Fathi Habashi

My trips to the Caribbean

2015

My Trips to the Caribbean

Volume derived from

Fathi Habashi

Department of Mining, Metallurgy, and Materials Engineering
Laval University, Quebec City, Canada

2015

The Book

The present volume is derived from *De Re Metallica. A Metallurgist on the Move*, which is a diary of the trips the author has undertaken during his professional career. He visited many industries, universities, research centres, and museums and participated in many conferences. The book therefore reflects the state of extractive metallurgy since he left his home country Egypt and went to study in Vienna. *De Re Metallica* is in seven volumes fully illustrated mainly by coloured photographs. It includes a short history of the place visited and its main sightseeing sites. Volume 1 Egypt, Volume 2 Canada, Volume 3 United States, Volume 4 Latin America, Volume 5 Asia [in two parts], Volume 6 Europe [in two parts], and Volume 7 Russia & other countries. Total number of pages was 5500.

Since these volumes could not be separated and therefore they will not be available to many readers, I decided to split the book into selected 29 small units, each representing one country or a group of countries closely related geographically. The present volume is one of these volumes.

The Author

Fathi Habashi, Professor Emeritus at Laval University in Quebec City. He holds a B.Sc. degree in Chemical Engineering from the University of Cairo, Dr. techn. degree in Inorganic Chemical Technology from the University of Technology in Vienna, Dr. Sc. *honoris causa* from the Saint Petersburg Mining Institute, Dr. *h.c.* from National Technical University in Lima, and Dr. *h.c.* from San Marcos University also in Lima. He held the Canadian Government scholarship at the Mines Branch in Ottawa, taught at Montana College of Mineral Science & Technology, then worked at the Extractive Metallurgical Research Division of Anaconda Company in Tucson, Arizona, before joining Laval in 1970. His research was mainly directed towards organizing the unit operations in extractive metallurgy and putting them into a historical perspective.

Published by:

Métallurgie Extractive Québec
800 Alain, #504, Québec City, Québec, Canada G1X 4E7
Tel.: (418) 651-5774. E-mail: Fathi.Habashi@arul.ulaval.ca
http://pages.infinit.net/habashi
http://works.bepress.com/fathi_habashi/

Distributed by:

Laval University Bookstore Zone
Pavillon Maurice-Pollack, Cité Universitaire, Québec City, Canada G1V 0B4
Tel.: (418) 656-2600, Fax: (418) 656-2665
E-mail: conseiller@zone.ul.ca

Dépôt légal 2015

- Bibliothèque nationale du Québec, Montréal
- National Library of Canada, Ottawa

ISBN 978-2-922686-45-6

Fathi Habashi, *My Trips to the Caribbean.*

Page set up in Québec City by **Jean-François Morin**.

Printed in Québec City by **Les Copies de la Capitale, Inc.**

Métallurgie Extractive Québec is a non-profit publisher registered in Québec City #2240676462 devoted to diffusion of extractive metallurgy literature.

To Nadia,
Hani, and Hatem
with love

Other Books by the Author

Published by Métallurgie Extractive Québec, Québec City and distributed by Laval University Bookstore except otherwise stated.

Technical

F. Habashi, *Principles of Extractive Metallurgy*:

- Volume 1: General Principles (422 pages), 1969 (reprinted 1980) (out of print), Gordon & Breach Science Publishers.
- Volume 2: Hydrometallurgy (468 pages), 1970 (reprinted 1980) (out of print), Gordon & Breach Science Publishers.
- Volume 3: Pyrometallurgy (493 pages), 1986 (reprinted 1992) (out of print), Gordon & Breach Science Publishers.
- Volume 4: Amalgam and Electrometallurgy (380 pages), 1998.

F. Habashi (editor), *Handbook of Extractive Metallurgy*, 4 volumes, 2 500 pages, WILEY–VCH, Weinheim, Germany, Also: John Wiley, 605 Third Avenue, New York, NY 10158-0012.

F. Habashi (editor), *Alloys. Preparation, Properties, Applications*, 312 pages, WILEY–VCH, Weinheim, Germany (out of print). Now available from Métallurgie Extractive Québec.

F. Habashi, *Metallurgical Chemistry*, American Chemical Society, Washington, DC, Manual (279 pages), Audio Course (MP3 CD, 5 hours playing time). Now available from Métallurgie Extractive Québec.

F. Habashi, *Metals from Ores. An Introduction to Extractive Metallurgy*, 2003, 475 pages.

F. Habashi, *Pollution Problems in the Mineral and Metallurgical Industries*, 1996. 150 pages.

F. Habashi, *Textbook of Hydrometallurgy*, 2nd edition, 1999, 750 pages.

F. Habashi, *Textbook of Pyrometallurgy*, 2002, 600 pages.

F. Habashi, *Kinetics of Metallurgical Processes*, 1999, 376 pages.

F. Habashi (editor), *Progress in Extractive Metallurgy*, Vol. 1, Gordon & Breach 1973, 239 pages (out of print). Now available from Métallurgie Extractive Québec.

F. Habashi, *Chalcopyrite. Its Chemistry and Metallurgy*. McGraw-Hill International Book Company 1978, 177, pages (out of print). Now available from Métallurgie Extractive Québec.

F. Habashi, I. N. Beloglazov, and A. A. Galnbek (editors), *International Symposium. Problems of Complex Ores Utilization*, Mineral Processing & Extractive Metallurgy. Special Issue, Gordon & Breach 1995, 280 pages (out of print). Now available from Métallurgie Extractive Québec.

F. Habashi, *Aluminum. History & Metallurgy*, 2008, 160 pages.

F. Habashi, *Researches on Rare Earths. History and Technology*, 2008, 125 pages.

F. Habashi, *Researches on Copper: History, Metallurgy*, 2009, 400 pages.

F. Habashi, *Gold: History, Metallurgy, Culture*, 2009, 277 pages.

F. Habashi, *Researches on Asbestos*, 2011, 115 pages.

F. Habashi, *Mineral Processing for Nano-Scientists*, 2011, 170 pages.

F. Habashi, *Extractive Metallurgy of Copper*, 2012, 412 pages.

F. Habashi, *Pyrite. History, Chemistry, and Metallurgy*, 2012, 115 pages.

F. Habashi, *Pressure Hydrometallurgy*, 2014, 242 pages.

F. Habashi, *De Re Metallica. A Metallurgist on the Move*, 7 volumes, 2015, 5523 pages.

Historical

F. Habashi (editor), *Gellert's Metallurgic Chymistry*, 1998, 500 pages.

F. Habashi, D. Hendricker, C. Gignac, *Mining and Metallurgy on Postage Stamps*, 1999, 335 pages.

F. Habashi, *Extractive Metallurgy Today. Progress and Problems*, 2000, 325 pages.

F. Habashi, *From Alchemy to Atomic Bombs*, 2002, 350 pages.

F. Habashi, *Schools of Mines. The Beginnings of Mining and Metallurgical Education*, 2003, 604 pages.

F. Habashi, *Ida Noddack (1896–1978). Personal Recollections on the Occasion of 80th Anniversary of the Discovery of Rhenium*, 2005, 164 pages.

F. Habashi, *Readings in Historical Metallurgy*, Volume 1: Changing Technology in Extractive Metallurgy, 2006, 800 pages.

F. Habashi, *Postage Stamps: Metallurgy, Art, History*, 2008, 125 pages.

F. Habashi, *The Copts of Egypt*, 2006, 92 pages.

F. Habashi, *Chemistry and Metallurgy in the Great Empires*, 2009, 272 pages.

F. Habashi, *Science, Technology, and Society*, 2009, 316 pages.

F. Habashi, *Aqua Science Through the Ages. An Illustrated History of Water*, 2010, 166 pages.

F. Habashi, *Mining and Civilization. An Illustrated History*, 2010, 510 pages.

Preface

De Re Metallica. A Metallurgist on the Move is a diary of the trips the author has undertaken during his professional career. He visited many industries, universities, research centres, and museums and participated in many conferences. The book therefore reflects the state of extractive metallurgy since he left his home country Egypt and went to study in Vienna. The book is in seven volumes fully illustrated mainly by coloured photographs. It includes a short history of the place visited and its main sightseeing sites. Volume 1 Egypt, Volume 2 Canada, Volume 3 United States, Volume 4 Latin America, Volume 5 Asia [in two parts], Volume 6 Europe [in two parts], and Volume 7 Russia & other countries. Total number of pages was 5500.

Since these volumes could not be separated and therefore they will not be available to many readers, I decided to split the book into selected 28 small units each representing one country or a group of countries closely related geographically as shown below.

1	Arab Countries	Jordan, Kuwait, Morocco, Syria, Tunis
2	Austria	
3	Australia & Southeast Asia	Australia, Cambodia, Indonesia, Malaysia, Philippines, Thailand, Vietnam
4	Balkans	Albania, Bosnia, Bulgaria, Croatia, Greece, Romania, Serbia, Slovenia
5	Baltic Countries	Latvia, Lithuania, Poland
6	Brazil	
7	Canada	
8	Caribbean	Cuba, Puerto Rico, Venezuela
9	Caucasus	Armenia, Azerbaijan, Georgia
10	Central Asia	Afghanistan, Kazakhstan, Mongolia, Uzbekistan
11	Central Europe	Czech Republic, Slovakia, Hungary, Switzerland
12	Chile and Argentina	
13	China	
14	Egypt	
15	England and France	
16	Germany	
17	Iberian Peninsula	
18	India	
19	Italy and Vatican	
20	Japan and Korea	
21	Low Countries	

22	Mexico	
23	Middle East	Iran, Turkey
24	Peru and Bolivia	
25	Russia	
26	Scandinavia	
27	South Africa	
28	USA	

I hope in this way the book will available to a large number of readers.

Fathi Habashi
Fathi.Habashi@arul.ulaval.ca

Table of Contents

Chapter 1

Cuba

Figure 1.1: Flag of Cuba.

Figure 1.2: Cuba and her neighbours.

Figure 1.3: Cuba, showing Havana on the west and Holguín on the east of the island. Santiago de Cuba is south of Holguín. The US Naval Base Guantánamo is on the extreme eastern part of the island.

Figure 1.4: Map showing Holguín Province on the east coast of Cuba, where the nickel plants at Nicaro, Moa, and Punta Gorda are located.

Historical Introduction

On October 27, 1492, Christopher Columbus landed in Cuba and claimed the island to the King of Spain. Havana was founded in 1519 on the west side of a bay named after a local Indian chief. In the 16th century, and for hundreds of years after that, the Caribbean Sea was the centre of piracy. France and England, coveted the wealth the Spaniards were obtaining from their American colonies, and authorized their seamen to attack ships under the Spanish flag and loot them.

Havana was captured by the British on June 6, 1762 during the Seven Years' War. The British immediately opened up trade with their North American and Caribbean colonies, causing a rapid transformation of Cuban society. Thousands of slaves from West Africa were transported to the island to work on the sugar plantations. After signing the Peace of Paris ending the Seven Years' War, Britain got Florida in exchange for Cuba. The Spanish population was boosted by settlers leaving Haiti when that territory was ceded to France.

Chinese immigration to Cuba started in 1847 when Spanish settlers brought in hundreds of thousands of contract workers from Hong Kong, Macau, and Taiwan to work alongside African slaves in the sugar fields. Throughout the 19th century, Southern politicians in the USA plotted the island's annexation as a means of strengthening the pro-slavery forces and there was a party in Cuba which supported such a policy.

Spanish colonialism in America ended when the United States warship Maine was sunk in Havana port on February 15, 1898, giving the US the pretext to invade the island. Under American occupation, Havana grew and prospered. According to the Treaty of Paris of December 10, 1898 Cuba gained independence, the United States took over Guam, Puerto Rico, and the Philippines and maintained military control over Cuba. Numerous residencies, luxury hotels, casinos and nightclubs were constructed.

Fulgencio Batista took over the Government by a military coup on March 10, 1952. The American Mafia played a large role in the government, handing out bribes in exchange for the right to control gambling and prostitution. On January 1, 1959 Fidel Castro overthrew Batista after months of guerilla warfare. In 1961, after the abortive US-backed Bay of Pigs Invasion, the new Cuban government nationalized all property held by religious organizations, including the dominant Roman Catholic Church. Hundreds of members of the church, including a bishop, were permanently expelled from the nation, with the new Cuban government being declared officially atheist. Fidel Castro declared Cuba a one-party communist state. By 1966–1968, the Cuban government nationalized all privately owned businesses.

During this period a Russian ship transported more than one thousand young Cuban students to Ukraine to learn Russian. They were then sent to Moscow and other cities in the USSR to study. Now, they are everywhere in the country. Following an economic crisis after the collapse of the Soviet Union in 1991 and with it the end of subsidies. Russian is no longer taught in schools — it has been replaced by English

José Martí

José Julián Martí Pérez (1853–1895) (Figure 1.5) is Cuba's national hero. He was a leader of the Cuban independence movement from Spain, a renowned poet, and a writer. He was born in Havana, to a Spanish father and a mother from the Canary Islands. On October 21, 1869, he was arrested because of his first political writings and was condemned to six years in prison. When he fell ill, he was repatriated to Spain. There, he studied law and wrote articles attacking the Spanish rule in Cuba.

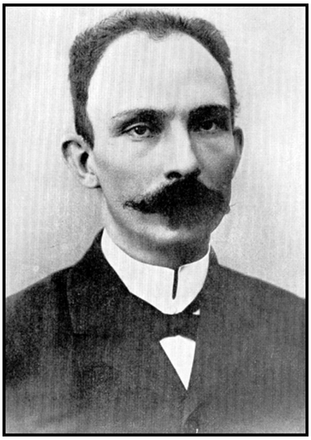


Figure 1.5: José Martí.

Figure 1.6: José Martí Monument in Havana, constructed by the Castro regime.

He travelled to France, where he spent some time before secretly returning to Cuba in 1877. He was unable to obtain employment, then accepted a job as a professor of history and literature in Guatemala City. In 1878, he returned to Havana but was arrested in the next year and deported again to Spain. In 1880, Martí moved to New York City serving as a joint consul for Uruguay, Paraguay, and Argentina. During his stay, he translated several books for a publishing house. In January 1892, he founded the Cuban Revolutionary Party, with the purpose of gaining independence for both Cuba and Puerto Rico. On March 25, 1895, he published a proclaiming Cuban independence. On April 11, 1895, he landed in Cuba with a small force of rebel exiles. He was killed at the Battle of Dos Ríos at the age of 42. Two large monuments for him were constructed in Havana by the Castro regime (Figures 1.6–1.7).

Figure 1.7: Monument to José Martí.

Che Guevara

Ernesto “Che” Guevara (1928–1967) was an Argentine Marxist revolutionary and a major figure of the Cuban Revolution. As a young medical student, he travelled throughout Latin America and was shocked by the poverty he witnessed. His experiences during these trips led him to conclude that the economic inequalities were a result of capitalism and imperialism, with the only remedy being world revolution. This belief prompted his involvement in Guatemala’s social reforms under President Jacobo Arbenz, whose eventual CIA-assisted overthrew solidified Guevara’s political ideology.

Later, while living in Mexico City, he met Raúl and Fidel Castro, joined their 26th of July Movement, and sailed to Cuba aboard the yacht, Granma, with the intention of overthrowing US-backed Cuban dictator Fulgencio Batista. Following the Cuban Revolution, Guevara performed a number of key roles in the new government. He then left Cuba in 1965 to foment revolution abroad, first unsuccessfully in Congo-Kinshasa and later in Bolivia, where he was captured by Bolivian forces and executed.

On October 17, 1997, Guevara’s remains, with those of six of his fellow combatants, were laid to rest with military honours in a specially built mausoleum in Santa Clara, where he had commanded over the decisive military victory of the Cuban Revolution (Figure 1.8).

Figure 1.8: Ernesto “Che” Guevara monument in Santa Clara, Cuba.

Visits to Cuba

Contact with scientists from Cuba was first established on October 10, 1986 when two researchers, Martha Liz Álvarez and José Castellanos Suárez, from Centro de Investigaciones para Industria Minero Metalúrgica in Havana (CIIMM) visited Laval University to get acquainted with research activities in the area of extractive metallurgy. This was followed on January 27, 1987 by two more researchers from the same centre [Ing. Estebán Alfonso Olmo and Ing. Lourdes Bobes Rodríguez (*see* Laval University in Quebec City)]. All four invited me to Cuba to visit their laboratories and to hold meeting with their colleagues. They planned visits for me to the nickel refineries.

Formal invitation was received later by telephone from Raphael de La Paz from the Cuban Embassy in Ottawa and confirmed by Ing. Pablo González from the Cuban Trade Mission in Montreal, who later made a visit to Laval. The trip was agreed to be during the Christmas period since there are no holidays in Cuba at that time.

In general, the People's Republic of Cuba was doing fairly well in Tourism, petroleum, steel, cement, fertilizers, rum industries, sugar, nickel and cobalt production expanding, chromium and manganese ores are exported, and gold production in pilot stage.

Cuba has the largest world reserve of nickel and ranks fifth in mine production after the Soviet Union, Canada, Australia, and New Caledonia. She does not produce the metal but produces chemical concentrates that are all shipped to the Soviet Union under long term agreements. Russian nickel consultants are frequent visitors to Cuba, e.g., Prof. G. N. Dobrokhotov from Leningrad Mining Institute and Dr. S. I. Sobol from Gipronickel Research Institute also in Leningrad.

Table 1.1: Visits to Cuba.

Dates	City	Purpose of visit
December 20–27, 1987	Havana	Lecturing at the Mineral Research Centre
	Moa	Visiting the nickel industry
March 12–26, 1989	Havana	UN mission
	Moa	UN mission
	Nicaro	UN mission
July 6–18, 2008	Havana	Lectures at the Summer School at the University of Havana
		Visit to Centro de Investigación de Proyectos en Minas y Metalurgia
	Santiago	Cultural visit
	Moa	Visit to Institute of Mining

Havana

Havana is the largest city in Cuba and the Caribbean region. Nearly half of the population is white and the other half is black and mulatto. Havana has a significant Chinese minority. In 1987, I was put at Riviera Hotel (Figure 1.9), a magnificent former American hotel with a Casino — a landmark of Havana. In 1989, as a delegate from the United Nations to investigate the progress at the Laterite Research Centre in Moa, I was put at Hotel Nacional (Figure 1.10), another magnificent former American hotel that was completely deteriorating and neglected. In 2008, I stayed at Hotel Havana Libre, formerly Hilton (Figures 1.11–1.12), because I did not like to stay at the university residence.

Figure 1.9: Hotel Riviera, a nationalized American property.

CIIMM

The Centro de Investigaciones para Industria Minero Metalúrgica, known by the acronym CIIMM, was founded in 1967 in collaboration with United Nations Industrial Development Organization and belongs to the Ministry of Basic Industries. It has over 330 workers of these are 75 university graduates, 120 technicians, and 70 economists. It includes the following departments: Mining, Mineralogy, Analysis, Beneficiation, Extractive Metallurgy, Corrosion, Waste Treatment, Inorganic Biotechnology, Computer Systems, and Technical Information. The Centre is fairly well equipped and the personnel are interested in their work. Senior researchers are completely tied with Eastern Block countries (schooling, attending conferences, exchanging researchers, etc.) and practically ignorant of the Western Block literature.

Figure 1.10: Hotel Nacional in Havana.

University of Havana

The University of Havana (Figures 1.15–1.20) was founded in 1728 as a religious institution, today it has 15 faculties. The Summer School 2008 was organized by Prof. Guillermo Samalea, Prof. Ernesto Estevez Rams, and Prof. Carlos Rodríguez Castellanos, Director, Institute of Science and Technology of Materials. Lectures delivered:

- Periodic Table and the Metallurgist
- Extractive Metallurgy Today. Progress and Problems
- Recent Advances in Extractive Metallurgy
- Leaching Methods and Equipment

CIPIMM Research Institute

Meeting Director Aida Álvarez, José Castillanos, and others.

Figure 1.11: Hotel Havana Libre, formerly Hilton.

Figure 1.12: View of Havana from hotel room.

Figure 1.13: Seminar at Mineral Research Centre [CIIMM]. Photo by Nadia Habashi, 1987.

Figure 1.14: Seminar at Mineral Research Centre [CIIMM]. Photo by Nadia Habashi, 1987.

Figure 1.15: University of Havana.

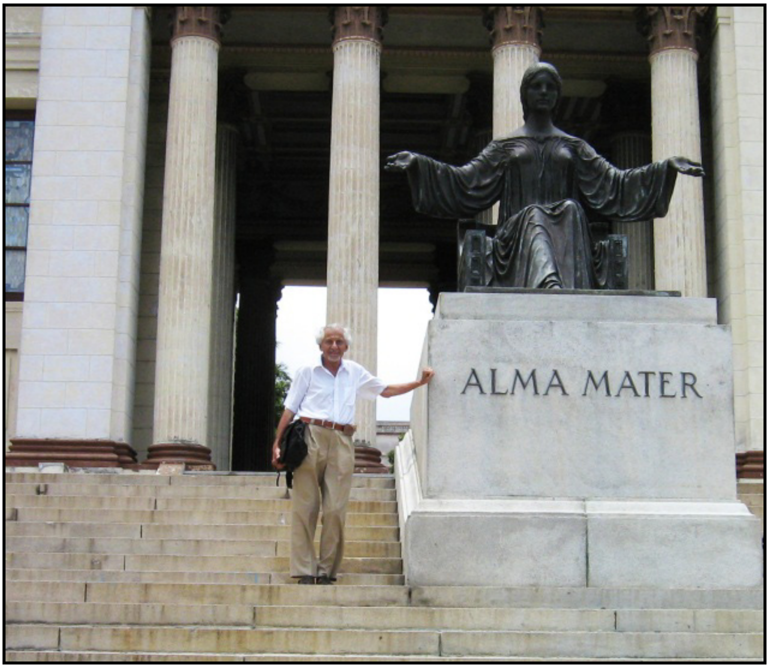


Figure 1.16: University of Havana, 2008.

Figure 1.17: Russian-educated Prof. Guillermo Samalea, host, formerly Director of Research at Moa.

Figure 1.18: Opening ceremony of the Summer School. Photo by Fathi Habashi, 2008.

Figure 1.19: With engineers from Moa attending the Summer School at Havana University.


INSTITUTO DE CIENCIA Y TECNOLOGÍA DE MATERIALES.
UNIVERSIDAD DE LA HABANA.

CERTIFICADO DE PARTICIPACIÓN

Se otorga a: Dr. Fatthi Habashi

por su participación como **Profesor** en la **"XV Escuela Internacional de Ciencia y Tecnología de Materiales"** que se impartió en este centro entre los días 7 y 18 del mes de Julio de 2008.

Y para su constancia se expide el presente, en la Ciudad de La Habana, a los 18 días del mes de Julio de 2008.

INSTITUTO DE CIENCIA Y TECNOLOGIA DE MATERIALES UNIVERSIDAD DE LA HABANA

Dr. Carlos Rodríguez Castellanos
Director IMRE

Dr. Ernesto Estévez Ram
Presidente del Comité Académico
Programa Doctoral de Ciencia de los Materiales

Figure 1.20: Certificate of participation.

Figure 1.21: Revolution Museum.

Museum of the Revolution

Museum of the Revolution (Figure 1.21) was built in 1913 to house the government of the Province Havana, became the Presidential Palace of the 1950s dictator General Fulgencio Batista, now houses the most famous museum in Havana. The Hall of Mirrors was meant to be a replica of a room at Versailles. The museum tells the history of Cuba, maps of battlefields, etc.

Havana Cathedral

The cathedral was finished in 1777, almost 30 years after it was started by the Jesuits, who were expelled from Cuba during construction.

Figure 1.22: Havana's Capitolio built in 1929 to replicate Washington's Capitol building was originally a parliament but after the Revolution, Castro's regime converted it into an academy and library.

Figure 1.23: Capitol monument.

Hemingway Museum

A short distance from the cathedral plaza is Hotel Ambos Mundos, where Ernest Hemingway stayed off and on during the 1930s. Room 511 is now a museum decorated with Hemingway memorabilia.

Figure 1.24: Monument to Cuban engineer Francisco de Albear y Lara (1816–1887) chief engineer in Havana constructed the Havana Water Works, several bridges, roadways, and numerous other projects of historic importance.

Figure 1.25: The Havana's Grand Theatre is the oldest theatre in all Latin America was built in 1837.

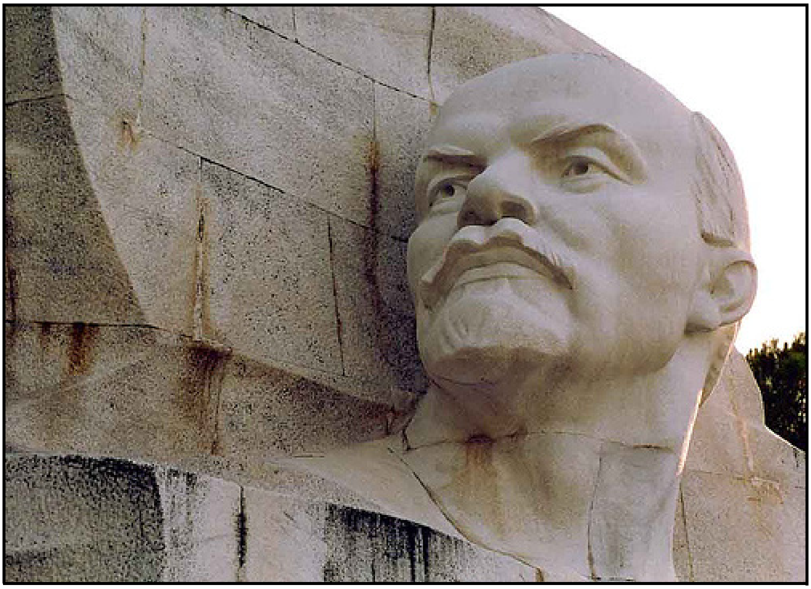


Figure 1.26: Monument of Lenin in Parque Lenin in Havana.

Santiago de Cuba

Santiago de Cuba, the second largest city of Cuba after Havana, was founded by Spanish conquistador Diego Velázquez de Cuéllar in 1514. From 1522 until 1589, it was the capital of the Spanish colony of Cuba. The city experienced an influx of French immigrants in the late 18th and early 19th centuries, many coming from Haiti after the Haitian slave revolt of 1791. On July 26, 1953, Fidel Castro and a group of revolutionaries attacked Moncada barracks in Santiago, initiating the Revolution. The survivors, among them Fidel Castro and his brother Raúl, were captured shortly afterwards.

In 1955, under political pressure, the Batista regime freed all political prisoners in Cuba including the Moncada attackers. Thereafter, the Castro brothers joined with other exiles in Mexico to prepare a revolution to overthrow Batista. During this period, Fidel met and joined forces with Ernesto "Che" Guevara. The revolutionaries named themselves the "26th of July Movement," in reference to the date of their attack on the Moncada Barracks in 1953. The yacht *Granma* arrived in Cuba on 2 December 1956, carrying the Castro brothers and 80 other members of the 26th of July Movement. On 21 August 1958, Castro's forces descended from the Sierra Maestra Mountains and won a series of victories (Figure 1.27).

Figure 1.27: Map of Cuba showing the location of the arrival of the rebels on the Granma in late 1956, and the rebels' stronghold in the Sierra Maestra Mountains.

On 31 December 1958, the city of Santa Clara fell to the combined forces of Che Guevara. The news caused Batista to flee for the Dominican Republic. Castro then took over Santiago de Cuba. The Garrison was turned into the 26th of July School in 1959. In 1963 a museum was opened in one of its buildings documenting the storming of the garrison.

I arrived from Havana by bus because no seats were available on the flights to Santiago. The bus trip took 15 hours, arriving at midnight. Professor José Falcón from the University of Santiago drove me to Hotel Meliá (Figure 1.28). Landmarks of Santiago de Cuba include:

Figure 1.28: Hotel Meliá Santiago de Cuba.

Figure 1.29: Santiago Cathedral.

- The cathedral (Figure 1.29).
- The Morro Castle erected in the 17th century on a cliff at the entrance of the bay to defend the city (Figure 1.30). The atrocities, looting and violence committed by the pirates is documented there.
- The 16th-century house where Diego Velázquez governed Cuba is now a museum (Figure 1.31). It houses the smelter where gold collected from all parts of the South America was melted into ingots for shipment to Spain. The museum shows also the various stages of Cuban material culture, mainly represented by furniture and decorative objects.

Figure 1.30: Santiago Morro [castle].

Figure 1.31: With Professor José Falcón at the entrance to the Museum in Santiago de Cuba.

Moa

In 1987, I was flown from Havana to Moa. There, I stayed in Mira Flora Hotel, which was full of Russian technicians. In 1980, I heard that it was full with Canadian metallurgists since there is joint venture with the Canadian nickel industry at Fort Saskatchewan in Alberta.

In 2008, I took a car supplied by Nickel Industry that drove me from Santiago to Moa.

Higher Institute of Mining & Metallurgy

The Instituto Superior Minero Metalúrgica was opened in 1977 in Moa, graduating about 50 engineers every year. Lecture delivered: "Extractive Metallurgy Today."

Figure 1.32: Higher Institute of Mining & Metallurgy, Moa [Univ. of Moa].

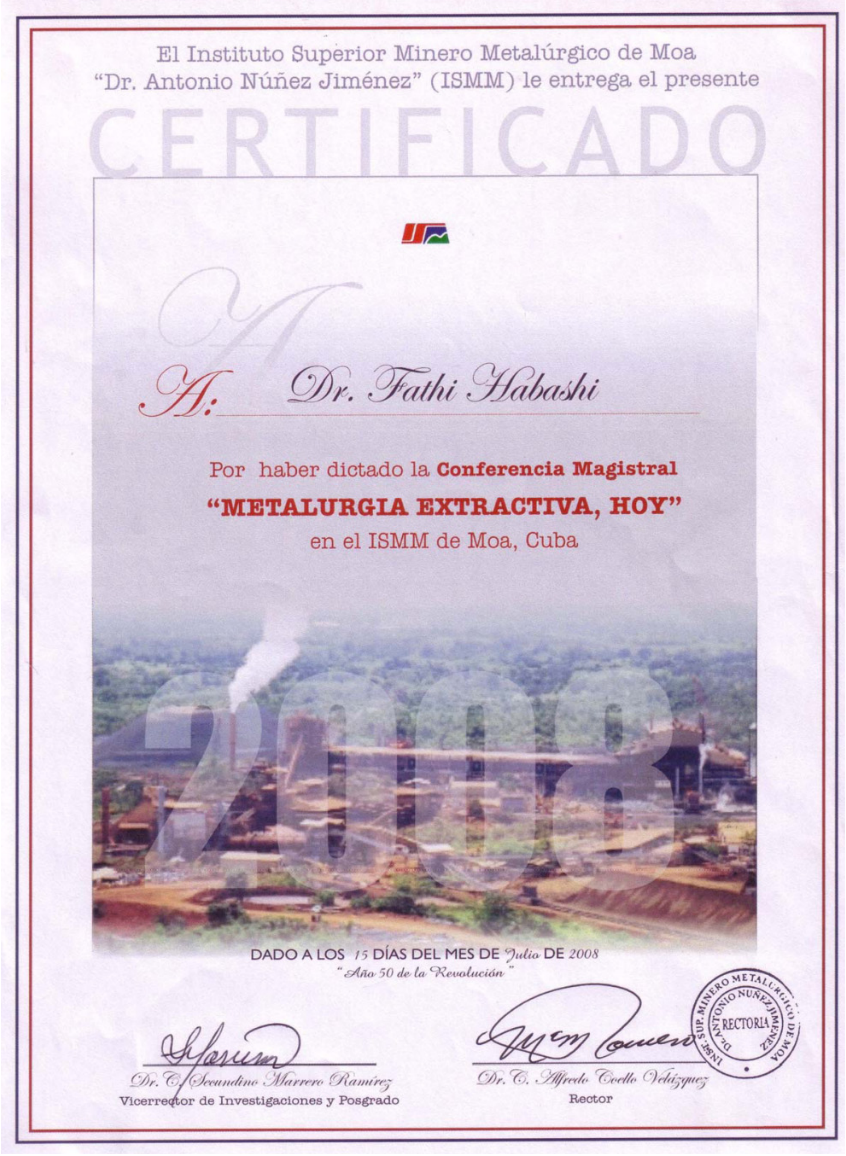


Figure 1.33: Certificate for presenting a lecture entitled "Extractive Metallurgy Today," 2008.

Figure 1.34: Professors from the University of Moa. From left: Vice rector.

Figure 1.35: Ing. Ana Cabrejas, Manager of Centro de Capacitación y Certificación del Níquel (CECYC).

Figure 1.36: Reception after my lecture.

Centro de Capacitación y Certificación del Níquel

Ing. Ana Cabrejas, Manager of Centro de Capacitación y Certificación del Níquel. Lecture, "Extractive Metallurgy Today. Progress and Problems."

NICKEL IN CUBA

After the nationalization of the nickel industry in the 1940s the new regime contracted an Indian consulting firm to restart the refineries (Figures 1.37–1.39). Cuba does not produce the metal but produces chemical concentrates that were shipped to Russia under long term agreements. The deposits are in form of laterites and are mainly in the Holguín Province which is a part of the former Orientale Province. These deposits are of two types:

- *Limonitic.* These are iron oxide containing nickel and minor amounts of magnesium silicates and is located in Moa. They are leached with concentrated H_2SO_4 at 250 °C and at 4 000 kPa (Figures 1.40 and 1.41). There are 16 autoclaves for conducting this operation. Nickel and cobalt are recovered from the leach solution by H_2S precipitation in autoclaves as a mixture of sulfides.

Figure 1.37: Indian metallurgical engineers contracted in the 1940s to restart nickel refineries.

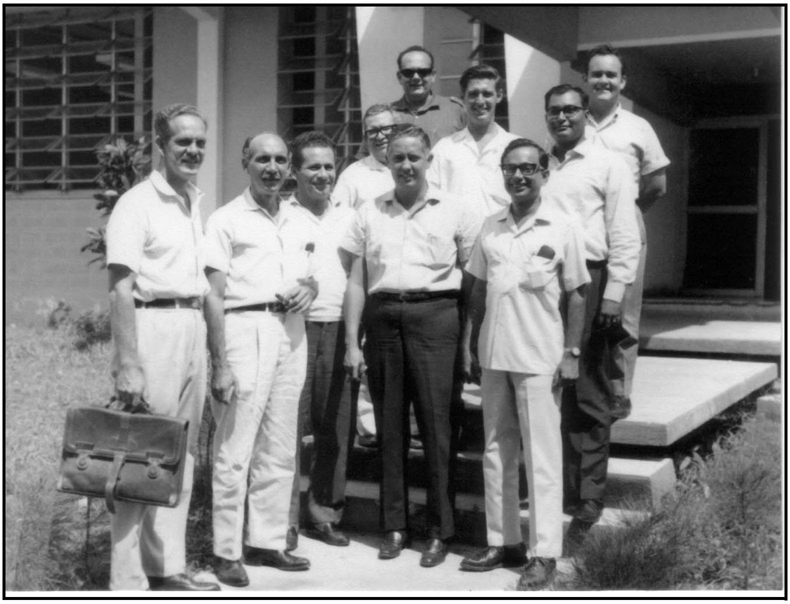


Figure 1.38: Indian metallurgical engineers contracted in the 1940s to restart nickel refineries.

Figure 1.39: Indian metallurgical engineers contracted in the 1940s to restart nickel refineries.

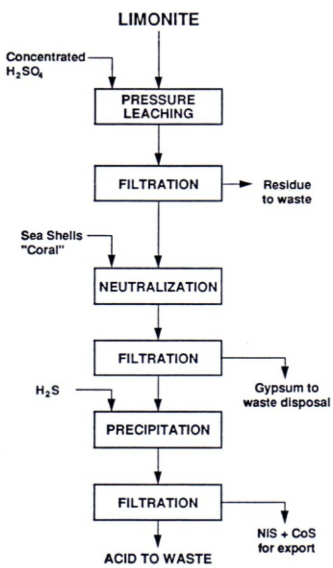


Figure 1.40: Recovery of nickel and cobalt from limonitic laterite by acid leaching at Moa.

Figure 1.41: Leaching autoclaves for laterites in Moa.

- *Serpentine.* These are mainly nickeliferous hydrated magnesium silicates and are located in Nicaro. They cannot be acid leached because acid consumption would be excessive; hence these ores are first reduced to transform the nickel values in the metallic state, then leached by ammoniacal ammonium carbonate in presence of air (Figures 1.42–1.43).

There are 24 multi-hearth furnaces to conduct the reduction. All the cobalt and appreciable amounts of nickel are precipitated from the solution by ammonium sulfide. The solution is then purified by an oxidation step to remove iron and manganese impurities, then boiled to distil off ammonia and to precipitate the remaining nickel as a basic nickel carbonate which is filtered off and calcined to NiO. Cuba imports liquid ammonia from Russia for the nickel operations; about 60 tons/day are consumed.

Table 1.2 gives data on nickel plants in operation or under construction. Due to variation of ores during mining, it is always desirable to test ore samples in a pilot plant two years before the ore is introduced in the industrial unit so that the optimum operating conditions can be worked out. As a result a pilot plant in Nicaro was constructed few years after the first industrial unit was built to test continuously the ore. As the industry developed, a need arose to construct two more pilot plants: one to test the ammonia process on a more flexible basis incorporating new technologies such as ion exchange and solvent extraction, and another to test and improve the sulfuric acid leaching process. The status of these pilot plants is outlined in Table 1.3.

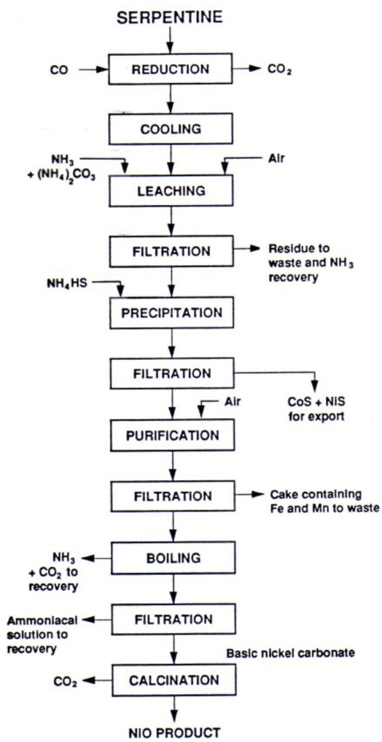


Figure 1.42: Recovery of nickel and cobalt from serpentinic laterite by ammonia leaching at Nicaro.

Figure 1.43: Nicaro plant.

Figure 1.44: Laterite reduction kilns at Nicaro.

Figure 1.45: Ammonia distillation towers at Nicaro.

Table 1.2: Nickel plants in Cuba, 1989.

Name of plant	Location	Process	Capacity, tons contained Ni + Co/year	Date of construction
René Ramous Latour	Nicaro	Ammonia	30 000	1944[a]
Pedro Sotto Alba	Moa	Sulfuric acid	24 000	1960
Ernesto Che Guevara	Punta Gorda	Ammonia	30 000	1987
Las Camariocas	Las Camariocas	Ammonia	30 000	Under construction

a. Shut down between 1947 and 1952 for expansion.

Table 1.3: Pilot plants for laterite treatment in Cuba, 1987.

Location	Process	Capacity, t/day dry ore	Date of construction
Moa	Sulfuric acid leaching	20	Under construction
Nicaro	Ammonia leaching	6	1954
	Cobalt precipitation		1977
	Electrolysis		1987
Punta Gorda	Ammonia leaching	30	1980
	Ion exchange		Near completion
	Solvent extraction		Near completion

Punta Gorda

The Punta Gorda pilot plant has been designed with the help of the United Nations Development Program and the project is known as the "Laterite Project." In 1987 a Laterite Research Centre was founded in Moa by the Unión Empresa del Níquel, the organization responsible for nickel production in Cuba which is under the jurisdiction of the Ministry of Basic Industries. It should also be mentioned that the United Nations aided Cuba in founding the Mineral and Metallurgical Research Centre in Havana. With the exception of two or three engineers in these centres who witnessed the early American involvement in Cuban nickel industry, most of the others were trained in Russia or other Eastern European countries particularly Czechoslovakia. There are two ammonia leaching plants for recovering nickel from laterite in the former Communist block: one in Šered near Bratislava in the former Czechoslovakia [now Slovakia] and the other in Albania. Both are treating Albanian laterite.

An international seminar on Laterite Ore Acid Leaching Technology was held in November 1991 in Moa. It was sponsored by the United Nations Development Program, the United Nations Department of Technical Cooperation for Development, State Committee for Economic Cooperation, Ministry of Basic Industries, Cubaníquel, National Union of Nickel Enterprises, and the Moa Mining and Metallurgical High Institute. The last mentioned institute was founded by Russian assistance less than 10 years ago.

A brief description of the Cuban pilot plants is outlined below; the commercial plants are well described in the book *The Winning of Nickel* by J. R. Boldt Jr. and P. Queneau published in 1967 and all information there is still valid.

The ammonia leaching pilot plant at Punta Gorda

The ore is ground then reduced in a multiple hearth furnace to transform nickel and cobalt silicates into metallic nickel. The metal is then leached with an ammoniacal ammonium carbonate solution. The slurry is filtered, the solids are disposed off and the solution is treated for metal recovery. The recovery steps are the following (Figure 1.46):

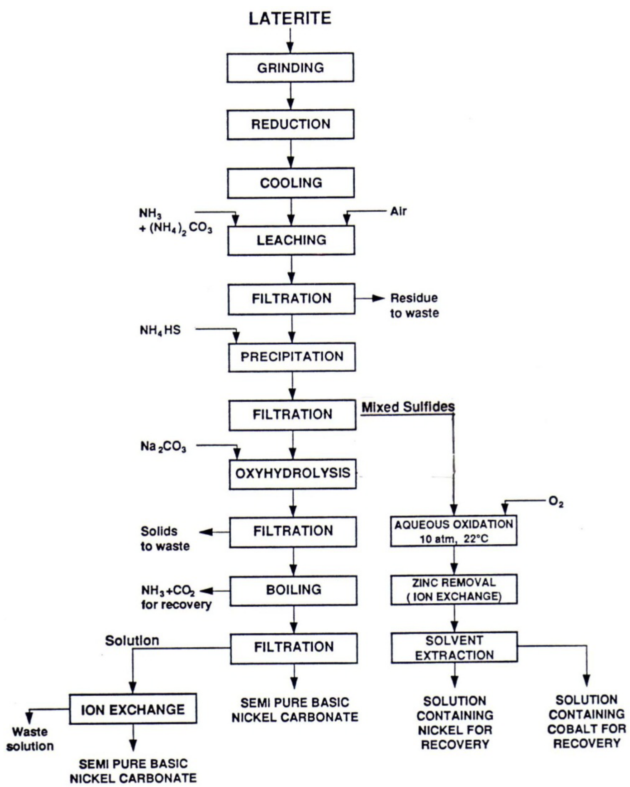


Figure 1.46: Recovery of nickel and cobalt from serpentinic laterite. The Punta Gorda ammonia leaching pilot plant.

1. The solution is treated with a limited amount of ammonium sulfide to precipitate all the cobalt together with an appreciable amount of nickel in form of sulfides. These are filtered off and collected for further treatment.
2. The cobalt-free solution containing the remaining nickel is subjected to an oxyhydrolysis step (1 000 kPa, 200 °C) in autoclaves in presence of Na_2CO_3 to oxidize unsaturated sulfur compounds and to form sodium sulfate; iron and manganese impurities are also removed by filtration. The solution is then boiled to distil off and recover NH_3 and CO_2. During this step, nickel in solution precipitates as a basic nickel carbonate. It is filtered off and collected for further treatment.
3. The remaining solution still containing traces of nickel and sulfur compounds. It is treated in an ion exchange system to recover the remaining nickel. The affluent solution is then disposed off.

The intermediate product of this plant, as mentioned above, containing NiS–CoS mixture is slurred with water and dissolved at high temperature (200 °C) in an autoclave in presence of oxygen to form sulfates. Separation of nickel from cobalt is then effected from the solution by extraction with the organic solvent LIX-64.

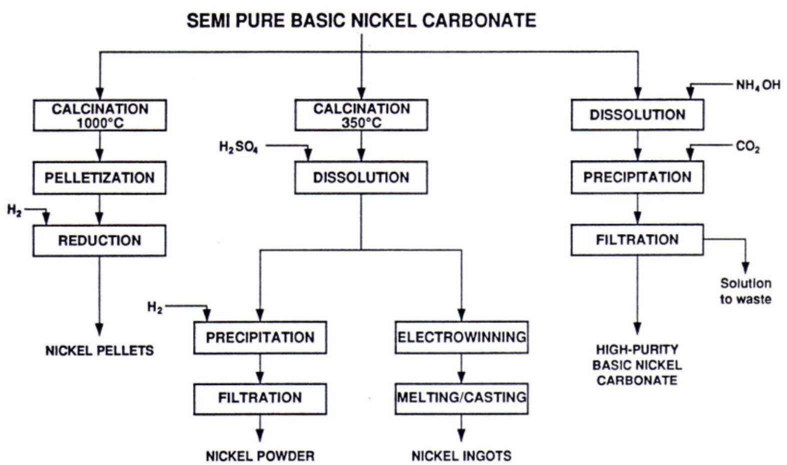


Figure 1.47: Routes for processing basic nickel carbonate at the Punta Gorda ammonia leaching pilot plant.

Basic nickel carbonate

This semi-pure product contains about 0.5 % S and other impurities (Fe, Zn, Mg) is treated in a variety of ways (Figure 1.47):

(a) Calcination to NiO then pelletization and reduction by hydrogen to metal.

(b) Calcination at low temperature (below 350 °C) to get a nonstoichiometric oxide which is solubilized in dilute H_2SO_4 to prepare a solution from which metallic nickel is obtained by electrowinning or by precipitation by hydrogen under pressure.

(c) Purification by dissolution in ammonium hydroxide and re-precipitation by CO_2 as a high-purity basic carbonate.

The proposed acid leaching pilot plant at Moa

The Moa acid leaching plant is the only plant in the world using acid pressure leaching for oxide ores and under extreme conditions of 240 °C and 4 000 kPa pressure. Also, it has the unique application of H_2S for precipitating sulfides at 120 °C and 1 000 kPa in autoclaves. The plant is said to be very efficient and has the highest nickel recovery. However, the problem facing this plant at present is the large mount of H_2SO_4 that must be neutralized before adding H_2S and the large amount of waste acid produced after adding H_2S that is disposed of and causing environmental problems. To overcome the first problem it was conceived to use serpentinic laterite for neutralization and to simultaneously solubilize nickel present in the serpentine. However, the neutralization reaction is slow and to accelerate the reaction it is necessary to dehydroxylate the serpentine by heating at 700 °C so that it is rendered porous and more reactive. This is the basis of the proposed acid leaching pilot plant (Figure 1.48).

Nickel products from Cuba

Cuba produced nickel oxide and shipped nickel and cobalt sulfides to Russia for smelting. After the collapse of the Soviet Union a joint venture with the Canadian company Sherritt Gordon in Fort Saskatchewan was established.

Pollution problems

1. The reduction–ammonia leaching process for nickel and cobalt recovery from laterites proved to be a polluting process due to extensive dust emission. It is surprising that the initial Nicaro Plant with all of its problems has been exactly re-done at Punta Gorda, and further a third plant of same design is under construction at Las Camariocas near Moa. In the pilot plant at Punta Gorda no measures were taken to eliminate these problems although in the opinion of the writer this should be quite simple: introduce a waste heat boiler and a bag filter between the cyclone leaving the furnace and the chimney.
2. There has been no attempt to neutralize the waste acid generated during the precipitation of nickel–cobalt sulfides by H_2S in the Moa plant:

$$M^{2+} + H_2S \rightarrow MS + 2H^+$$

The acid is simply sent for disposal. This seems to have not been considered in the original design of 1960.

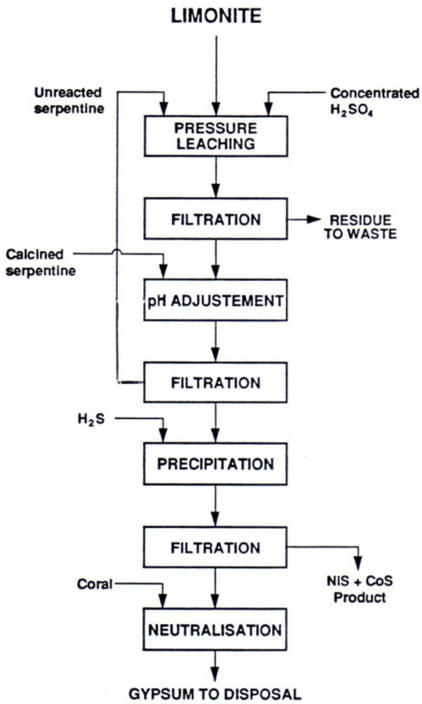


Figure 1.48: Proposed flowsheet for the two-stage acid leaching process at Punta Gorda.

Hydrogen sulfide technology

Hydrogen sulfide precipitation of nickel and cobalt was introduced by the American designers in Moa Plant as a rapid method to transfer the nickel values from Cuba to USA. This proved to be a highly polluting method to be used on a large scale. Leaks result in the escape of the toxic gas and this no doubt will cause damage to the vegetation. The gas has a high solubility in water and is highly corrosive. It is surprising that this operation was not replaced by solvent extraction. Further, hydrogen sulfide is only an intermediate reagent that serves no real purpose in the process — on the opposite, all sulfur introduced in the system must be eliminated later.

When the American engineers introduced this technology, the following factors played a role — none of them is valid today:

(a) The plant was designed by Texas Gulf, a major sulfur producer that was interested to find a market for sulfur.

(b) A nickel smelter for treating nickel sulfides was in operation in New Orleans, Louisiana.

(c) Solvent extraction technology was not yet applied commercially except for uranium.

Sulfide precipitation was introduced in the 1970s in the ammonia leach systems to separate cobalt. However, it suffers from the following disadvantages.

1. Preparation of the reagent (ammonium sulfide) involves handling H_2S which is a toxic and explosive gas.
2. Precipitation of cobalt is not selective with respect to nickel. There is an enrichment of cobalt in the sulfide precipitate — from a Co/Ni ratio of 1/10 in solution to 1/3 in the precipitate, but there is still an appreciable amount of nickel in the precipitate.
3. Sulfur compounds, e.g., sulfides and sulfamates remain in solution and they partly contaminate the basic nickel carbonate precipitated later, and partly contaminate the waste solution for disposal.
4. Since the sulfide mixture has to be solubilized later and its components separated by solvent extraction, the whole operation might as well be eliminated and separation of cobalt and nickel might be conducted on the crude basic nickel carbonate, e.g., by dissolution in ammonium hydroxide and extraction by organic solvents without the need to use ammonium sulfide. Other routes are known and are conducted on commercial scale, all of them do not.

Residue disposal

The residue after ammonia leaching is disposed of as a slurry in ponds without any attempt to recycle the water. The bottom of the pond was not compacted and covered with an impermeable material. As a result, when the slurry is introduced, water drains rapidly underground leaving a solidified mass. Should the pond has been prepared and made impermeable before use, the solids would have settled and the supernatant water could have been pumped back to the plant. In fact, as it stands, the water that is continuously draining underground may contaminate subterranean water. This residue is mainly Fe_3O_4 and may be reduced in a rotary kiln to produce a metallized product that can be charged in an electric furnace to make steel and the gangue minerals (magnesium silicates) eliminated as slag.

Laterite Research Institute

The Laterite Research Institute was funded by the United Nations Development Program was planned to be fully functional by 1988.

TYPICAL CUBA

Revolutionary posters

Revolutionary posters are still wide spread (Figures 1.49–1.58).

Figure 1.49: Havana, 2008.

Figure 1.50: Revolutionary poster. Photo by Fathi Habashi, 2008.

Figure 1.51: Revolutionary poster.

Figure 1.52: Revolutionary poster.

Figure 1.53: Revolutionary poster.

Figure 1.54: Revolutionary poster.

Figure 1.55: Revolutionary poster.

Figure 1.56: Revolutionary poster.

Figure 1.57: Revolutionary poster.

Figure 1.58: Revolutionary poster.

Neglected buildings

Figure 1.59: Buildings falling apart.

Figure 1.60: Buildings falling apart.

Figure 1.61: Typical photos near my hotel in Havana showing once elegant houses falling apart. Photo by F. Habashi.

Transportation problems

Figure 1.62: Transportation problems.

Figure 1.63: Transportation problems.

Figure 1.64: Transportation problems.

Figure 1.65: A taxi bicycle.

Figure 1.66: Old cars still running.

Figure 1.67: Old cars still running.

Figure 1.68: Old cars still running.

Figure 1.69: Old cars still running.

Beautiful landscape

Figure 1.70: Wide spread trees.

Figure 1.71: Wide spread trees.

Figure 1.72: Wide spread trees.

The pioneers

Figure 1.73: The pioneers.

Observations and Remarks

- Not a single new public building was constructed; only a monument to José Martí.
- Not a single shopping centre except the few shops attached to Hotel Havana Libre.
- Food stores are practically non-existing.
- Magnificent old villas were falling apart and other building are just deteriorating.
- Transportation is a major problem. People are standing all the way from Santiago to Moa waiting for transportation. Some are carrying their umbrellas to protect themselves from the sun and walking, others using bicycles, horses, chariots. Some old trucks are packed with standing people.
- The road from Santiago de Cuba to Moa is so full of holes that driving on it is a challenge.
- To my surprise, sugar production in Cuba has been drastically reduced after the collapse of the Soviet Union in 1990. Today, only 10% of the previous level is produced. No body was able to explain to me this bizarre situation.
- The road from Havana to Santiago is a reasonably good road. The only large town on the way is Santa Clara.
- The bus service is also reasonably good using Chinese-made buses.
- Havana is famous of the old American cars of the 1950s and 1960s that are still running.
- Santiago de Cuba the second largest city in the country with a population of about half a million — is nothing but a large village. In the main square one finds the Cathedral, the City Hall, and the former Spanish Governor's house that is now kept as a museum. It is in a miserable situation.
- Moa is a first class industrial town with two large nickel ore processing plants and few small industries related to the metal industry. But the town is a depressing spot — apartment houses are ugly and dirty, no asphalt roads.
- University professors are highly motivated and the Havana Summer School is an excellent example. Students also have great interest to study and participate in academic activities. It is a pity that the chances offered to them are poor and far from reaching an adequate level.
- Water is a major problem in Cuba. Tap water is not drinkable.

Chapter 2

Puerto Rico

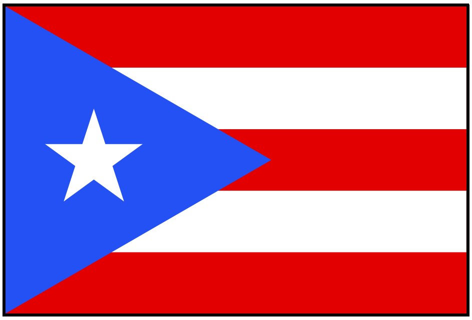


Figure 2.1: Flag of Puerto Rico.

INTRODUCTION

Puerto Rico, Spanish for "rich port," enjoys a tropical climate and is visited on a Christmas holiday in December 1975 with a group from Quebec to Mayagüez (Figures 2.2–2.4). Originally populated for centuries by indigenous aboriginal peoples known as Taínos, the island was claimed by Christopher Columbus for Spain during his second voyage to the Americas on November 19, 1493. Under Spanish rule, the island was colonized and the indigenous population was forced into slavery and wiped out due to, among other things, European infectious diseases. Spain possessed Puerto Rico for over 400 years, despite attempts at capture of the island by the French, Dutch, and British. In 1898, Spain ceded the archipelago, as well as the Philippines, to the United States as a result of its defeat in the Spanish–American War under the terms of the Treaty of Paris of 1898. Since then Puerto Rico has remained under United States rule.

Figure 2.2: Puerto Rico in the Caribbean next to Dominican Republic.

Mayagüez

Christmas holiday in 1975 was spent at Mayagüez beach (Figures 2.3–2.4).

Figure 2.3: Map of Puerto Rico showing Mayagüez on the left coast.

Figure 2.4: Christmas holiday at Mayagüez beach.

Chapter 3

Venezuela

Figure 3.1: Flag of Venezuela.

Historical Introduction

The Spanish expedition led by Alonso de Ojeda, sailing along the length of the northern coast of South America in 1499, gave the name Venezuela ("Little Venice" in Spanish) to the Gulf of Venezuela — because of its imagined similarity to the Italian city. Spain's colonization of mainland Venezuela started in 1522. At the time of the Spanish arrival, indigenous people lived mainly in groups as agriculturists and hunters: along the coast, in the Andean mountain range, and along the Orinoco River. Their number gradually declined due exposure to European diseases and their systematic elimination.

In the 18th century, a Venezuelan society formed along the coast with the establishment of cocoa plantations manned by a large number of African slaves. Most of the Amerindians who still survived had migrated to the plains and jungles to the south. The Province of Venezuela came under the jurisdiction of the Viceroyalty of New Granada (established in 1717) (Figure

3.2). In 1721, Caracas had its university. The Province became the Captaincy General of Venezuela in 1777.

Figure 3.2: Gran Colombia.

War of Independence

The first organized conspiracy against the colonial regime in Venezuela occurred in 1797, organized by Manuel Gual and José María España. It took direct inspiration from the French Revolution, but was put down. After Napoleon's invasion of Spain, seven of the ten provinces of the Captaincy General of Venezuela declared their independence on July 5, 1811 but battles were still going on. On 17 December 1819 the Congress of Angostura declared Gran Colombia an independent country. After two more years of war, which killed half of Venezuela's white population, the country achieved independence from Spain in 1821 under the leadership of Simón Bolívar (1783–1830) (Figure 3.3), a Caracas-born army general. Venezuela, along with the present-day countries of Colombia, Panamá, and Ecuador, formed part of the Republic of Gran Colombia until 1830, when Venezuela separated and became a separate sovereign country.

Figure 3.3: Simón Bolívar (1783–1830).

For the rest of the 19th century, in independent Venezuela there was a bloody power struggle between different factions. This continued throughout the 20th century.

MINERAL INDUSTRY

Venezuela is a major producer and exporter of bauxite, coal, gold, iron ore, and oil, and the state controls most of the country's mineral reserves. The main coalfields are located in the western Zulia State, on the border with Colombia. Other known reserves include natural bitumen. Operating gold mines are located in the southeast produce about 20 tonnes of gold. Venezuela has the largest proven oil reserves in South America. The industry was nationalized in 1976.

Aluminum produced by two nationalized companies: Bauxilum producing alumina from bauxite and Venalum, the National Aluminum Corporation producing the metal from alumina. Both are located in Puerta Ordas. In 1988, Venezuela celebrated the tenth anniversary of Venalum, the National Aluminum Corporation, by issuing a set of stamps (Figure 3.4), one of which shows the interior of the plant, and another a drawing of an electrolytic cell. It is also there in Guayana, where a large hydroelectric power plant was constructed on the Orinoco River.

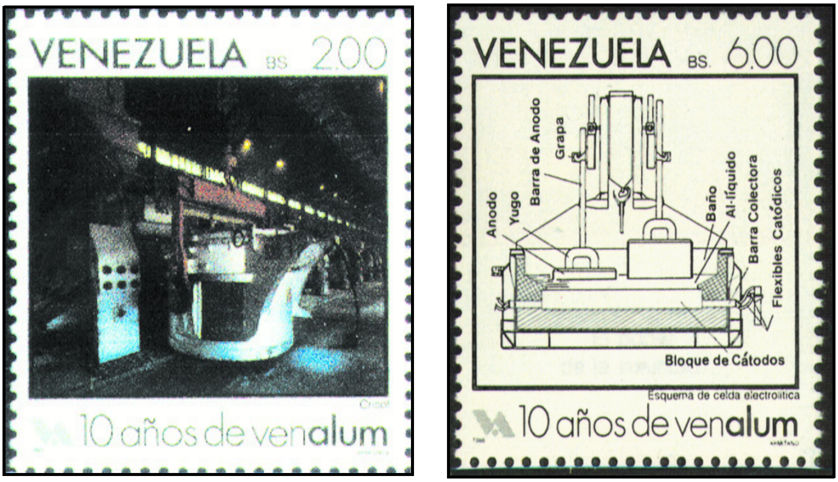


Figure 3.4: Two stamps commemorating the tenth anniversary of Venalum.

Caracas

Caracas (Figures 3.6–3.8) was founded in 1567 and in 1577 became the capital of the Spanish Empire's Venezuela Province. During the 17th century, the coast of Venezuela was frequently raided by pirates. With the coastal mountains as a barrier, the city was immune to such attacks. The cultivation of cocoa stimulated the development of the city, which in 1777 became the capital of the Captaincy General of Venezuela. The city was destroyed by an earthquake on 26 March 1812.

Figure 3.5: Map of Venezuela showing the regions visited.

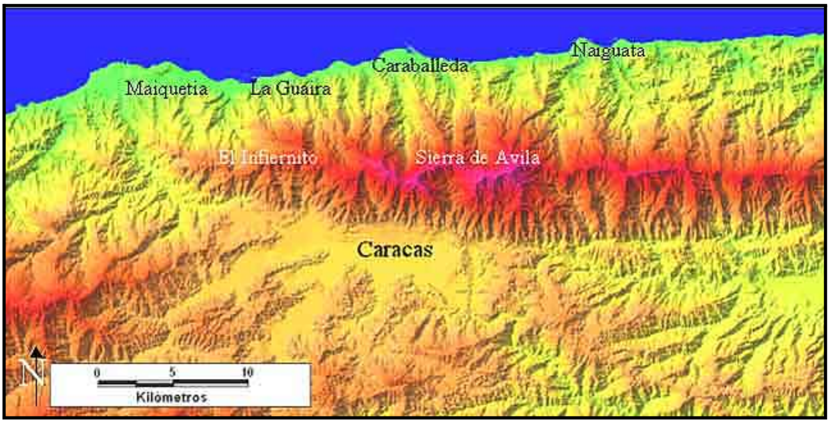


Figure 3.6: Location of Caracas and the coastal mountains.

Figure 3.7: View of Caracas and the coastal mountains.

Bolívar Museum

Bolívar's birthplace and museum honours the person who achieved independence from Spain for Venezuela and other South American countries (Figures 3.9–3.10).

Figure 3.8: Monument of Simón Bolívar in Caracas.

Figure 3.9: Bolívar Museum.

Figure 3.10: Bolívar Museum. Some leaders of the independence. From left: José Antonio Anzoategui, José de La Cruz Paredes, General Mariano Montilla, and José María Zamora.

Figure 3.11: Celebrating 25th anniversary of the School of Metallurgy.

School of Metallurgy

The School of Metallurgy (Figures 3.11–3.12) of the Central University of Venezuela founded in 1972; the university itself was founded in 1721.

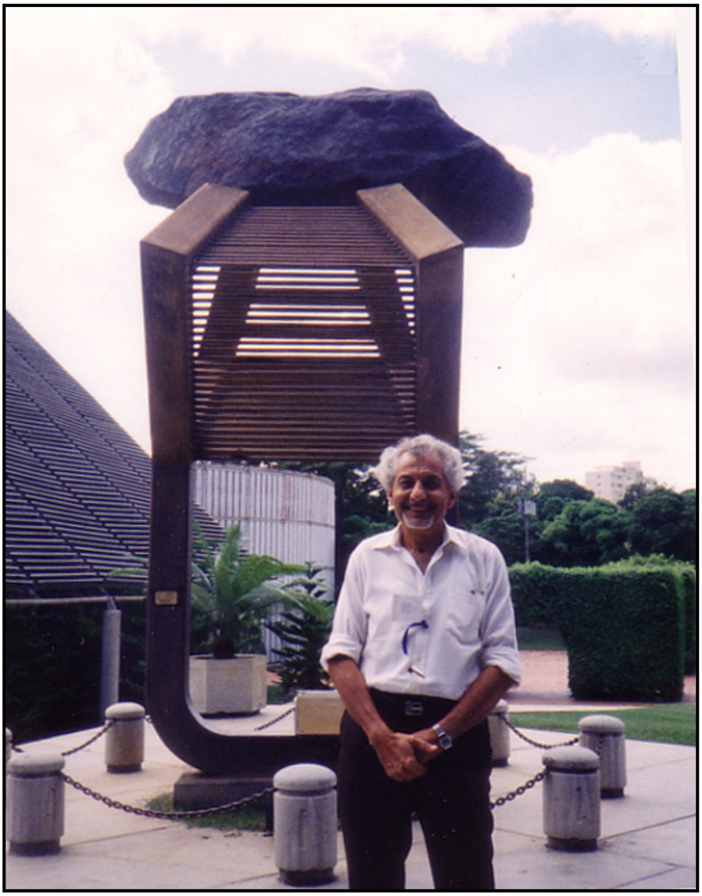
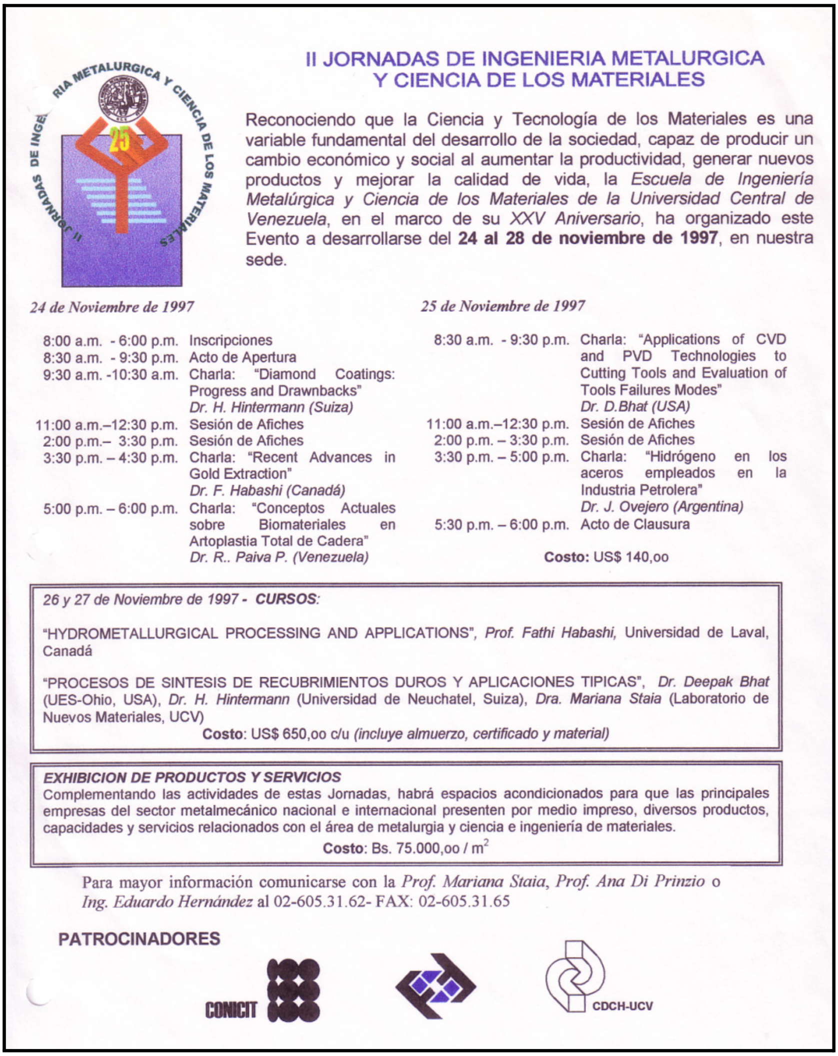


Figure 3.12: School of Metallurgy, November 1997.

Metallurgical Engineering & Materials Science

The conference was held November 1997 on the occasion of celebrating the 25th anniversary of the foundation of the School of Metallurgy (Figures 3.13–3.23). A short course on hydrometallurgy followed the conference. Visits were also arranged to the aluminum industry in Puerto Ordaz and the gold industry El Callao.



II JORNADAS DE INGENIERIA METALURGICA Y CIENCIA DE LOS MATERIALES

Reconociendo que la Ciencia y Tecnología de los Materiales es una variable fundamental del desarrollo de la sociedad, capaz de producir un cambio económico y social al aumentar la productividad, generar nuevos productos y mejorar la calidad de vida, la *Escuela de Ingeniería Metalúrgica y Ciencia de los Materiales de la Universidad Central de Venezuela*, en el marco de su *XXV Aniversario*, ha organizado este Evento a desarrollarse del **24 al 28 de noviembre de 1997**, en nuestra sede.

24 de Noviembre de 1997

8:00 a.m. - 6:00 p.m.	Inscripciones
8:30 a.m. - 9:30 p.m.	Acto de Apertura
9:30 a.m. -10:30 a.m.	Charla: "Diamond Coatings: Progress and Drawnbacks" *Dr. H. Hintermann (Suiza)*
11:00 a.m.–12:30 p.m.	Sesión de Afiches
2:00 p.m.– 3:30 p.m.	Sesión de Afiches
3:30 p.m. – 4:30 p.m.	Charla: "Recent Advances in Gold Extraction" *Dr. F. Habashi (Canadá)*
5:00 p.m. – 6:00 p.m.	Charla: "Conceptos Actuales sobre Biomateriales en Artoplastia Total de Cadera" *Dr. R.. Paiva P. (Venezuela)*

25 de Noviembre de 1997

8:30 a.m. - 9:30 p.m.	Charla: "Applications of CVD and PVD Technologies to Cutting Tools and Evaluation of Tools Failures Modes" *Dr. D.Bhat (USA)*
11:00 a.m.–12:30 p.m.	Sesión de Afiches
2:00 p.m. – 3:30 p.m.	Sesión de Afiches
3:30 p.m. – 5:00 p.m.	Charla: "Hidrógeno en los aceros empleados en la Industria Petrolera" *Dr. J. Ovejero (Argentina)*
5:30 p.m. – 6:00 p.m.	Acto de Clausura

Costo: US$ 140,oo

*26 y 27 de Noviembre de 1997 - **CURSOS:***

"HYDROMETALLURGICAL PROCESSING AND APPLICATIONS", *Prof. Fathi Habashi,* Universidad de Laval, Canadá

"PROCESOS DE SINTESIS DE RECUBRIMIENTOS DUROS Y APLICACIONES TIPICAS", *Dr. Deepak Bhat* (UES-Ohio, USA), *Dr. H. Hintermann* (Universidad de Neuchatel, Suiza), *Dra. Mariana Staia* (Laboratorio de Nuevos Materiales, UCV)

Costo: US$ 650,oo c/u *(incluye almuerzo, certificado y material)*

EXHIBICION DE PRODUCTOS Y SERVICIOS

Complementando las actividades de estas Jornadas, habrá espacios acondicionados para que las principales empresas del sector metalmecánico nacional e internacional presenten por medio impreso, diversos productos, capacidades y servicios relacionados con el área de metalurgia y ciencia e ingeniería de materiales.

Costo: Bs. 75.000,oo / m^2

Para mayor información comunicarse con la *Prof. Mariana Staia*, *Prof. Ana Di Prinzio* o *Ing. Eduardo Hernández* al 02-605.31.62- FAX: 02-605.31.65

PATROCINADORES

CONICIT CDCH-UCV

Figure 3.13: Program of the conference.

Figure 3.14: Organizing Committee and plenary speakers.

Figure 3.15: Conference badge.

Figure 3.16: Opening ceremony.

Figure 3.17: With Prof. Milton (?).

Figure 3.18: Metallurgy students.

Figure 3.19: Prof Mariana Staia conference chairperson and Prof. Seung-Am Cho. Photo by Fathi Habashi, 1997.

Figure 3.20: Acknowledgement of delivering a plenary lecture.

Figure 3.21: Announcement for the hydrometallurgy course.

Br. Carrasquero Edwuin

HIDROMETALLURGICAL PROCESSING AND APLICATIONS
DICTADO POR: Dr. FATHI HABASHI

Profesor en Metalurgia Extractiva de la Universidad de Laval, Quebec, Canada. Ha sido Profesor invitado en la Academia Rusa de Ciencias (1977), En la Universidad Nacional Autonoma de Mexico (1980), en el Instituto Real de Tecnologia, Estocolmo, Suecia (1981), del Consejo Nacional para el Desarrollo de la Ciencia & Tecnologia, Brasil (1982), la Academia Sinica de Beijing (1984), La Universidad Tecnica de Oruro (1986), el Instituto de Tecnologia Quimica de Sofia (1987), Central South University &Technology in Changsha, China (1990), en la Facultad de Metalurgia de Kosica, Checoslovaquia (1991), la Universidad Federal de Rio de Janeiro, Brasil y la Universidad Nacional de San Luis, Argentina (1992), la Universidad de Sonora, Mexico, Bandung Institute of Technology, University of the Witwatersrand, Johannesbourg, University of Port Elizabeth, South Africa y la Universidad Catolica del Norte, Antofagasta, Chile (1993).

Es el autor de destacadas obras en el area, incluyendo Principles of Extractive Metallurgy (1969-1986), Chalcopyrite, its Chemistry and Metallurgy (1978), Handbook of Hydrometallurgy (1993), Pollution Problems in the Minerals and Metallurgical Industries (1995), coautor de Mineral Resources of the Arab Countries (1981), editor de History of Metallurgy (1994) y Handbook of Extractive Metallurgy (1997) y co-editor de International Symposium, Problems of Complex Ores Utilization (1995)

En 1997, la Escuela de Ingenieria Metalurgica y Ciencia de los Materiales de la Universidad Central de Venezuela, en el marco de su XXV Aniversario, ofrece el Curso "Hidrometallurgical Processsing and Applications" dictado por este prestigioso investigador, orientado al desarrollo y actualizacion cognoscitiva de los profesionales de la Metalurgia Extractiva que laboran en los principales Centros Educativos, de Investigacion & Desarrollo Tecnologico del pais y de la Industria Nacional, que dia a dia deben enfrentar los retos e innovaciones que surgen en este importante sector.

Programa:
GENERAL PRINCIPLES
LEACHING PROCESS
RECENT ADVANCES IN PRESSURE LEACHING
KINETICS
PURIFICATION OF SOLUTIONS
PRECIPITATION METHODS
APPLICATION TO GOLD,
PHOSPHATE ROCK AND ALUMINIUM EXTRACTIVE METALLURGY
Costo: US$ 650[*]
(*) Incluye almuerzo, certificado y material
Depositar en la Cuenta de Ahorros del Banco Provincial N033-78819-L a nombre de: Mariana Staia. Enviar el comprobante y planilla de Inscripcion al FAX: 02-605.31.65 o presentarlos el dia de Inicio del Curso
PARA CUALQUIER INFORMACION ADICIONAL, COMUNICARSE CON:
PROF. MARIANA STAIA, PROF. CARLO DI YORIO o
ING. EDUARDO HERNANDEZ

Escuela de Ingenieria Metalurgica y Ciencia de los Materiales, Facultad de Ingenieria, Universidad Central de Venezuela. Ciudad Universitaria, Los Chaguaramos, Apartado Postal 51717, Caracas 1050, Venezuela.
Telf-Fax: 582-605.31.64 al 66 / 014-264317
e-mail: iijctm@sagi.ucv.edu.ve

http://www.coppe.ufrj.br/~notimat/51/cursos_venezuela.html

Figure 3.22: Hydrometallurgy course description.

Figure 3.23: Acknowledgement of course with signatures of participants.

4th International Gold Symposium

Coincided with the anniversary was the Fourth International Gold Symposium that took place at Hilton Hotel.

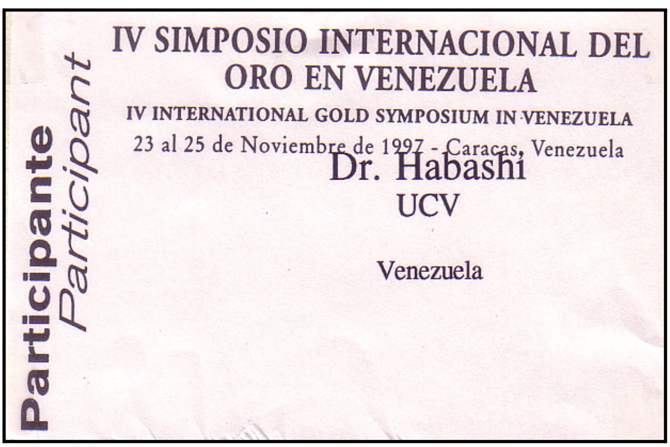


Figure 3.24: Fourth International Gold Symposium.

PUERTO ORDAZ

Puerto Ordaz, together with the older settlement of San Félix, forms Ciudad Guayana in Bolívar State, eastern Venezuela (Figure 3.25). Puerto Ordaz is located at the confluence of the Caroní and Orinoco Rivers and is the site of the Llovizna Falls. The city has a large hydroelectric power plant, Macagua Dam. It is one of Venezuela's largest cities and is the base for large steel and aluminum industries. Guayana City is one of Venezuela's most important ports, since goods are shipped through it into the Atlantic Ocean via the Orinoco River.

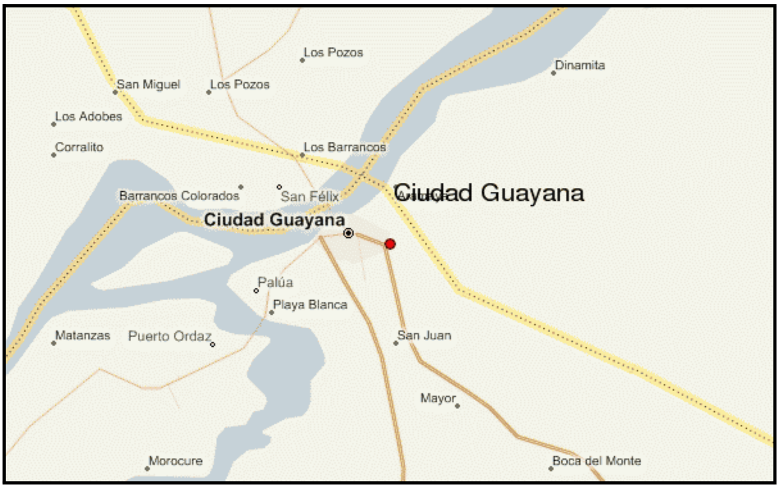


Figure 3.25: Location map of Puerto Ordaz and Orinoco River.

Bauxilum

Bauxilum is the state company for producing alumina from bauxite by Bayer process at Puerto Ordaz (Figures 3.26–3.27). Guide: Carlos Domínguez.

Figure 3.26: View of Bauxilum plant.

Figure 3.27: View of Bauxilum plant.

El Callao

El Callao (Figure 3.28) is reached by a three-hour drive from Puerto Ordaz airport. Guide: metallurgical engineer Archemedes Key, a graduate from the University of Bingham Young in Utah. La Planta Perú produces gold from cyanide solution by precipitation with zinc dust. Revemin II Gold plant at Monarch produces gold by carbon-in-pulp and electrowinning. Manager: Julio Roja from Chile. A visit was also made to an artisanal gold production by amalgamation. Guide: Ing. Sicfrido Rivas Valón.

Figure 3.28: Engineers at La Planta Perú gold processing plant.

Name Index

Subject Index