international value chains. Although the European Recovery Program, also known as the Marshall Plan, is generally considered to have been a central tool in the American quest to create an open trading order after the Second World War, the case of Jamaican bauxite shows how national security concerns could facilitate the creation of new raw materials sources within the American security perimeter but beyond the boundaries of the American state. Like Perchard, Ingulstad emphasizes the importance of understanding the decision-making apparatus of the state, especially since the outcomes are negotiated by actors with different ideas about what constitutes the national interest.

The fifth chapter, by Stephen Fortescue, marks the high point of the drive toward autarky by a state that consciously rejected globalization as a viable strategy for accessing bauxite. When faced with its own lack of workable bauxite ores, the Soviet leadership instead chose a policy of substitution through alternative processes. Fortescue, like several of the other contributors, also highlights the importance of understanding state decision-making structures in order to make sense of the policies that were ultimately chosen.

The sixth chapter, by Leda Papastefanaki, outlines the history of the bauxite industry in Greece, with a special emphasis on the struggle to maximize the benefits received from exploiting the raw material. She discusses how the discovery of rich bauxite deposits in the interwar years created the expectation of a more systematic industrial exploitation of the country's resources and analyzes why it was so long before Greece was able to integrate down the value chain from bauxite mining to aluminum smelting. However, the integrated aluminum industry in Greece had marginal spillover effects and

did not create the hoped-for conditions for a structural transformation of the Greek economy.

The seventh chapter, by Jon Olav Hove, brings us to the new problems related to the development of the bauxite and aluminum sector under the pressure of decolonization and Cold War politics. As Ghanaian independence drew closer, the companies in the industrialized North withdrew from the Volta River Project, an undertaking that was initially seen to both have great merit and potentially serve as a way to demonstrate support for the newly created state. The trumpeting of development assistance as a rationale for further colonial rule was thus revealed to be empty rhetoric.

The eighth chapter, by Robin S. Gendron, makes clear why the companies were indeed apprehensive about their investments overseas without the continued support of determined colonialist governments. As the Canadian government prioritized improving political relations with the newly independent governments, Alcan was left vulnerable to the nationalist aspirations of the Guinean and Guyanese governments. This chapter also highlights the growing pressure on aluminum companies in the late twentieth century to become better corporate citizens as they operated in developing countries around the world.

The bid for more power over natural resources has not palpably strengthened the Global South in all cases, and as Lou Anne Barclay and Norman Girvan make clear in the ninth chapter, the Jamaican government has experienced severe problems in recent decades in attempting to maintain control over revenues from its bauxite sector. The chapter analyzes the impact of policy changes in Jamaica after 1980 in the context of the global restructuring of the aluminum industry and shows that, although the country has been successful in restoring Jamaica as an attractive location for foreign direct investment, the policies have had unforeseen effects on the country's fiscal revenues.

Bonnie Campbell picks up the theme of policy impact in Chapter 10. In her study of Guinea, the country possessing the world's largest reserves of bauxite, she argues that there has been an exceptional lack of transparency with which the Guinean mining sector has been managed domestically and that this has resulted in an overarching emphasis being given to the lack of transparency of internal revenue flows. Campbell demonstrates that this emphasis has tended to mask the opacity of the way that mineral prices have been negotiated and mining contracts have been signed, helping to explain why the potential economic benefits of the bauxite-alumina sector have not been fully captured by the country.



The last thematic strand is kicked off by Bradley Cross, who analyzes the conflicts between aluminum companies and local populations around the world. He argues that the value chain from the tropics to the industrial centres in the North has reflected the racial hierarchies and that environmental degradation has touched off some conflicts between local activists and the corporations. As his chapter makes clear, the responses to these problems have changed over time and also across space.

Activist academic Felix Padel and filmmaker Samarendra Das also examine the theme of environmental degradation and the societal impact of bauxite mining. They examine the effects of bauxite mining on the tribal peoples of eastern India and their campaigns against bauxite developments in their localities, pitting them squarely against the political and economic agendas of Indian aluminum companies and state and national political and economic elites in the country.

Rounding off the book is Pål Thonstad Sandvik's chapter, which makes it clear that there were alternative routes to success for companies that were not vertically integrated. Nevertheless, as he demonstrates, at the beginning of a new millennium, the incentives for backward integration remain strong, even as the old established companies based in the North face new challenges from the new giant corporations based in the Global South.

## Notes

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