Fathi Habashi

My Trips in Germany

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 978-2-922686-35-7

Fathi Habashi, *My Trips in Germany*.

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

Pre-Nazi Germany

Figure 1.1: Flag of Germany.

Holy Roman Empire

The Saxons of the 7th and 8th centuries were a Germanic people living between the lower Rhine and the lower Elbe. One group of these Saxons had immigrated to the British Isles in the fifth century. Charlemagne (742–814) (Figure 1.2) led thirty year's war against them, which ended with their defeat. At the time of Charlemagne, Germany of today was called East Frankland, while France was West Frankland. Whereas East Frankland remained German, West Frankland was Latin in language and culture. The Holy Roman Empire formed by Charlemagne in 800 AD, with Aachen as its capital (Figure 1.3), broke up under his successors (Figure 1.4).

Holy Roman Empire of the German Nation

In 919, Duke Heinrich I of Saxony was elected as the German king. There was a century of confusion because each governor of a unit of the Empire was practically independent which caused the end of the Carolingian dynasty. Heinrich's son Otto I of Saxony (912–973) (Figure 1.5) restored the Empire. After consolidating his power in Germany, he defeated the rebellion in Italy. In 961, he was crowned King of Italy, and the next year Pope John XII anointed him Holy Roman Emperor of the German Nation (Figure 1.6).

Figure 1.2: Charlemagne (742–814).

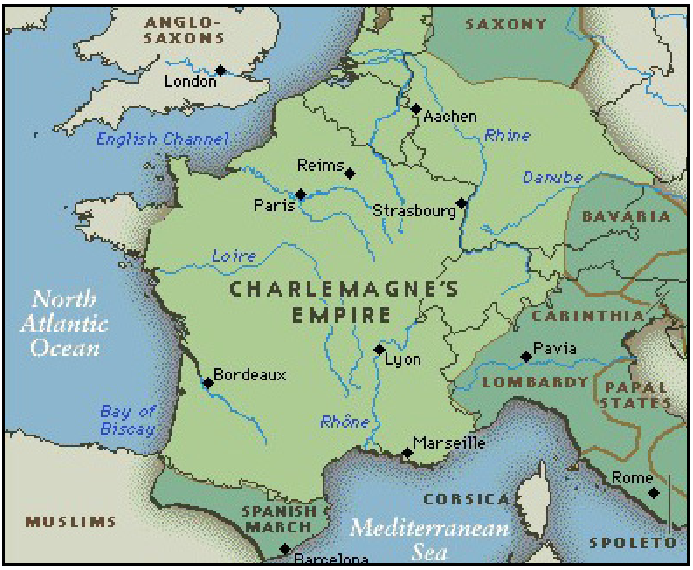


Figure 1.3: The Holy Roman Empire formed by Charlemagne with capital in Aachen.

Figure 1.4: The breakdown of Charlemagne's Empire. Church States were governed by the Pope.

Figure 1.5: Otto I the Great (912–973), Emperor of the Holy Roman Empire of the German Nation.

The Empire was a political body embracing most of central Europe claiming succession to imperial Rome to restore the order and unity Europe had known under Rome. It was based on feudalism and its rulers were chosen by German princes.

Figure 1.6: Holy Roman Empire of the German Nation, 1200.

Major silver deposits were discovered in the Empire which rendered certain districts important mining and metallurgical centres. The discoveries were first located in the Harz Mountains in the 10th century and in the 12th century in the Erzgebirge (Figure 1.7). Copper deposits were discovered in the Mansfeld area in the Harz Mountains in 1199 and it became one of the main copper and silver producers in Europe.

Figure 1.7: Harz and Erzgebirge Mountains.

As years went by, the Duchy of Saxony broke down to smaller fiefs, and the empire included over 300 German duchies and most of Italy. Most of the emperors who followed Otto quarrelled with the Popes concerning the right to appoint bishops and other matters. After 1356, the rulers of the Empire were chosen by a fixed number of electors, and crowned as kings at Aachen. After 1562, the emperors-elect dispensed with coronations by the Pope and were crowned at Frankfurt.

The Reformation of Martin Luther in 1517 destroyed the religious unity of the Empire. This was followed by the Thirty Years War (1618–1648) between the German princes who were backed by different foreign powers. As a result, imperial control over the principalities and kingdoms became minimal and within the federal structure arose two powerful rival states: Austria and Prussia.

Prussia

Friedrich Wilhelm (1620–1688), the Great Elector of Brandenburg and Duke of Prussia who ruled from 1640 to 1688, merged the two Hohenzollern possessions, Brandenburg and Prussia, into a single administrative unit with Berlin as its capital. His successors Friedrich I, Friedrich Wilhelm I, and Friedrich II the Great, who ruled from 1740 to 1786, organized a powerful standing army, invaded Silesia, partitioned Poland, and made Prussia the foremost military power in Europe (Figure 1.8).

When Napoleon invaded the German states in 1792, he was welcomed by German sympathizers as a possible reformer of the mediocre system of the hundreds of tyrants composing the German independent states. By 1806, almost all of Germany was in his hands and this ended the Holy Roman Empire of the German Nation.

Figure 1.8: German Empire, 1789.

German Empire

Friction between Prussia and France in 1870 resulted in war and the defeat of France during the reign of Napoleon III (nephew of Napoleon I). The supremacy of Prussia and the proclamation of Wilhelm I (1797–1888) as emperor of Germany by chancellor Otto von Bismarck took place in Versailles. The states of the Catholic south: Bavaria, Baden, and Württemberg joined in the confederation with Prussia. In half a century, Germany had evolved from a feudal, disunited, socially and industrially retarded area into the chief military and economic power of Europe.

The modern steel industry in Germany was founded in 1811 by Friedrich Krupp (1787–1826). His son Alfred Krupp specialized in armament manufacture. Great financial expansion took place under his son Friedrich Albert Krupp. The Krupp works became an important metallurgical enterprise. At the same time, the consulting firm Demag, founded in 1819, built the first large blast furnace, a puddling furnace and rolling mills in 1828.

In 1865 the chemical industry started in Germany when the Badische Anilin- und Sodafabrik was founded in Ludwigshafen and became one of the most important and most diversified chemical plants in the world. In 1866 the Norddeutsche Affinerie was founded in Hamburg to refine precious metals.

The industrial and commercial expansion was combined with the program of naval and colonial expansion under Wilhelm II (1859–1941) (a grandson of Queen Victoria of England). During this period chemistry and metallurgy flourished as nowhere else in Europe. The Empire included vast territories in Africa: Togo (present Togo and the eastern part of Ghana), Kamerun (Cameroon), Tanganyika (present Tanzania, Rwanda, and Burundi), and Southwest Africa (Namibia).

Weimar Republic

When the German Empire was defeated in World War I (1914–1918), a Social Democratic revolution forced the abdication of Emperor Wilhelm II (Figure 1.9) and the conclusion of an armistice. In 1919, the Germans accepted the Treaty of Versailles and the Empire was stripped of all her colonies. In 1920, the first united German Republic was created in Weimar with the first President Friedrich Ebert (1871–1925). The Republic faced a series of social, economic, and political challenges.

Figure 1.9: Emperor Wilhelm II.

During this period, German Christians were alarmed by the spread of Marxist–Leninist atheism, which took place in Russia following the 1917 Revolution, and involved a systematic effort to eradicate Christianity. In Berlin a general strike and an armed battles took place in January 1919 known as Spartacist uprising. The leaders were the Communists Karl Liebknecht and Rosa Luxemburg. They were overcome by bands of soldiers called Freikorps who had refused to disband when the Republic was formed.

The resentment of the Treaty of Versailles, the disastrous inflation, and the political turmoil of 1920–1923 resulted in the rise of radicals. Adolf Hitler led the Nazi Party and formed alliances with other right-wing groups to overthrow the Republic.

After the 1923 Munich Beerhall Putsch, Adolf Hitler was imprisoned. Catholic leaders attacked the Nazi ideology. The Wall Street Crash of 1929 caused a worldwide economic disaster. The Nazis and the Communists made great gains at the 1930 Election. Greatest gains for the Nazis came in the Protestant, rural areas of North, while Catholic areas remained loyal to the Centre Party. In the 1930s the Nazis combined terror tactics with conventional campaigning — while Sturmabteilung troops paraded in the streets, beat up opponents, and broke up their meetings.

President Paul von Hindenburg (1847–1934) (Figure 1.10) appointed the Catholic Franz von Papen as Chancellor in June 1932. At the July 1932 elections, the Nazis became the largest party in the Reichstag. In January 30, 1933 Hindenburg appointed Hitler Chancellor. Parliamentary elections were scheduled for March 1933 but the Reichstag fire of February led to the abrogation of basic civil rights and persecution of opponents.

Figure 1.10: President Paul von Hindenburg (1847–1934).

The National Socialists moved quickly to outlaw other political parties. Following a campaign of intimidation, the Catholic Centre Party and the Bavarian People's Party (a regional Catholic party) ceased to exist. Hitler issued a decree to have the Communist Party's offices raided and its representatives arrested, effectively eliminating them as a political force.

Chapter 2

Nazi Germany

The Enabling Act, "Law to Remedy the Distress of People and Reich" was passed on March 23, 1933 at the Opera House in Berlin (Figure 2.1), and was signed by President Hindenburg. The Communists had already been banned and were therefore not present while several Social Democrats were kept away as well. Nearly all the parties present voted for the act, with the Social Democrats being the only ones voting against. The law gave Hitler the freedom to act without parliamentary consent and even without constitutional limitations.

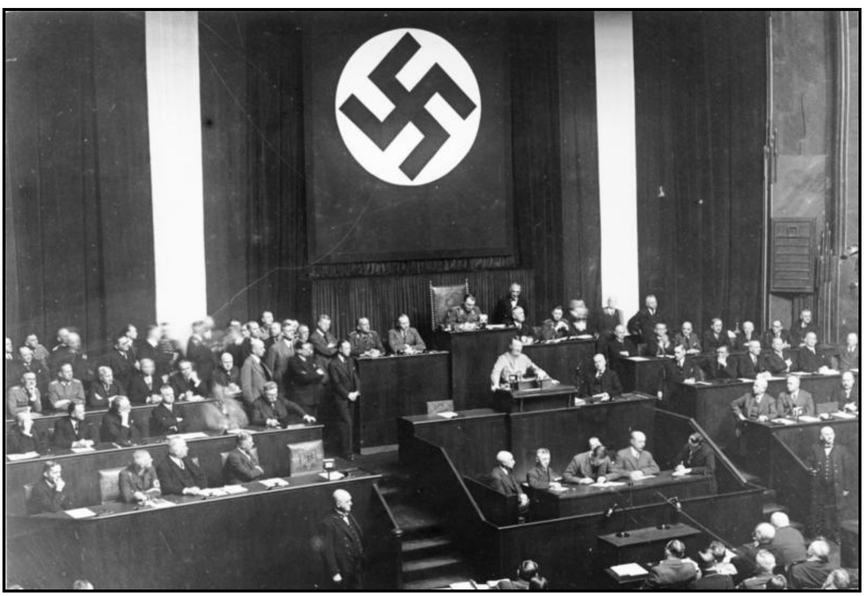


Figure 2.1: Hitler speaking at the Opera House in Berlin for the Enabling Act on March 23, 1933.

Night of the Long Knives

The Night of the Long Knives (*Nacht der langen Messer*) was carried out by the Nazi regime between June 30 and July 2, 1934 aimed at murdering leading figures of the left-wing faction of the Nazi Party and prominent conservative anti-Nazis. Many of those killed were leaders of the *Sturmabteilung* (SA), the paramilitary Brown Shirts. Adolf Hitler saw the independence of the SA as a direct threat to his newly gained political power. Many Catholic political activists were also killed and more than a thousand were arrested. Most of the killings were carried out by the *Schutzstaffel* (SS) and the *Geheime Staatspolizei* (Gestapo), the regime's secret police.

Death of Hindenburg

By the death of Hindenburg in August 2, 1934, Hitler became Chancellor and he abolished the Reichstag and all non-Nazi political parties.

Spanish Civil War

In the Spanish Civil War (1936–1939), Nationalists were aided by Fascist Italy and Nazi Germany while Republicans were aided by the Soviet Union and Mexico. The Spanish Republican president, Manuel Azaña, was anticlerical, while the Nationalist Generalísimo Francisco Franco established a long standing Fascist dictatorship which restored some privileges to the Church.

Kristallnacht 1938

Kristallnacht (Crystal Night or the Night of Broken Glass), was a series of attacks against Jews throughout Nazi Germany and parts of Austria on 9–10 November 1938. Shards of broken glass littered the streets of Jewish-owned stores, buildings, and synagogues when their windows smashed. German authorities looked on without intervening (Figure 2.2). A number of Jews were killed in the attacks, and 30 000 were arrested and incarcerated in concentration camps. Jewish homes, hospitals, and schools were ransacked. Over 1 000 synagogues were burned (95 in Vienna alone) and over 7 000 Jewish businesses destroyed or damaged. The pretext for the attacks was the assassination of the German diplomat Ernst vom Rath by a German-born Polish Jew resident in Paris.

On 11 November 1938, Pope Pius XI joined Western leaders in condemning the pogrom. In Munich in response, the Nazis organised mass demonstrations against Catholics and Jews.

World War II

Germany entered Poland in September 3, 1939 and this started World War II. Hitler conquered most of Europe but was finally defeated in May 1945. After the war, Germany was stripped of East Prussia and Silesia; her eastern border was moved to the Oder–Neisse rivers, which is her present border with Poland, and was partitioned into East Germany [German Democratic Republic] and West Germany (Figures 2.3–2.4) while the administration of Berlin was divided between the Allied Powers. After the collapse of the Soviet Union in 1989 Germany was re-united again (Figure 2.5).

Figure 2.2: Glass windows smashed.

Figure 2.3: Flag of East Germany [German Democratic Republic].

Figure 2.4: Germany divided after World War II [1945–1990].

Figure 2.5: German re-unification in 1990.

Chapter 3

German Federal Republic

Table 3.1: Visits to Germany.

Date	City	Purpose of visit
May 1955	Karlsruhe	Technische Hochschule
	Frankfurt/Main	ACHEMA exhibition
	Giessen	Liebig's Museum
	Munich	Deutsche Museum
September 1957	Ludwigshafen	Badische Anilin- und Sodafabrik
	Heidelberg	University of Heidelberg
October1962	West Berlin	Technische Hochschule Berlin
	East Berlin	Transfer by train to East Berlin, then taking Vindobona Express to Vienna via Prague. Arrival at Nord Bahnhof
June 1969	Cologne	International Conference on Hydro-metallurgy
	Duisburg	Duisburger Kupferhütte
	Bad Neuenahr	Interviewing Frau Dr. Ida Noddack at her retiring home.
October 1977	Düsseldorf	Max Planck Institute
	Bochum	Mining Museum
May–June 1979	Frankfurt	Gmelin Institute Lurgi
	West Berlin	From Warsaw after attending IMPC via East Berlin. Visiting Prof. F. Pawlek and Prof. Johannes Gerlach at the Techni-sche Hochschule in West Berlin.
	Munich	Visiting Dr. Friedrich Dannhauser
May 1981	Aachen	From Lisbon on the way to Stockholm. Host Prof. Heinz Hoberg, Kruger, and El-Gammal
November 1987	East Berlin	Transit from Sofia to West Berlin
	Wittenberg	Cultural visit
	Leipzig	Karl Marx University
	Freiberg	Bergakademie

Date	City	Purpose of visit
	Ludwigshafen	BASF NitroFoska plant
	Cologne	Cultural visit
November 1995	Heidelberg	Verlag Chemie
April 1996	Aachen	IMPC Council Meeting, on the way to Rome as Visiting Professor
September 1997	Berlin	Visiting Rudolf and Brigitte Pawlek
	Potsdam	Sans Souci Palace and Potsdam Conference Room
	Mannheim	To meet VCH editors concerning *Handbook of Extractive Metallurgy* in Heidelberg
	Aachen	International Mineral Processing Congress
October 2006	Frankfurt	Cultural visit
June 2009	Heidelberg	VCH–Wiley concerning the *Handbook of Extractive Metallurgy*
September–October 2009	Freiberg	Cultural Heritage Symposium
	Dresden	Cultural visit
	Munich	Cultural visit
June 2010	Hamburg	Copper 2010 Conference

KARLSRUHE

In 1715, Karl Wilhelm (1679–1738), Margrave of Baden-Durlach, founded a palace as a "resting place" in the area which became later the city of Karlsruhe. Karl Wilhelm is buried under the pyramid in the city centre (Figure 3.1). Initially there was a church on the same site, but had to be removed when the square was renovated and so the pyramid was built over the tomb in 1807. He was succeeded by Karl Friedrich Grand Duke of Baden (1728–1811) an enlightened despot (Figure 3.2).

In 1860 the first international convention for chemists was held in the city due to the initiative of August Kekulé who managed to mobilize a hundred colleagues from all over Europe. It was there at this conference when the Italian chemist Stanislao Cannizzaro (1826–1910) made an effort to have the views of his countryman Amedeo Avogadro (1778–1856) known in making a distinction between atoms and molecules. The conference was attended by Mendeleev and Lothar Meyer, who elaborated a system for the classification of elements in 1869.

Figure 3.1: The tomb of Karl Wilhelm.

Figure 3.2: Monument to Karl Friedrich, Grand Duke of Baden (1728–1811).

Technische Hochschule

The Technische Hochschule in Karlsruhe was founded in 1825 as the first technical school in the German Empire known as Fridericiana (Figure 3.3) in honour of Grand Duke Frederick I of Baden who elevated it to the status of a university. It was modelled upon the École Polytechnique in

Paris. In 1851 lectures on chemical technology were delivered and in 1872 the Institute of Chemical Technology was founded (Table 3.2).

Table 3.2: Directors of the Institute of Chemical Technology.

Director	Years of service
Karl Birnbaum (1839–1887)	1872–1875
Carl Engler (1842–1925)	1876–1887
Hans Bunte (1848–1925)	1887–1919
Paul Askenasy (1869–1938)	1920–1933
Friedrich A. Henglein (1893–1968)	1933–1961

Figure 3.3: Standing beside the monument of Fridericiana at the Technische Hochschule. In the background is the Institute for Chemical Technology. Photo by Radames Botros, 1955.

Among the distinguished professors at this institution were:

- Karl Weltzien, Professor of Organic Chemistry from 1841 to 1868, who organized the First International Chemistry Congress in 1860 that took place in Karlsruhe
- Lothar Meyer, Professor of Chemistry from 1868 to 1876, who introduced the Periodic Table of the Elements
- Carl Engler, Professor of Petroleum Chemistry and dyestuffs from 1876 to 1887
- Hans Bunte, Professor of Fuel Technology from 1887–1919

- Fritz Haber, Professor of Physical Chemistry from 1896 t0 1906 and developed the high-pressure synthesis of ammonia in 1909 and won a Nobel Prize in Chemistry in 1918
- Hermann Staudinger, Professor of Chemistry from 1907 to 1912 who won in 1953 the Nobel Prize in Chemistry for his discoveries in the field of macromolecular chemistry
- Georg Bredig, Professor of Physical Chemistry from 1911 to 1933, studied catalysis and metal colloids
- Wilhelm Nusselt, Professor of Machines from 1920 to 1925 co-founder of chemical engineering
- Rudolf Planck, Professor of Applied Thermodynamics and Refrigeration from 1925 to 1954
- Emil Kirschbaum, Professor of Chemical Engineering from 1928 to 1966

Among the distinguished graduates were Karl Benz (1844–1929) the inventor of the automobile, Edward Teller (1908–2003) who is known as the originator of the hydrogen bomb, and others.

Prof. Friedrich August Henglein was invited by the Department of Chemical Engineering at the University of Alexandria to give a series of lectures during March 1955. I attended his lectures and made acquaintance with him. When he learned that I was planning to attend the ACHEMA exhibition in Frankfurt in May the same year he was kind enough to invite me to visit him in Karlsruhe.

In May 1855 I left Alexandria by boat to Genoa then took the train to Karlsruhe. I stayed with a relative of mine who was studying at the Technische Hochschule which simplified many things for me. There, I visited Prof. Henglein at his office and he invited me for dinner at his home in the same day (Figures 3.4–3.6).

By coincidence, Dr. Walter Noddack (1893–1961) and his wife Ida Noddack (1896–1978) (Figure 3.7) were just back from Turkey and were invited to the same dinner. They were then taking a position at the Institut für Geochemie in Bamberg.

When the host introduced his two guests to me as the discoverers of rhenium, I did not know at that time what was he talking about. Henglein had to open his book *Grundriß der Chemischen Technik* (Figure 3.6) to show me the Periodic Table and rhenium in it. He presented a copy of his book with a dedication that I greatly treasure (Figure 3.8).

Figure 3.4: With Prof. F. A. Henglein in his office after presenting me a copy of his book. Photo by Radames Botros, 1955.

Since then I became interested in this metal and cherished greatly the occasion that I had to meet such great chemists. Eventually, I managed to meet Frau Noddack later when my German was better and wrote some papers later about her as will be described later when I was in Cologne in 1969. Henglein also drove me around to show me the Black Forest where he signed a postcard at the café shop on the top of the mountain (Figure 3.9).

Professor Henglein was a generous person, highly cultured, with great humour, and a distinguished scientist. No wonder when I received the notice of his death I was deeply saddened. I immediately wrote an obituary that was published in the Viennese journal *Allgemeine und Praktische Chemie* volume 19, issue no. 8, page 259 [1968] outlining his contributions to chemical industry and metallurgy and to education. I left Karlsruhe by train to Frankfurt (Figure 3.10).

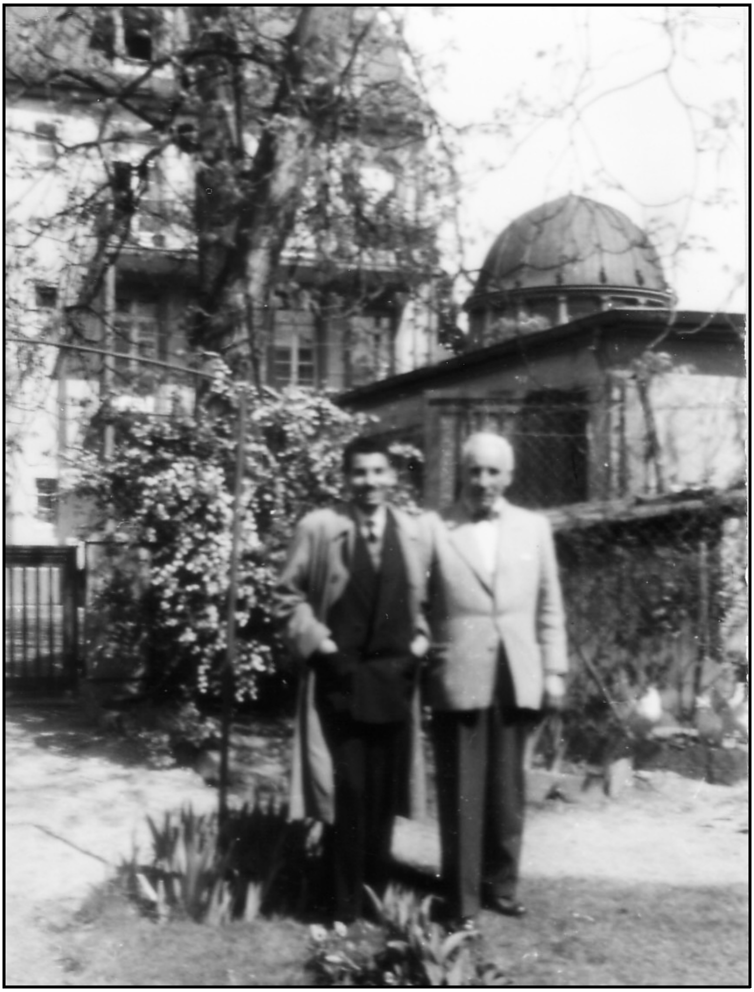


Figure 3.5: With Prof. F. A. Henglein in his garden at home. Photo by Radames Botros, 1955.

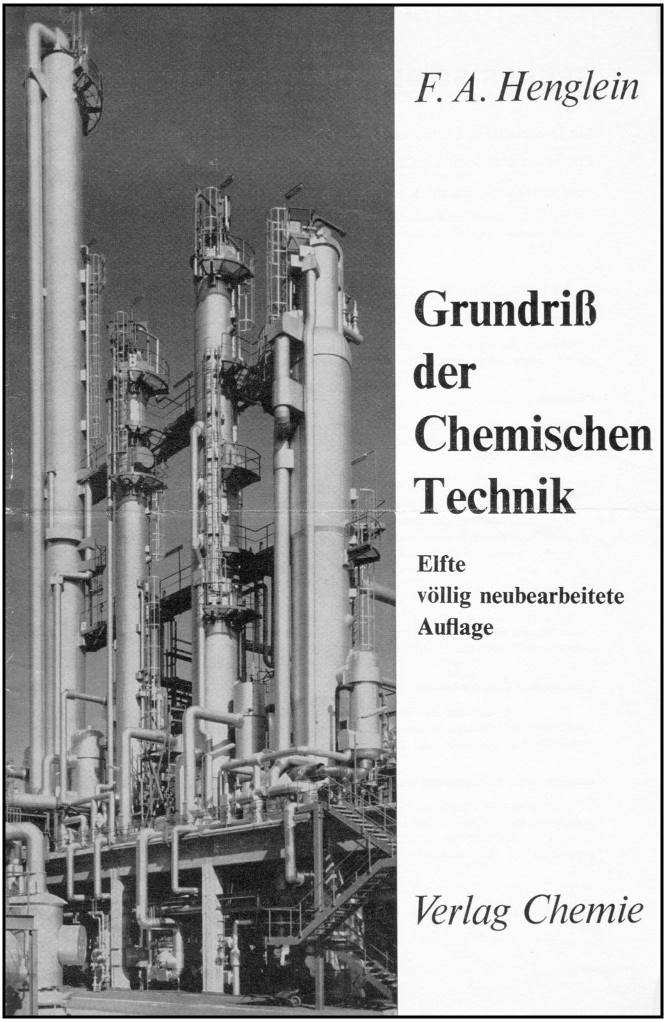
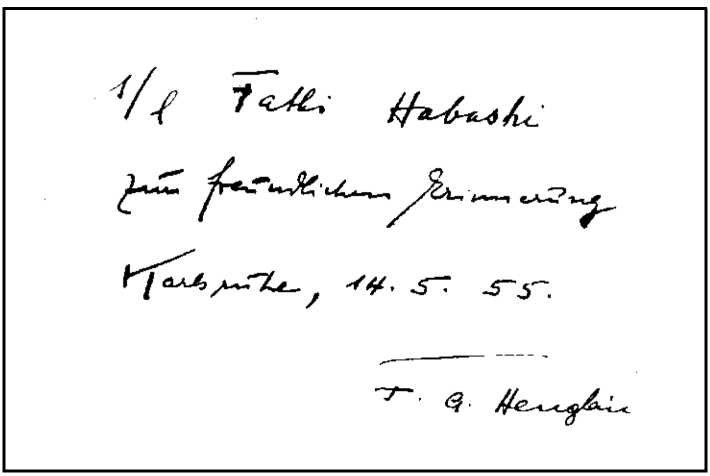


Figure 3.6: Front cover of Henglein's book presented to me.

Figure 3.7: Walter and Ida Noddack.



Fathi Habashi
zur freundlichen Erinnerung
Karlsruhe, 14. 5. 55.
F. A. Henglein

Figure 3.8: Henglein`s dedication of his book.

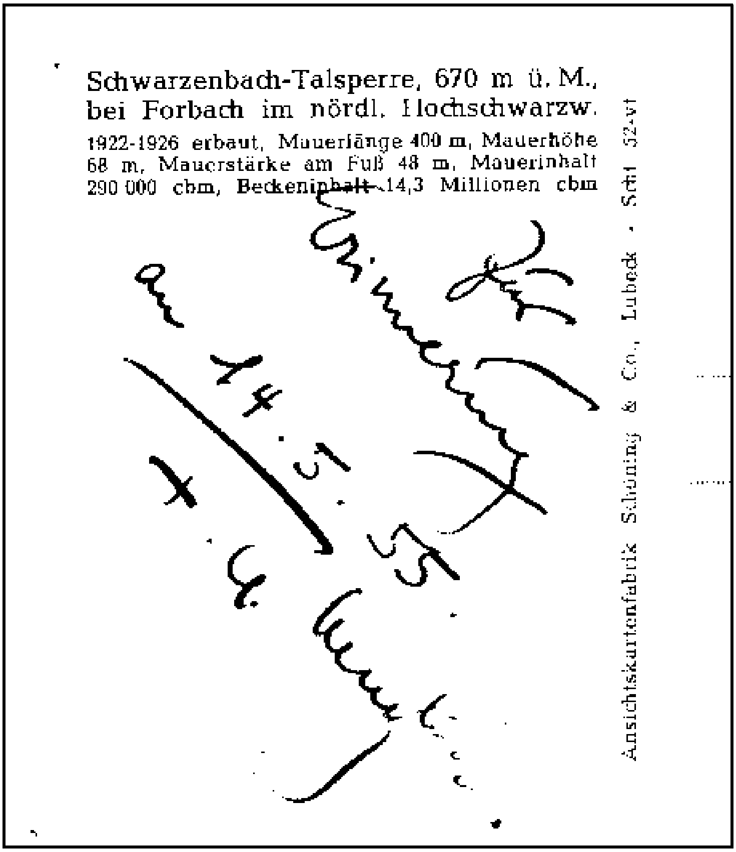


Figure 3.9: Remembering the Black Forest, May 14, 1955.

Figure 3.10: Taking the train to Frankfurt. Photo by Radames Botros, 1955.

FRANKFURT 1955

Frankfurt am Main (Figures 3.11–3.12) is the financial centre of Germany and the largest financial centre in continental Europe. As a part of early Franconia, the inhabitants were the early Germanic tribes of the Franks where the river was shallow enough to be crossed by wading. Thus the city's name reveals its legacy as being "the ford of the Franks on the Main River." During the Holy Roman Empire the German kings and emperors were elected in Frankfurt and crowned in Aachen. From 1562 the kings/emperors were also crowned in Frankfurt. This tradition ended in 1792, when Franz II was elected.

Figure 3.11: Map of Frankfurt.

Figure 3.12: Frankfurt Railway Station, 1955.

ACHEMA

ACHEMA, acronym for Ausstellungstagung für chemisches Apparatewesen, is held in May every year in Frankfurt. It is one of the largest exhibitions in the world displaying chemical equipment and machinery, industrial chemicals, etc. At the ACHEMA conference in May 1955 I met Dr. Alois

Peham, who was Director of the Chemical Laboratory at the Fertilizer plant in Suez, Egypt, where I was a chemical engineer working in the Nitric Acid Plant from 1949 to 1952. To my great pleasure he invited me for dinner with him at the Frankfurter Hof (Figure 3.13), which is a landmark hotel in the city centre at Kaiserplatz.

Figure 3.13: The Frankfurter Hof, 1955.

FRANKFURT 1977

Gmelin Institute

The Gmelin Institute (Figure 3.14) is a documentation centre in the field of Inorganic Chemistry and Extractive Metallurgy. It is supported by the German Chemical Society and the Max-Planck Society. It publishes the *Handbook on Inorganic Chemistry* (Figure 3.15), which is a comprehensive treatise on that subject in numerous volumes. Staff members are scientists of whom 65 are full-time editors. A meeting was held with Dr. W. Lippert, Deputy Director.

Lurgi

Lurgi Chemie and Hüttenwesen Gesellschaft (Figures 3.16–3.17) is a large German group of companies that are involved in all sectors of the chemical and metallurgical industries. It is unique when compared with US or Canadian companies in that they conduct experimental research, consultations to clients, production of equipment for chemical and metallurgical plants, as well as the construction of plants in Germany and abroad.

Figure 3.14: Gmelin Institute, 1977.

Figure 3.15: *Gmelin Handbuch der anorganischen Chemie*, 1977.

I visited the Department for Extractive Metallurgical Research, which is headed by Dr. W. Schwartz, assisted by Dr. Pietsch and Dr. P. Fischer, and the Pilot Plant headed by Dr. Hansrausch assisted by W. Koch and O. Zügel. The research workers were willing to show and enter in every detail without claiming to reveal any company secrets.

Figure 3.16: Lurgi Research Department, 1977.

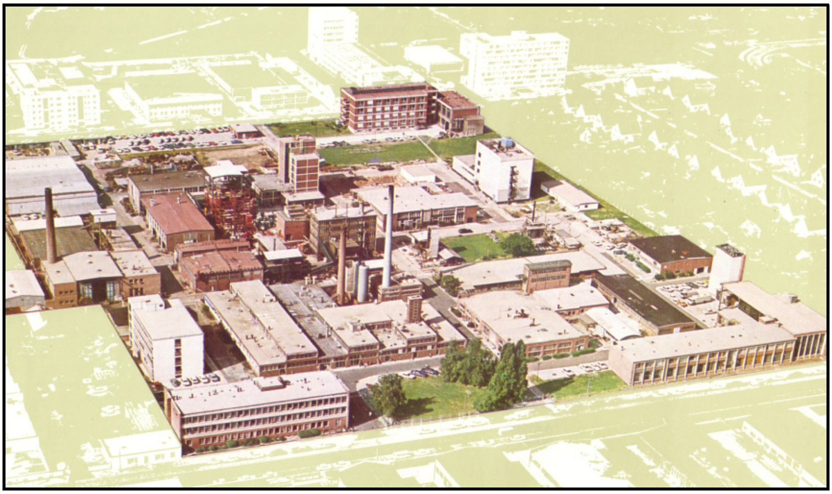


Figure 3.17: Lurgi Metallurgical Pilot Plants, 1977.

Chapter 4

Berlin

Berlin was the capital of the Kingdom of Prussia (1701–1918), the German Empire (1871–1918), the Weimar Republic (1919–1933) and the Third Reich (1933–1945). After World War II, the city was divided into East Berlin — the capital of East Germany — and West Berlin, a West German enclave surrounded by the Berlin Wall (1961–1989) (Figures 4.1–4.2). Following German re-unification in 1990, the city regained its status as the capital of Germany.

WEST BERLIN 1962

My first visit to Berlin was in October 1962 when my Fellowship in Ottawa terminated and I took the boat from Montreal to Amsterdam on my way back to Vienna. Then I took the train to Berlin where I was invited to give a seminar at the Metallurgy Department of the Technische Hochschule (Figure 4.3). Prof. Franz Pawlek (1903–1994) (Figure 4.4) was Head of the Metallurgy Department and Professor Otto Dahl (1899–1962) (Figure 4.5) was in charge of the colloquia.

Relations with the Technische Universität [formerly Hochschule] in Berlin–Charlottenburg goes back to summer 1962 when Prof. Pawlek visited the Mines Branch in Ottawa where I was working as a Post-Doctoral fellow. He invited me to stop in Berlin to hold a seminar to his students on my return to Europe. Prof. Pawlek then visited me in Arizona in 1969 (Figure 4.6) and in Quebec, where he talked to my students at Laval in 1971. After retiring he was still active and maintained an office at the University. He was a distinguished hydrometallurgist. At the TH in Berlin in 1962 I made acquaintance with Dozent Johannes Gerlach, who also visited me in Arizona and in Quebec.

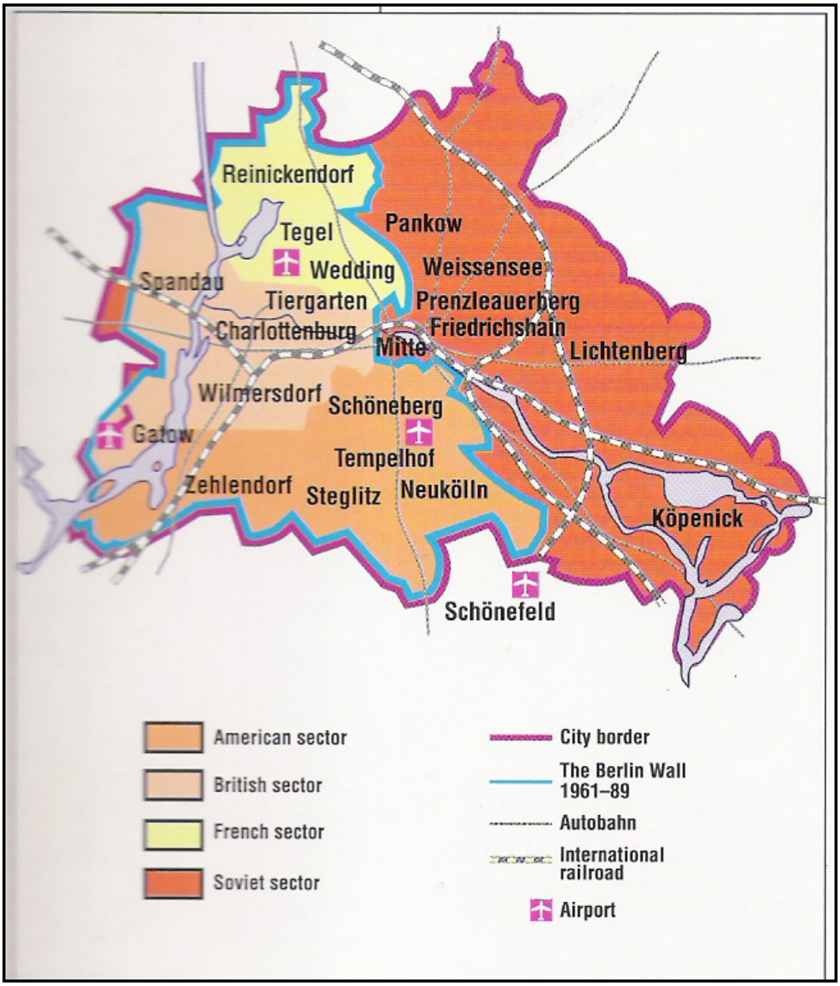
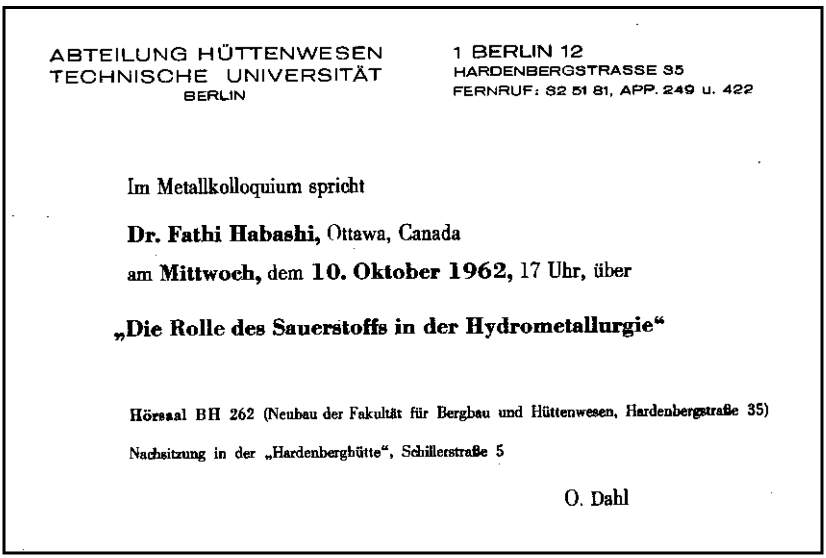


Figure 4.1: Berlin during the Cold War.

Figure 4.2: Berlin Wall [1961–1989] before taking it apart.



ABTEILUNG HÜTTENWESEN
TECHNISCHE UNIVERSITÄT
BERLIN

1 BERLIN 12
HARDENBERGSTRASSE 35
FERNRUF: 32 51 81, APP. 249 u. 422

Im Metallkolloquium spricht

Dr. Fathi Habashi, Ottawa, Canada

am **Mittwoch,** dem **10. Oktober 1962,** 17 Uhr, über

„Die Rolle des Sauerstoffs in der Hydrometallurgie"

Hörsaal BH 262 (Neubau der Fakultät für Bergbau und Hüttenwesen, Hardenbergstraße 35)

Nachsitzung in der „Hardenberghütte", Schillerstraße 5

O. Dahl

Figure 4.3: Announcement of my lecture at TH Berlin.

Figure 4.4: Prof. Franz Pawlek (1903–1994).

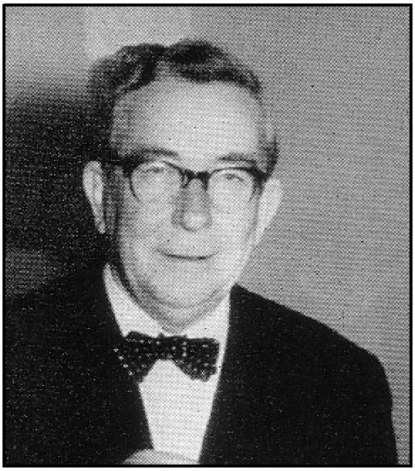


Figure 4.5: Prof. Otto Dahl (1899–1962).

Figure 4.6: Professor Franz Pawlek, in Tucson, Arizona 1969.

Charlottenburg

Charlottenburg is a district of West Berlin where the Technische Hochschule is located. There is also the Dahlem Museum where the bust of Queen Nefertiti, mother of Tut Ankh Amon is found (Figure 4.7). It is 3 300-year-old painted limestone bust of the wife of Pharaoh Ekhmaton discovered by German archaeologists in 1912 during their excavations in Amarna near Assyout in Egypt.

Figure 4.7: The bust of Queen Nefertiti.

West Berlin 1979

After attending the International Mineral Processing Congress in Warsaw in 1979, I flew to East Berlin and from there I crossed to West Berlin to visit my colleagues at the Technische Hochschule to discuss recent advances in hydrometallurgy.

West Berlin 1987

During my sabbatical in 1987 I took the opportunity of being in Europe to visit Prof. Pawlek who had retired few years earlier and succeeded by

Prof. Roland Kammel (1925–2009) (Figure 4.8). Gerlach passed away at a young age, Kammel was sick. A useful meeting was held with Prof. W. Wuth who visits Bolivia regularly and is specialized in pyrometallurgy.

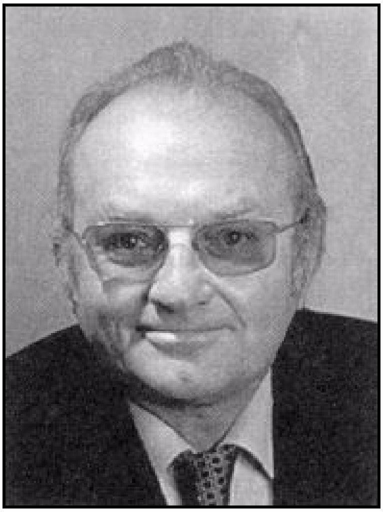


Figure 4.8: Prof. Roland Kammel (1925–2009).

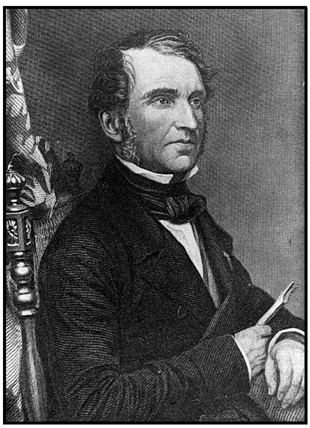


Figure 4.9: Justus von Liebig (1803–1873) created a teaching laboratory for chemistry that had a world fame.

GIESSEN

Giessen is 50 km north of Frankfurt. A trip was organized by ACHEMA to visit Liebig Museum, established in 1920 in Giessen to honour the chemist Justus von Liebig (1803–1873) (Figure 4.9). When Liebig became professor of chemistry at Giessen in 1824 he immediately took steps to offer laboratory instruction in chemistry in the same way as he himself got it in Paris. His students were first trained in qualitative and quantitative analysis, they then prepared organic compounds, and finally carried out a special investigation on a problem suggested by him. The laboratory at Giessen received great attention and attracted students from many parts of Europe. It is preserved today as a museum (Figures 4.10–4.13).

Figure 4.10: Justus von Liebig's laboratory in Giessen, 1955.

Figure 4.11: Liebig's office in his Giessen laboratory, in the 1840s.

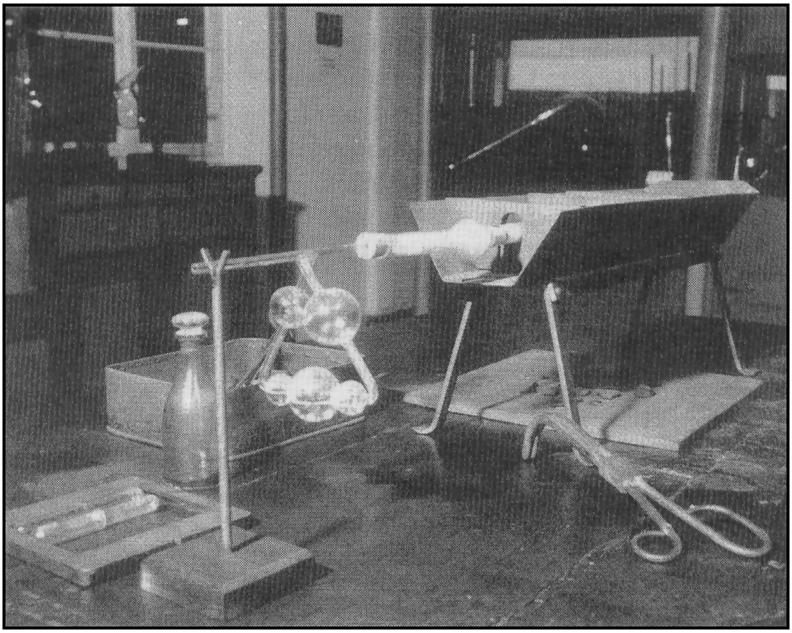


Figure 4.12: Liebig's organic quantitative analysis apparatus..

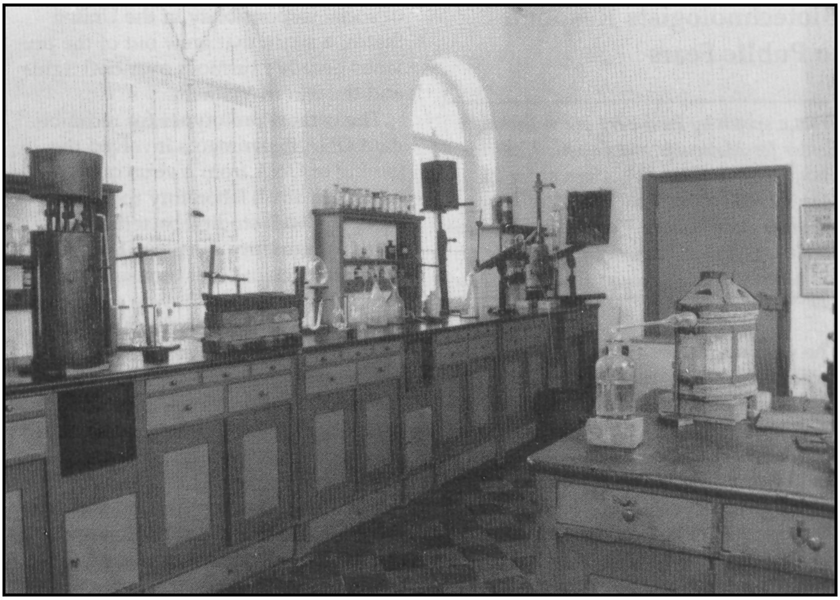


Figure 4.13: Justus von Liebig's analytical laboratory with original furniture and equipment.

Liebig's laboratory was unique in the results it produced due to the enthusiasm and inspiration of Liebig himself. An expert analyst, he made numerous contributions to analytical chemistry. He had a talent for devising unique methods and new apparatus for accomplishing a particular purpose, e.g., the Liebig condenser. The large number of his students who rose to prominence is testimony to his greatness as a teacher. Among these were August von Hofmann, Carl Remigius Fresenius, Max von Pettenkofer, Hermann Kopp, Hermann von Fehling, Jacob Volhard, Heinrich Will, F. Varrentrapp, Emil Erlenmeyer, Adolph Strecker, and Friedrich August Kekulé from Germany; William Henneberg from Denmark; Adolphe Wurtz, Henri-Victor Regnault, and Charles Gerhardt from France; Alexander Williamson, Lyon Playfair, and James Muspratt from England; and Eben Norton Horsford, O. Wolcott Gibbs, and J. Lawrence Smith from the United States.

During the earlier years Liebig's interests leaned strongly toward organic chemistry and he was instrumental in the isolation and analysis of various new compounds. Gradually, he turned toward applied fields, particularly agricultural chemistry.

MUNICH

Das Deutsche Museum

The German Museum in Munich (Figure 4.14) was founded in 1903 and is the largest establishment for science and technology. It is divided into numerous departments: Chemistry, Physics, Mechanics, Astronomy, Astrophysics, Mechanical Engineering, Shipbuilding, Mining, Metallurgy, etc. Because of limitation of time, it was possible to examine only the Metallurgy Department. This department is extremely well presented. It relates the history of metal extraction from the time of the primitive furnace that had to be destroyed each time a batch of metal was produced, to a model of a modern blast furnace about 3 m high shown in cross section with every detail.

Models of Bessemer convertors, Siemens–Martin furnace, LD convertors with an actual lance shown in cross section, electric furnaces, cupola furnaces, etc. The old methods of making steel like puddling process, crucible process, etc., are well presented together with other metallurgical operations for casting, rolling, extrusion, etc. The Museum was visited twice: in 1955 and in 1979.

Figure 4.14: Entrance to the Deutsches Museum.

LUDWIGSHAFEN

In the early 17th century a fortress on the other side of the River Rhine was built by Frederick IV, Elector Palatine to protect the City of Mannheim. In 1844 it was bought by Ludwig I King of Bavaria who renamed the fortress after himself and started construction of an urban area as a Bavarian rival to Mannheim on the opposite bank which became Ludwigshafen (Figure 4.15).

BASF

The prosperity of Ludwigshafen is due to the Badische Anilin- und Soda-Fabrik. The company started as a Gas Works in 1861 in Mannheim by Friedrich Engelhorn (1821–1902) (Figure 4.17) for street lighting for the town.

Figure 4.15: Map showing the River Rhine, Mannheim on the right and Ludwigshafen and Oppau on the left.

The gas works produced large amounts of tar as a by-product which created a problem. When he learned of the discovery of William Perkin in England that tar could be used to make synthetic dyes from aniline, Engelhorn founded a small aniline and dyestuff factory, which was located not far away from the Mannheim gas works. He started producing the dye fuchsin and four years later he founded the Badische Anilin- & Soda-Fabrik (BASF). But the town council was not willing to sell land for the new factory because it wanted to protect the population against possible pollution. Engelhorn then went to neighbouring Ludwigshafen and bought ground there. The new venture was a great success and became soon an important chemical company. Two years after its foundation, BASF employed already more than 300 workers.

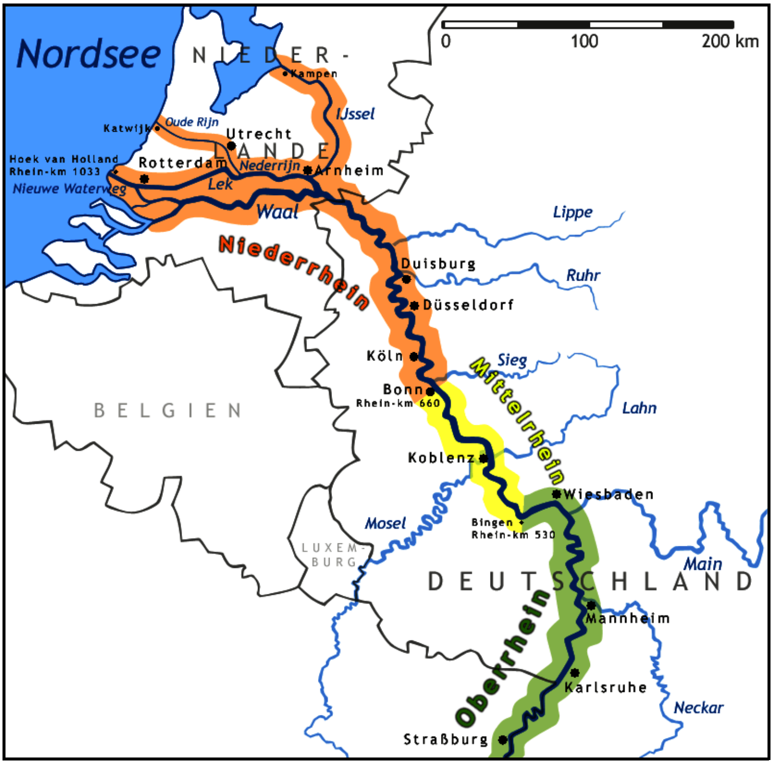


Figure 4.16: The lower part of the River Rhine with some of its tributaries: the Main and Neckar.

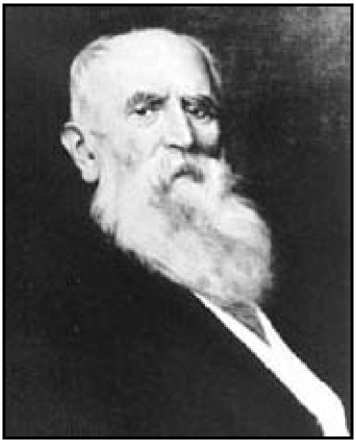


Figure 4.17: Friedrich Engelhorn (1821–1902).

From the beginning BASF was engaged in chemical research. In 1868 the company appointed the chemist Heinrich Caro (1834–1910) (Figure 4.18) as first head of its laboratory. In collaboration with Professor Carl Graebe and Carl Liebermann from Berlin University the first synthetic dyestuff alizarin was discovered.

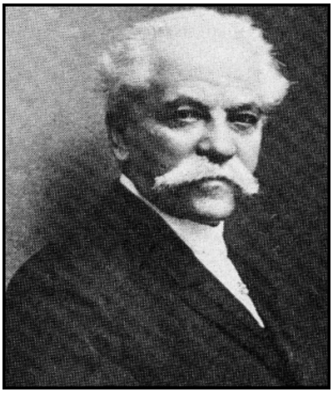


Figure 4.18: Heinrich Caro (1834–1910).

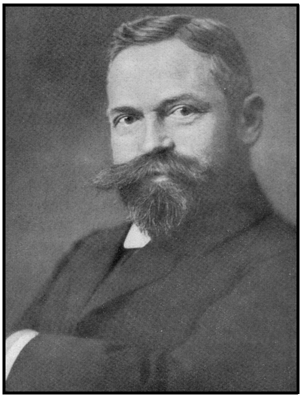


Figure 4.19: Rudolf Knietsch (1854–1906).

In 1890 a unit using the new contact process for sulfuric acid production was brought on stream, producing acid at higher concentration than the chamber acid and at lower cost. Such high concentration was needed for the manufacture of dyestuffs. This followed extensive research and development by Rudolf Knietsch (1854–1906) (Figure 4.19).

When the Badische in 1908 acquired the process of high-pressure synthesis of ammonia, which had been developed by Fritz Haber (1868–1934) at the Technische Hochschule in Karlsruhe, Carl Bosch was given the task of developing this process on an industrial scale. This task involved the construction of plant and apparatus which would stand up to working at high gas pressure and high reaction temperatures. Haber's catalysts, osmium and uranium had to be replaced by another which would be both cheaper and more easily available. The catalyst problem was solved by using pure iron with certain additives developed by Alwin Mittasch (1869–1953) (Figure 4.20).

Further problems which had to be solved were the construction of safe high-pressurized reactors and a cheap way of producing and cleaning the gases necessary for the synthesis of ammonia. Step by step larger manufacturing units were constructed. In order to solve the growing problems posed by materials and related safety problems, BASF set up the chemical industry's first Materials Testing Lab in 1912 to identify and control problems in materials for instrumentation and process engineering.

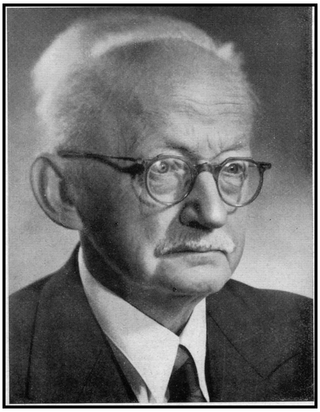


Figure 4.20: Alwin Mittasch (1869–1953).

The plant in Oppau for the production of ammonia and nitrogen fertilizers was opened in 1913. Bosch wanted fertilizers to be tested thoroughly so that customers were to be given proper instructions for their use. This meant extensive trials to determine the effect of fertilizers on soil and on plants. As a result the Agricultural Research Station in Limburgerhof, near Ludwigshafen, opened in 1914.

In 1922 the fluidized-bed reactor was invented by Fritz Winkler (1888–1950) (Figure 4.21) for coal gasification but applied in 1942 for catalytic cracking and in 1947 for roasting sulfides.

Figure 4.21: Fritz Winkler (1888–1950).

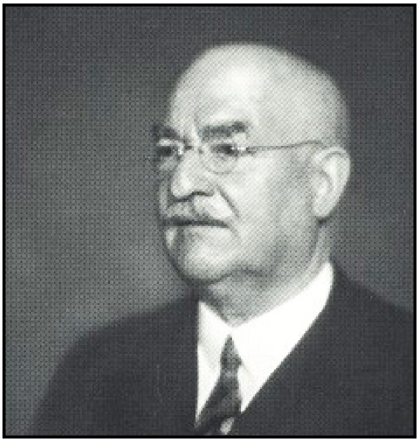


Figure 4.22: Carl Duisberg (1861–1935).

IG Farben

After World War I and the resulting difficult economic situation in Germany, chemist and industrialist Carl Duisberg (1861–1935) (Figure 4.22) who was the Chief Executive Officer of the firm Bayer campaigned to cut expenses and improve administration. He founded in 1923 a cartel with the major chemical companies known as Interessen Gemeinschaft für Farbenindustrie or IG Farben for short.

In the 1930s, Walter Reppe (1892–1969) (Figure 4.23) made extensive research on acetylene and was able to produce a large number of new organic compounds on industrial scale although acetylene is a highly explosive gas. During the same period Friedrich Bergius (1884–1949) (Figure 4.24) produced liquid hydrocarbons used as synthetic fuel by hydrogenation of lignite at high temperature and pressure.

The Wall Street crash of 1929 also triggered an economic crisis in Germany that shattered the political structure of the Weimar Republic. Mass unemployment and economic hardship provided a fertile ground for the Nazi Party. President Hindenburg appointed Adolf Hitler as chancellor in 1933 and agreed to his demand to dissolve the German parliament. In the following months, the Nazi party took control of the socio-political and ideological aspects of the individual operating units of IG Farben. The national socialist ideology also shaped day-to-day operations at Ludwigshafen and Oppau plants. The local newspaper re-organized, labour unions were banned, and IG Farben became gradually enmeshed in the Nazi system.

Figure 4.23: Walter Reppe (1892–1969).

Figure 4.24: Friedrich Bergius (1884–1949).

In 1932, AEG and IG Farben collaborated in the development of a magnetic recording device. A year later, the first "magnetophones" were presented to the public at the 1935 Radio Fair in Berlin. In 1936, the Guest House in Ludwigshafen hosted a special concert with Sir Thomas Beecham conducting the London Philharmonic Orchestra that was recorded on magnetic tape. By that time Bosch was appointed Chairman of the Board of Directors of the I.G. Farbenindustrie A.G.

The outbreak of World War II in September 1939 forced IG Farben to switch production to the war effort. Many male employees were called up and replaced by women conscripts, prisoners of war, and forced labourers from the occupied countries of Eastern Europe. Concentration camp inmates were put to work at IG Farben's Buna factory in Auschwitz, commissioned on the orders of the German army high command in 1940.

Massive air raids were launched on Ludwigshafen in 1943/44. Production dropped drastically and came to a standstill by the end of 1944. By the end of the war in 1945, the extent of the damage was enormous. Economic recovery was hindered by continuous political unrest, reparations obligations, the dismantling of factories, lack of coal, transportation problems, and the French occupation of the west bank of the Rhine. In November 1945, the Allied Control Council ordered the dissolution of IG Farben. Little by little, a starving, freezing and war-weary population began to re-build the site, and production re-started.

BASF again

In 1952, BASF was re-founded following the efforts of Carl Wurster (1900–1974) (Figure 4.25). Wurster was chairman of a Military Economy Council of Nazi Germany. After the war he was arrested in 1947 by American authorities to face trial at Nuremberg. However he was acquitted and soon returned to a leading position in German business.

In the 1950s, BASF added synthetics such as nylon, polystyrene, and many other new products.

Chemistry Graduate students program — BASF 1957

Every year BASF invites one hundred chemistry students in Graduate Schools from all over the world for four weeks as guests of the company. They are given accommodation, lectures, plant tours, and sight seeing tours on weekends. I was one of those fortunate participants in September 1957 when I was graduate student at the Technische Hochschule Wien. A group photo of participants was taken (Figure 4.29). The March 1958 issue of the BASF magazine made a comprehensive illustrated report on this activity (Figures 4.28–4.30). The 4-week program including the names of participants was distributed to participants (Figures 4.41–4.43).

Figure 4.25: Carl Wurster (1900–1974).

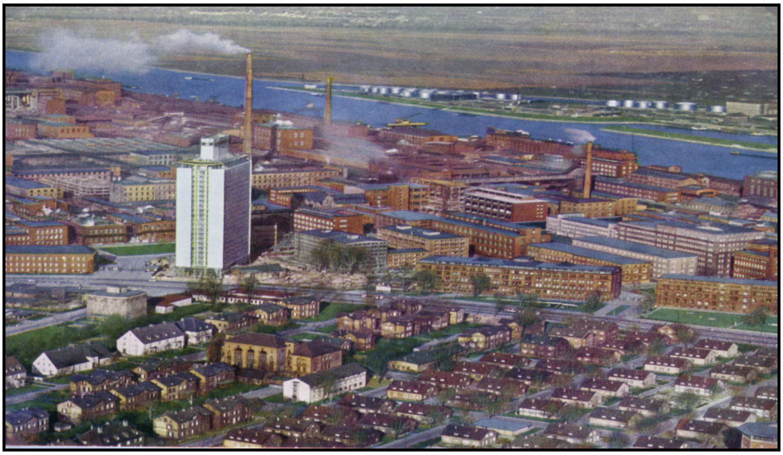


Figure 4.26: Ludwigshafen today with BASF plant, 1957.

Figure 4.27: BASF administrative building in Ludwigshafen, 1957.

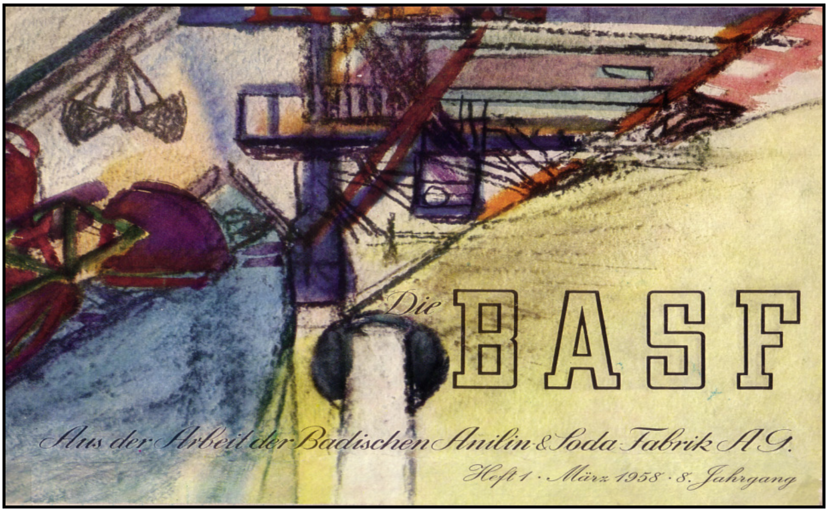
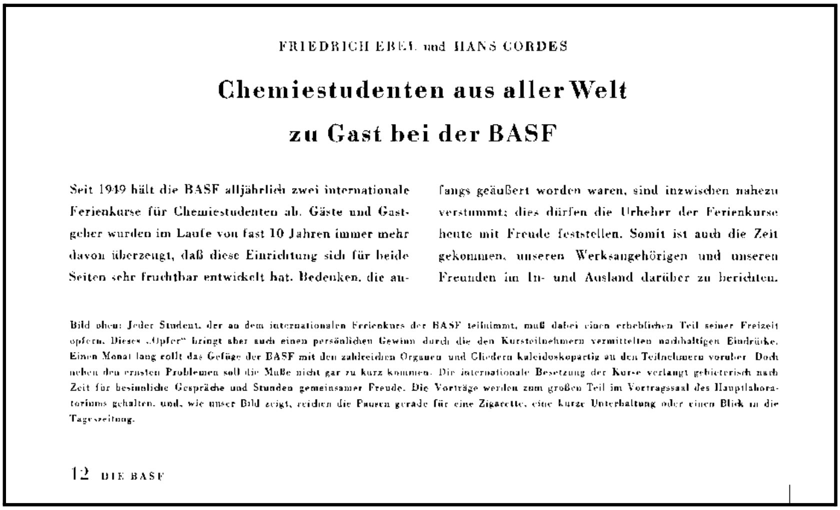


Figure 4.28: Front cover of March 1958 issue of BASF Magazine.

Figure 4.29: Group photo of participants. I am the second to the right on the front row.



FRIEDRICH EBEL und HANS CORDES

Chemiestudenten aus aller Welt zu Gast bei der BASF

Seit 1949 hält die BASF alljährlich zwei internationale Ferienkurse für Chemiestudenten ab. Gäste und Gastgeber wurden im Laufe von fast 10 Jahren immer mehr davon überzeugt, daß diese Einrichtung sich für beide Seiten sehr fruchtbar entwickelt hat. Bedenken, die anfangs geäußert worden waren, sind inzwischen nahezu verstummt; dies dürfen die Urheber der Ferienkurse heute mit Freude feststellen. Somit ist auch die Zeit gekommen, unseren Werksangehörigen und unseren Freunden im In- und Ausland darüber zu berichten.

Bild oben: Jeder Student, der an dem internationalen Ferienkurs der BASF teilnimmt, muß dabei einen erheblichen Teil seiner Freizeit opfern. Dieses „Opfer" bringt aber auch einen persönlichen Gewinn durch die den Kursteilnehmern vermittelten nachhaltigen Eindrücke. Einen Monat lang rollt das Gefüge der BASF mit den zahlreichen Organen und Gliedern kaleidoskopartig an den Teilnehmern vorüber. Doch neben den ernsten Problemen soll die Muße nicht gar zu kurz kommen. Die internationale Besetzung der Kurse verlangt gebieterisch nach Zeit für besinnliche Gespräche und Stunden gemeinsamer Freude. Die Vorträge werden zum großen Teil im Vortragssaal des Hauptlaboratoriums gehalten, und, wie unser Bild zeigt, reichen die Pausen gerade für eine Zigarette, eine kurze Unterhaltung oder einen Blick in die Tageszeitung.

12 DIE BASF

Figure 4.30: Title of the article about the chemistry student program.

Figure 4.31: Coffee break between lectures. I am standing at the extreme right.

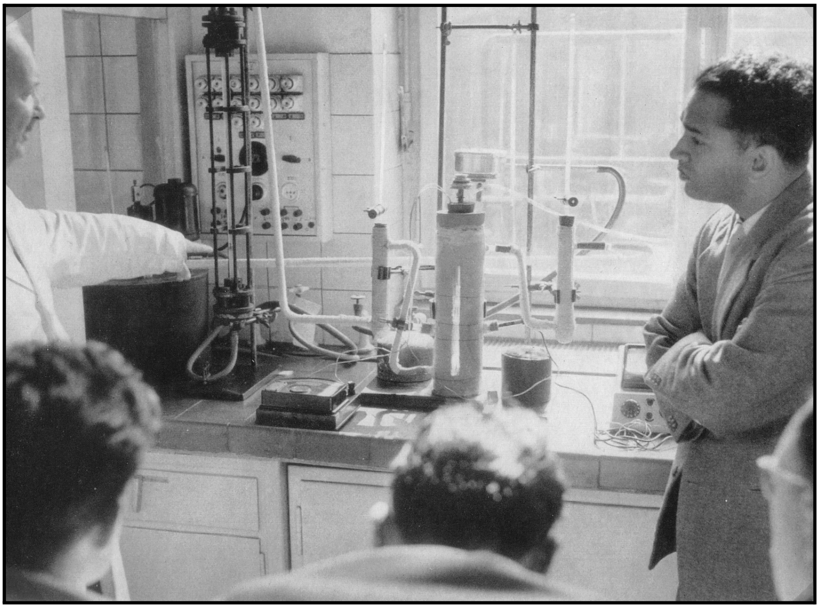


Figure 4.32: Listening to explanations of an expert.

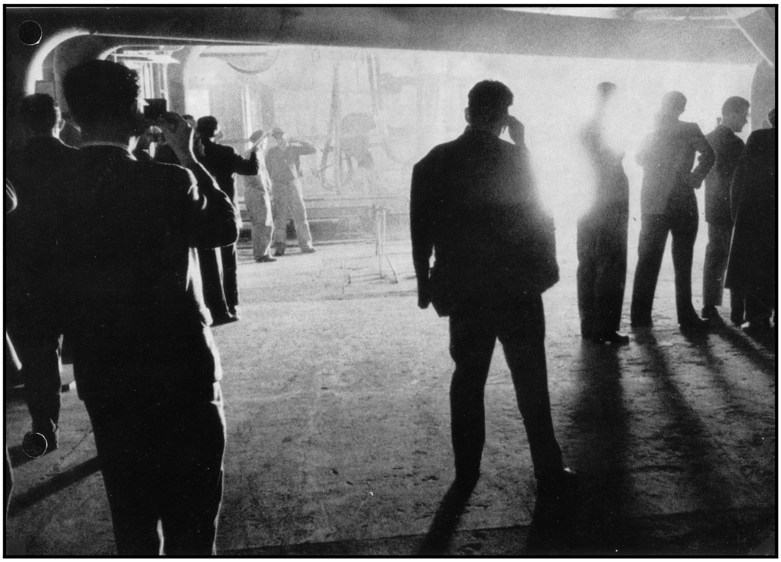


Figure 4.33: Visiting the Calcium Carbide Department.

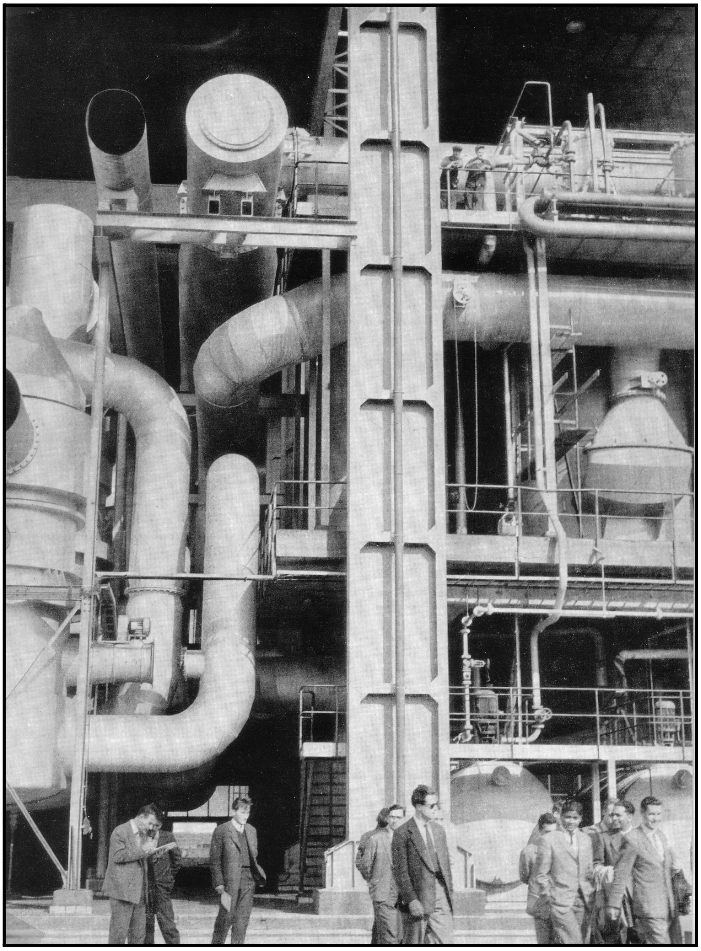


Figure 4.34: Plant tour.

Major accidents at BASF

- September 21, 1921 an explosion occurred in Oppau, killing 565 people. It was in the ammonium nitrate ammonium sulfate silo and not in the high pressure production facilities. Workers were trying to break loose the compacted fertilizer using dynamite.
- July 29, 1943. A tank car containing over 16 tons of a mixture of butadiene and butylene detonated, killing about 570 people.
- July 28 1948, an explosion due to ether in which 207 people died occurred.

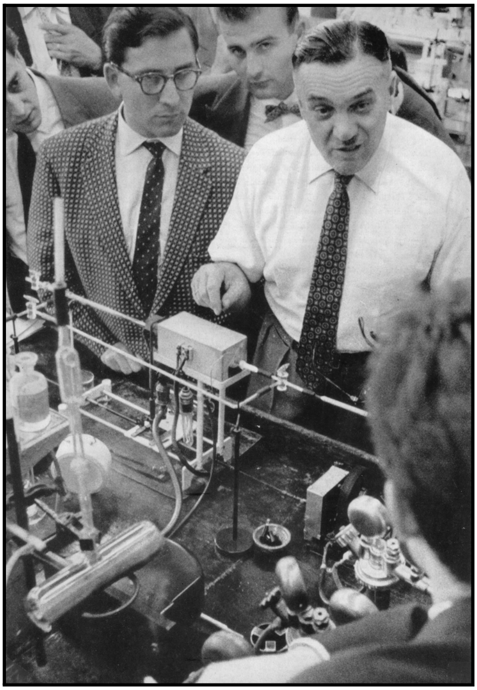


Figure 4.35: Listening to explanations of an expert.

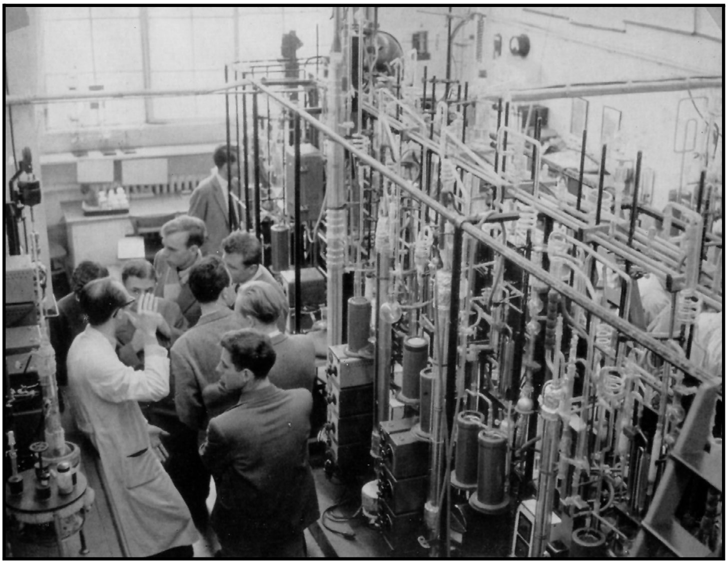


Figure 4.36: Main Laboratory.

Figure 4.37: Main Laboratory.

Figure 4.38: Lunch time.

Figure 4.39: Lunch time.

Figure 4.40: Restaurant personnel.

Teilnehmerverzeichnis

des 18.Studenten-Ferienkurses der BASF Ludwigshafen a.Rh. vom 2.9.bis 27.9.1957

Adolph	Horst	27.11.32	Tübingen-Lustnau, Linsenbergstr.18 Tübingen, Chem.Inst.d.Univ.
Axelsson	Olle	23.3.35	Djursholm (Schweden), Torvägen 12 Stockholm, Kungl.Tekn.Hochschule
de Azevedo Gomes	Alb.	17.12.27	Lissabon (3)(Portugal) R.do Almirante Pessanhan 7 Lissabon (Portugal), Inst.Sup.Tecn.
Becker DCh.	Georg	9.7.32	Münster (Westf.), Cheruskerring 50 Münster (Westf.), Org.-Chem.Inst.d.Univ.
Beecken DCh.	Hermann	23.7.29	Göttingen, Schillerstr. 21/II Göttingen, Org.Chem.Inst. d. Univ.
Behrens	Walter	1.5.31	Braunschweig, Wendemaschstr.11 Braunschweig, Org.-Chem.Inst.d.TH.
Bejar Quinonez	Luis	0.30.9.32	Paris (14), Cité Universitaire, Maison du Mexique Paris, Pharmazeutische Fakultät d.Univ.
Bernhard	Claus	17.7.28	Wehrda, Marburgerstr.111 Marburg, Chem. Inst.d.Univ.
Bork	Karlheinz DCh.	23.4.27	Griesheim bei Darmstadt, Schöneweiberg.32 Darmstadt, Inst.f.Org.Chemie d.TH.
Catalán	Andréu	13.8.27	Madrid (Spanien), Serrano 119 Madrid, Universität
David	Reginald	28.1.33	Lyon, 87, Av. Berthelot Lyon, Ecole Sup. de Chimie industrielle
Delorme	Henri	30.7.35	Lyon, 11 rue Jarente Lyon, Ecole française de Tannerie
Dutto	Mario	6.10.35	Rom (Italien), Via Monte Oliveto 8 Rom (Italien), Chem. Inst.d.Univ.
Gebril Dr.	Bahi	26.1.29	Alexandrien (Ägypten), Universität Faculty of Engineering
Giesler DCh.	Erich	15.4.30	Karlsruhe, Gartenstrasse 64 bei Bauer Karlsruhe, Inst.f.Org.Chemie d.TH.
Gruber DCh.	Josef	17.2.31	München, Fürstenstr. 3/V 1 München, Anorg.Inst.d.TH.
Grüll	Friedrich	5.12.24	Gernsheim, Krs. Gr.Gerau, Schafstrasse 16 Frankfurt a.M., Inst.f.Org.Chemie d.Univ.
Habashi	Fathi	9.10.28	Kairo-Kobba Gardens, Khandak Street 9 (Ägypten) Wien VI, Inst.f.anorg.chem.Technolgie d.TH.
Hammer Dipl.Ing.	Hans	10.12.24	Berlin-Wittenau, Am Kesselpfuhl 71 Berlin-Charlottenburg,Inst.f.Techn.Chm.d.TUniv.
Heydkamp	Wolfgang	22.3.32	Klosterlechfeld b.Augsburg, Haus Nr. 33 München, Inst.f.Org.Chemie d.Univ.
Isler	Paul	1.4.30	Basel (Schweiz),Mariasteinstr.7 Basel (Schweiz), Universität
John	Karl	29.5.31	Ober-Abtsteinach, über Weinheim Heidelberg, Chem.Inst.d.Univ.

Figure 4.41: Names and addresses of participants [page 1 of 3].

Teilnehmerverzeichnis

des 18. Studenten-Ferienkurses der BASF Ludwigshafen a.Rh.vom 2.9. bis 27.9.1957

Jolly	Jean-Pierre	12,11.36	La Roch/Yon (Vendée), 26, rue M.Berthelot Paris, Ecole Nat. Sup.des Mines
Jović	Zoran	3.4.32	Karlovac (Jugoslavien), Šebetićeva 4 Zagreb, Universität
Just	Dieter	29.9.32	Bonn, Wegelerstr. 12 Bonn, Inst.f.physikalische Chemie d.Univ.
Kasperl DCh.	Herbert	3.12.31	Ziegelhausen-Heidelberg, Buchweg 2 Heidelberg, Chemisches Inst.d.Univ.
Klamberg Dr.	Horst	7.11.23	Marburg/Lahn, Weidenhäuserstr. 38 Marburg, Chem.Inst.d.Univ.
Kobi	Vladimir	20.4.31	Ljubljana (Jugoslavien), Šaranovićeva 11 Ljubljana, Technische Hochschule - Chemie
Kroeger	Hanns-Hermann	25.9.26	Hamburg 21, Richardstrasse 52 Hamburg, Chemisches Staatsinstitut
Kuhn	Karl-Dieter	31.3.34	Saarbrücken 3, Neffstr. 7 Saarbrücken, Inst.f.Org.Chemie d.Univ.
Langer	Heimo	17.5.36	Klagenfurt, Heinzgasse 7 Wien, Inst.f.Org.Chemie der TH.
Lefevre	Jean	22.4.25	Paris (18), 12, rue Ramey Paris, Ecole Nat.Sup.de Chimie
Ludwig	Werner	6.6.27	Maikammer (Pfalz), Weinstr. Nord 19 Mainz, Org.Chem.Inst.d.Univ.
Mathew	Thomas	31.10.32	Nedunagapallil House, Puttiocava, Mavelikara Kerala (Indien) Madras (Indien),Universität
Mayr	Kurt	20.9.33	Steyr, Oberösterreich, Gutenberggasse 4 Graz, Universität
Metzger	Karl	2.6.31	Baden, Martinsbergerstr.20 Zürich, Eidgen. Techn. Hochschule
Mohler	Werner	12.1.31	Würzburg, Chemisches Inst.d.Univ.
Müller DCh.	Horst	7.3.29	Freiburg i.Br., Merianstr. 7 Freiburg i.Br., Chem.Labor. d. Univ.
Mussawi Dr.	Mir Hassan	2.8.27	Teheran (Iran), Basar Rubernic Saraiemirsaes-mail Braunschweig, Techn.Hochschule
Natarajan Dr.	Parutiure N.	24.10.29	Madras 4 (Indien), Muthugramani Street 3 Münster (Westf.), Inst.f.Pharmazie und Chemische Technologie d.Univ.
Ongena	Théo	10.4.33	Deurne-Antwerpen(Belgien),26, Van Havrelei Gent (Belgien), Rijksuniversität
Otto DCh.	Hans Werner	2.11.28	Kiel, Klopstockstr. 9/II Kiel, Inst.f.Org.Chemie d. Univ.
Poite	Michel	25.3.35	Laon (Aisne), 21, rue de la Hurée Paris, Ecole Nat. Sup. de Chimie

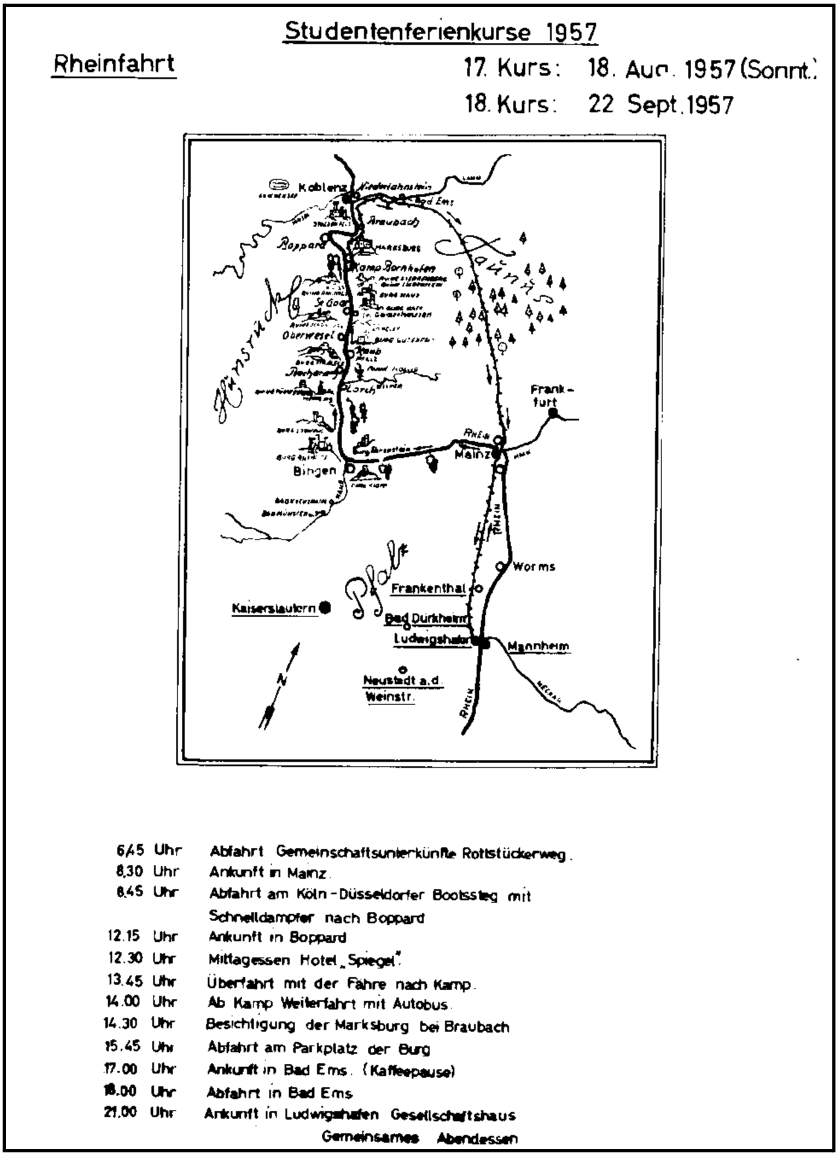
Figure 4.42: Names and addresses of participants [page 2 of 3].

Teilnehmerverzeichnis

des 18. Studenten-Ferienkurses der BASF Ludwigshafen a.Rh. vom 2.9. bis 27.9.1957

Reiss	Wolfgang	17.11.32	Braunschweig, Hagenring 39 Braunschweig, Anorg.Chem.Inst.d.TH.
Rimpler	Manfred	19.11.32	Berlin-Zehlendorf, Hilssteig 25 Berlin-Dahlem, Inst.f.Org.Chemie d. F.Univ.
Robert	Henri	6.10.32	Lyon (5), 41, rue des Macchabées Lyon, Ecole Sup. de Chimie industrielle
Rzepski	Claude	5.10.35	Paris (14), 15, rue Ferrus Paris, Ecole Nat. Sup. de Chimie
Satzinger	DCh. Gerhard	29.6.30	Nürnberg, Amalienstr. 38 Erlangen, Inst.f.Org.Chemie d.Univ.
Scheuerbrandt	Günter	25.4.30	Freiburg i.Br., ~~[illegible]~~ Franz-Eugen-str. 11 Freiburg i.Br., Chem.Labor.d.Univ.
Schiessler	DCh. Siegfried	18.2.31	München, Hochstrasse 4a/I München, Phys.Chem.Inst.der TH.
Schmadel	DCh. Edmund	23.4.31	Darmstadt, Liebfrauenstrasse 90 Darmstadt, Inst.f.Org.Chemie d. TH.
Schmidt	DCh. Werner	8.10.21	Hannover, Pestalozzistr. 12 Hannover, Inst.f. Org.Chemie d.TH.
Schott	Michel	20.8.36	Paris (5), 45 Rue d'Ulm Paris, Ecole Normale Supérieure
Sommer	DCh. Hans A.	17.7.31	Hamburg, Wandsbek, Rantaustrasse 31 Hamburg, Chemisches Staatsinstitut
Steininger	Erwin Franz	16.11.30	Linz (Österreich), Bischofstr.11 Wien, Technische Hochschule
Tinani	Hari K.	26.11.34	Zürich (Schweiz), Scheuchzerstrasse 25 Zürich, Universität
de Tomasi	Marco	16.10.35	Zürich 44, Köllikerstrasse 26 Zürich, Inst. f. Technologie
Traber	Walter	26.11.28	Zürich 4, Kanzleistrasse 57 Zürich, Universität
Vallino	Maurice	20.3.35	Paris, 45 Rue d'Ulm Paris, Ecole Normale Supérieure
Weilenmann	Hans Rudolf	14.10.26	Zürich 11/50, Regensbergstr. 248 Zürich, Universität
Wollenweber	Paul	20.2.29	Zingsheim/Eifel, über Euskirchen I Aachen, Inst.f.Brennstoffchemie der TH.
Zei Dr.	Francesco	9.2.33	Villadossola (Novara), Via Cardezza 3 (Italien) Pavia, Universität, Ist.di Chimica Generale
SUGASAWA	Tsutomu	12.2.26	Tokio Suginami-ku Iogi 3.40 Darmstadt TH.

Figure 4.43: Names and addresses of participants [page 3 of 3].



Studentenferienkurse 1957

Rheinfahrt

17. Kurs: 18. Aug. 1957 (Sonnt.)
18. Kurs: 22 Sept. 1957

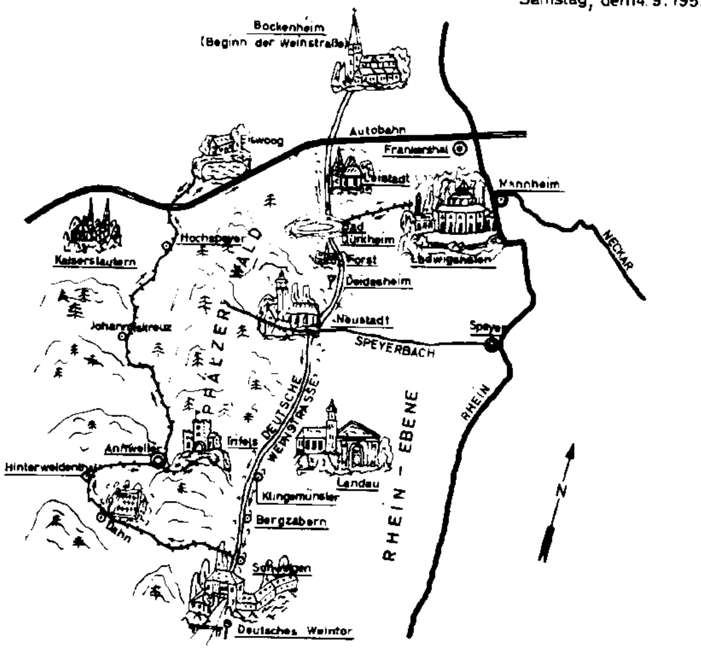
6.45 Uhr	Abfahrt Gemeinschaftsunterkünfte Rottstückerweg.
8.30 Uhr	Ankunft in Mainz
8.45 Uhr	Abfahrt am Köln-Düsseldorfer Bootssteg mit Schnelldampfer nach Boppard
12.15 Uhr	Ankunft in Boppard
12.30 Uhr	Mittagessen Hotel „Spiegel".
13.45 Uhr	Überfahrt mit der Fähre nach Kamp.
14.00 Uhr	Ab Kamp Weiterfahrt mit Autobus.
14.30 Uhr	Besichtigung der Marksburg bei Braubach
15.45 Uhr	Abfahrt am Parkplatz der Burg
17.00 Uhr	Ankunft in Bad Ems. (Kaffeepause)
18.00 Uhr	Abfahrt in Bad Ems
21.00 Uhr	Ankunft in Ludwigshafen Gesellschaftshaus Gemeinsames Abendessen

Figure 4.44: Rhine tour schedule.

18. Studentenferienkurs 1957

Pfalzfahrt

Samstag, den 14. 9. 1957



7.30 Uhr Abfahrt Gemeinschaftsunterkünfte.
9.15 Uhr Ankunft Schweigen/Weintor.
10.00 Uhr Abfahrt nach Dahn.
10.45 Uhr Kriegerfriedhof Dahn oder Burg Alt-Dahn
12.30 Uhr Ankunft Kurhaus Trifels (Mittagessen).
14.00 Uhr Aufstieg zum Trifels (Besichtigung).
15.30 Uhr Abfahrt nach dem Eiswoog.
17.00 Uhr Eiswoog /Kaffepause/Gelegenheit zum Baden.
18.00 Uhr Abfahrt nach Leistadt.
19.00 Uhr - Ankunft in Leistadt (Abendessen).
20.00 Uhr Abfahrt nach Bad Dürkheim.
20.30 Uhr Ankunft in Bad Dürkheim /Wurstmarkt.
22.30 Uhr Abfahrt nach Ludwigshafen.
23.00 Uhr Ankunft Gemeinschaftsunterkünfte.

Figure 4.45: Pfalz tour schedule.

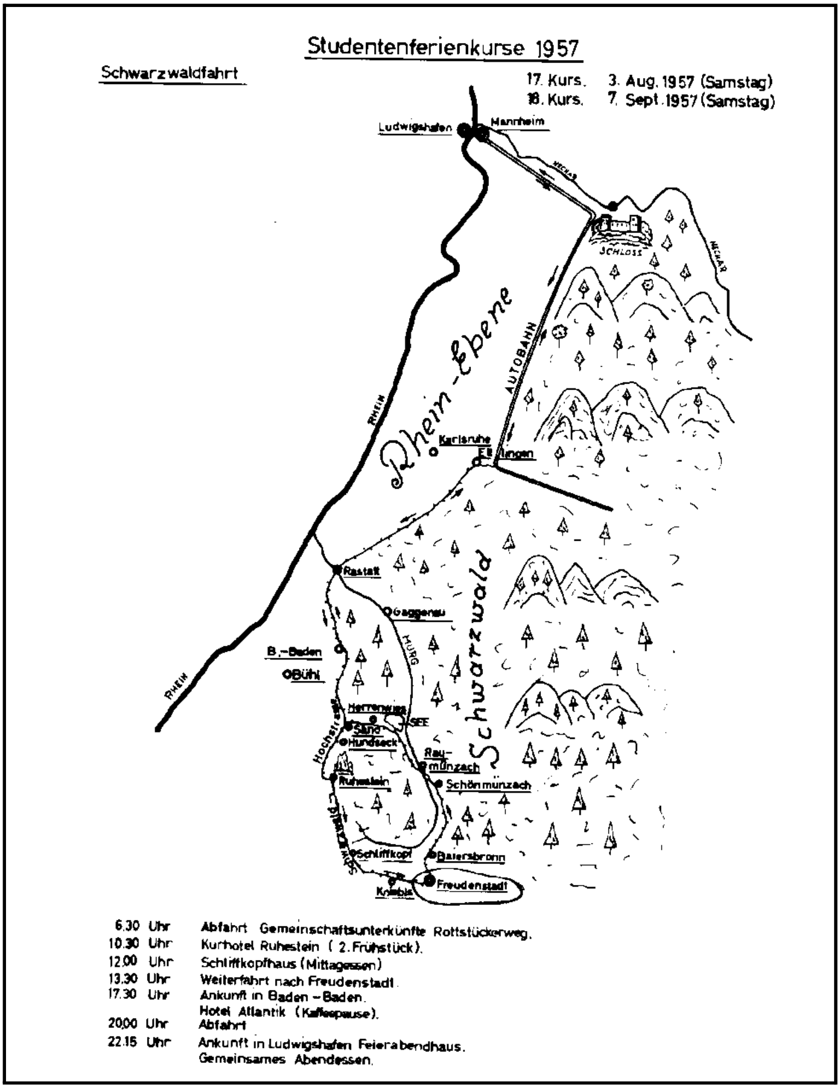


Figure 4.46: Black Forest tour schedule.

Farewell party

At the farewell party German-speaking students sang some songs such as *Gaudeamus igitur*. The text is in Latin and goes back to the 12th century when the first universities were founded in Italy. Johannes Brahms incorporated the melody in his Academic Festival Overture when he received in

1880 an honorary degree from the University of Breslau in Silesia when it was a German Province. After World War II, it was transferred back to Poland and is known as Wrocław, and German citizens were forced to leave.

The beginning of the song in Latin:

Gaudeamus igitur
Iuvenes dum sumus.
Post iucundam iuventutem
Post molestam senectutem
Nos habebit humus.

The complete text in English:

[1] Let us rejoice, therefore,
While we are young.
After a pleasant youth
After a troubling old age
The earth will have us.

[2] [2] Where are they who, before us,
Were in the world?
Go to the heavens
Cross over into hell
If you wish to see them.

[3] Our life is brief
Soon it will end.
Death comes quickly
Snatches us cruelly
To nobody shall it be spared.

[4] Long live the academy!
Long live the professors!
Long live each student;
Long live the whole fraternity;
For ever may they flourish!

[5] Long live all girls,
Easy [and] beautiful!
Long live [mature] women too,
Tender, lovable,
Good, [and] hard-working.

[6] Long live the state as well
And he who rules it!
Long live our city
[And] the charity of benefactors
Which protects us here!

[7] Let sadness perish!
Let haters perish!
Let the devil perish!
And also the opponents of the fraternities
And their mockers, too!

BASF 1987

During my sabbatical of 1987 I visited BASF to get first hand information about the nitric acid process for leaching phosphate rock. Dr. Lothar Diehl, Manager of Nitrophosphate Plant, was present at the Boston Conference on Phosphates organized by the Institut Mondial de Phosphate and he was my host.

HEIDELBERG

Heidelberg on the Neckar is the home of the University of Heidelberg, founded in 1386. It was visited for the first time after the BASF course was finished. A student at the course was my guest.

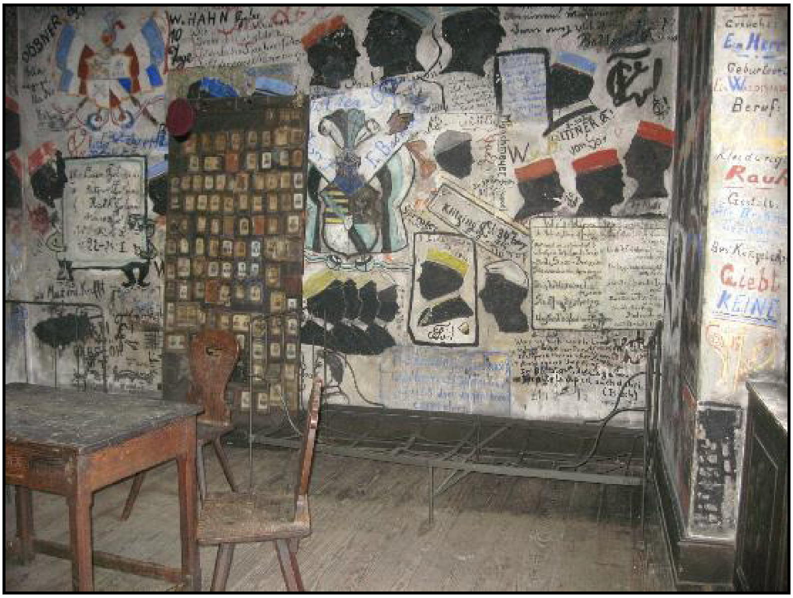


Figure 4.47: Students' prison at the Old University, 1957.

COLOGNE

Cologne, (Figures 4.49–4.51) is Germany's fourth-largest city after Berlin, Hamburg and Munich. It was founded in 50 AD by the Romans and was named *Colonia Claudia Ara Agrippinensium*. It became one of the most important trade centres in the Roman Empire. The *Eau de Cologne* is a spirit-citrus perfume launched in Cologne in 1709 by an Italian perfume maker and was delivered to nearly all royal houses in Europe. In 1806, his grand-grand-nephew opened a perfumery business in Paris. The city is famous for its Cathedral.

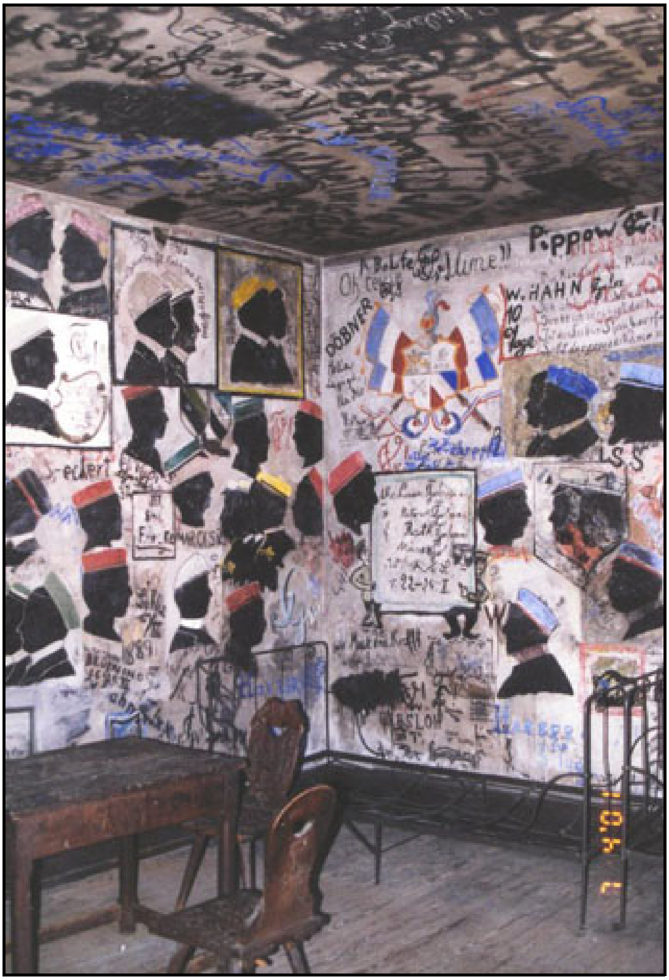


Figure 4.48: Students' prison at the Old University, 1957.

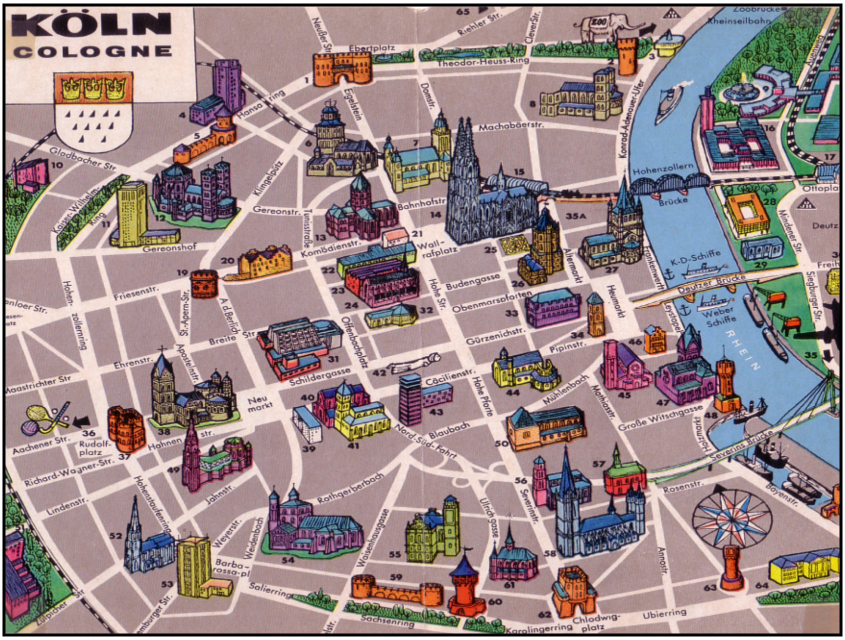


Figure 4.49: Map of Cologne.

Figure 4.50: Cologne and its Cathedral.

Figure 4.51: Old Cologne.

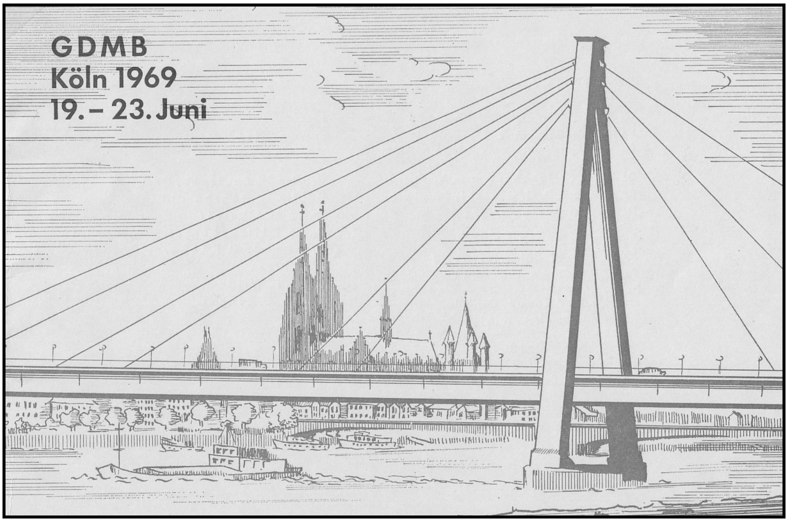


Figure 4.52: Cover of the program of German Mining and Metallurgical Society in June 1969 devoted to hydrometallurgy.

While in Cologne attending the Hydrometallurgy Symposium (Figure 4.52), I arranged a visit to Dr. Ida Noddack at her residence in Bad Neuenahr (Figure 4.53), which can be reached by train from Cologne via Remagen (Figure 4.54). Incidentally, there was a fierce battle at Remagen during the retreat of the German Army at the end of World War II. When Frau Noddack learned about the Rhine excursion organized by the symposium next day she decided to join us (Figure 4.55). The Hydrometallurgy Symposium was organized by Professor Franz Pawlek from Berlin.

Figure 4.53: Retiring home in Bad Neuenahr where I interviewed Frau Ida Noddack in 1969.

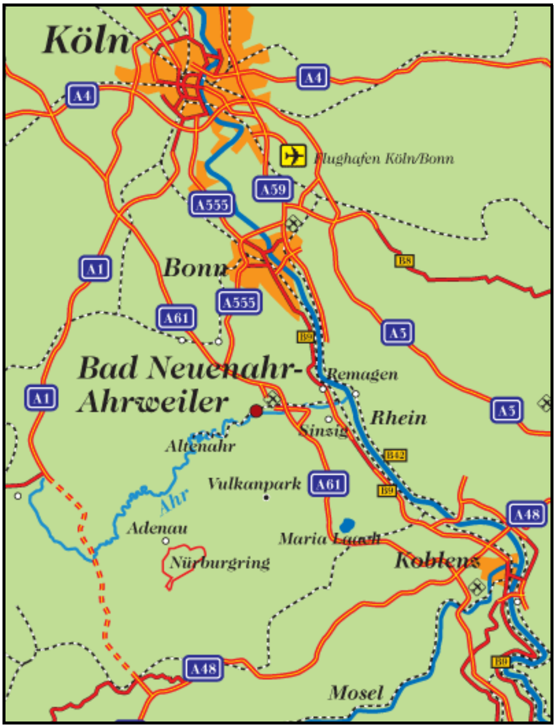


Figure 4.54: Reaching Bad Neuenahr from Cologne via Remagen.

Figure 4.55: The former Director of Research at Duisburger Kupferhütte in conversation with Frau Ida Noddack during the Rhine excursion. Photo by Fathi Habashi, 1969.

DUISBURG

Duisburg is a large port on the River Rhine located in the western part of the Ruhr Area and a centre for the steel industry.

Duisburger Kupferhütte

In 1876, the Duisburger Kupferhütte (Figures 4.56–4.58) was founded to purchase the pyrite required for the sulfuric acid manufacture and to treat the residues of the oxidation of pyrite at Duisburg for the recovery of copper and other nonferrous metals as well as reducing the purified iron oxide to make iron. The operation proved to be very successful and contributed extensively to extractive metallurgy. A visit to the plant was organized during the German Mining and Metallurgical Society hydrometallurgy conference in Cologne in 1969. Director of the plant was Dr. Hermann Schackman.

Figure 4.56: Entrance to Duisburger Kupferhütte plant in Duisburg.

Figure 4.57: Duisburger Kupferhütte plant to process pyrite cinder.

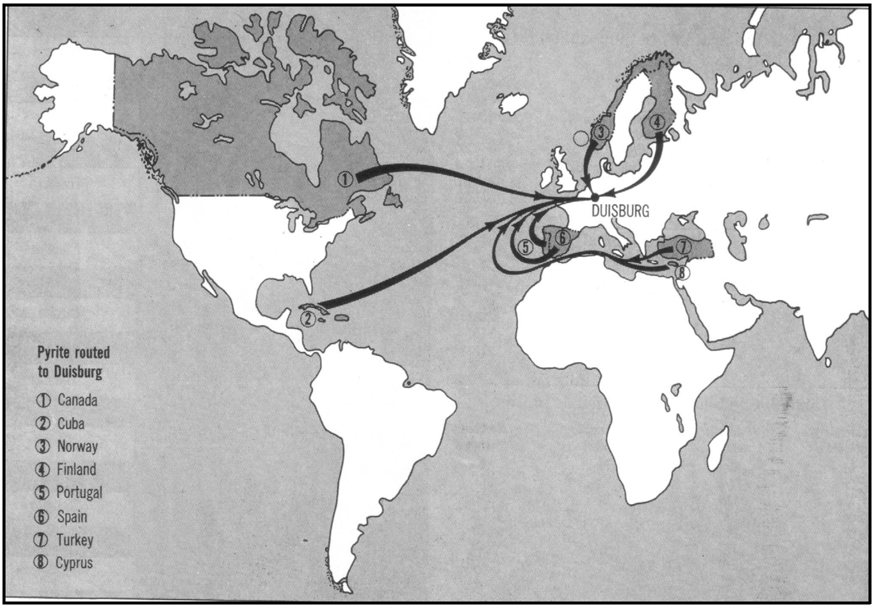


Figure 4.58: Importing pyrite from world wide suppliers to Duisburger Kupferhütte plant.

In this plant, pyrite was imported from all over the world by the company, sold to acid manufacturers in Germany on the agreement that the iron oxide resulting from roasting is shipped back to Duisburg for treatment to recover nonferrous metals, precious metals, and metallic iron. The pyrite cinder was mixed with NaCl and heated continuously in a multiple hearth furnace at 800 °C to transform nonferrous metals into water-soluble chlorides. Each batch requires about 2 days for leaching in vats (Figure 4.59).

Copper was precipitated from solution in two steps:

$$Cu + CuCl_2 \rightarrow Cu_2Cl_{2(ppt)}$$

$$Cu^{2+} + Fe \rightarrow Cu + Fe^{2+}$$

Copper for the first step was obtained from the second step. Cuprous chloride recovered is then treated with calcium hydroxide to precipitate copper(I) oxide which was reduced with coal in a furnace to black copper:

$$Cu_2Cl_2 + Ca(OH)_2 \rightarrow Cu_2O + CaCl_2 + H_2O$$

$$2Cu_2O + C \rightarrow 4Cu + CO_2$$

The black copper was cast into anodes and refined electrolytically; the precious metals were collected in the anodic slimes. The solution obtained after cementation is evaporated under vacuum to recover $Na_2SO_4 \cdot 10H_2O$.

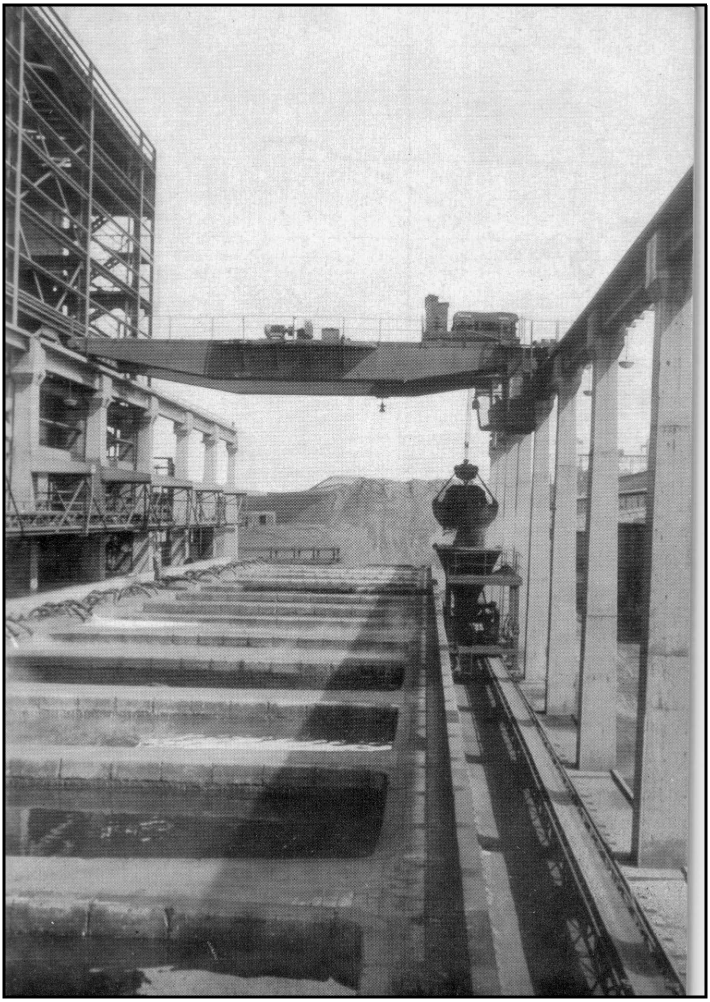


Figure 4.59: Vat leaching of roasted pyrite cinder.

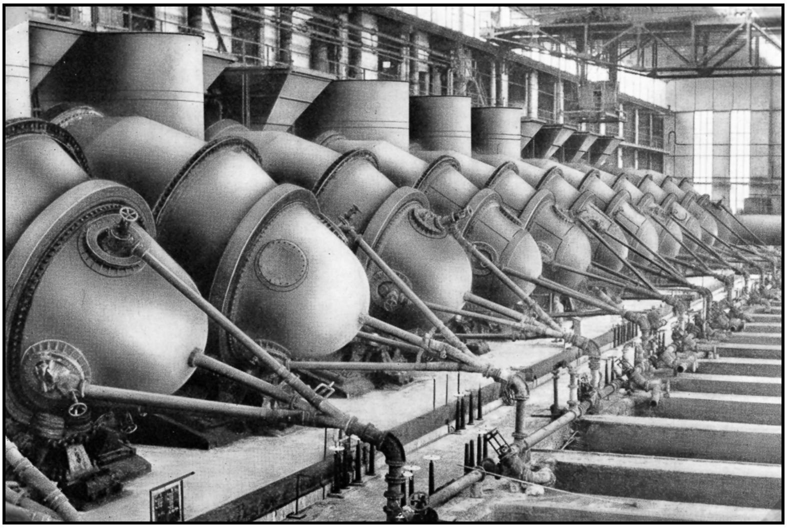


Figure 4.60: Cementation plant to recover copper using scrap iron.

Table 4.1: Data on Duisburger Kupferhütte plant.

- Imported 3 million tonnes of pyrite annually
- Processed 2 million tonnes of cinder
- Consumed 200 000 tonnes NaCl
- Employed 4 100 people
- Produced annually:
  - 1.2 million tonnes pig iron
  - 6 000 tonnes Pb
  - 24 000 tonnes Cu
  - 60 000 tonnes Zn
  - 50 tonnes Ag
  - 70 tonnes Cd
  - 10 tonnes Tl
  - Minor amounts of Co, Au, In, Pt
  - 170 000 tonnes sodium sulfate

The residue, called "purple ore," now a high-grade iron ore (61–63% Fe), is sintered and delivered to the blast furnace. Since lead and silver form chlorides during roasting which are insoluble in the leaching step, they remained in the purple ore. When the sintered purple ore was charged in the blast furnace, lead–silver alloy is formed. Being insoluble in iron and has a higher density it settles at the bottom of the hearth. The furnace was provided with an opening below the iron notch to tap the lead–silver alloy once a week (Figure 4.61). Data on plant production is given in Table 4.1.

The firm had an excellent research laboratory staffed by a large number of highly skilled chemists and engineers who were capable to devise successfully such a complex process (Figure 4.62).

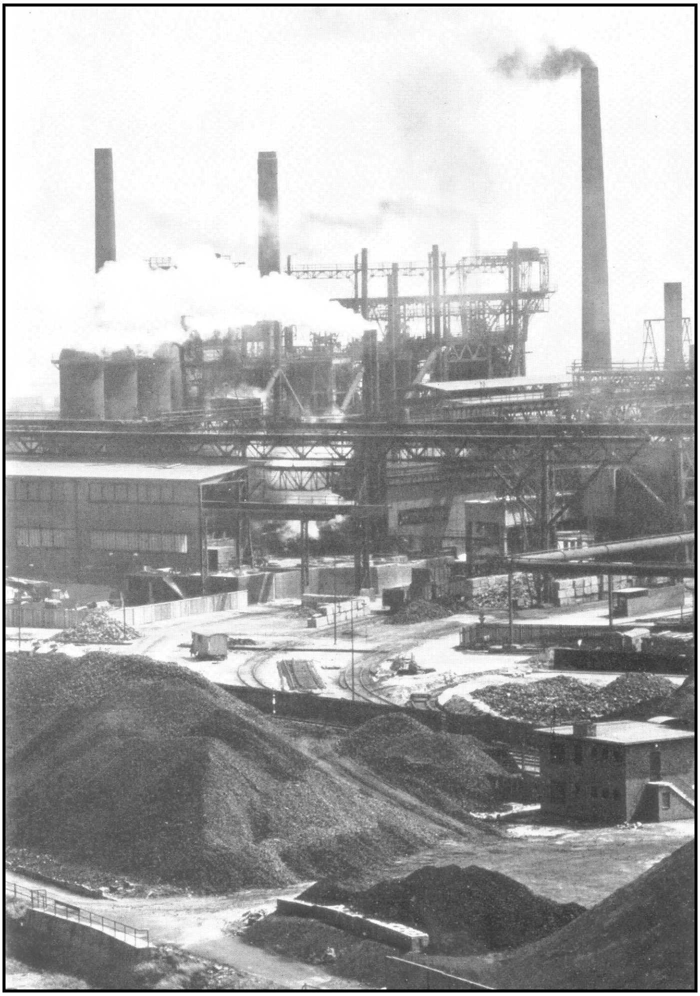


Figure 4.61: Blast furnace plant producing pig iron and lead–silver alloy.

Figure 4.62: Research Laboratory at Duisburger Kupferhütte.

The operations were discontinued when elemental sulfur became widely available and it replaced pyrite as a source for sulfuric acid manufacture. Elemental sulfur was mainly obtained as a by-product of petroleum refining.

DÜSSELDORF

Düsseldorf is a financial centre on the Rhine. There is a monument to one of its famous rulers, Johann Wilhelm II (1690–1716) (Figure 4.63).

McGraw-Hill International

A meeting was held with the editor regarding the manuscript for my book *Chalcopyrite — Its Chemistry and Metallurgy* which was published in 1978 (Figure 4.64).

Max Planck Institut für Eisenforschung

The Max Planck Institute for Iron Research was founded in 1917 and is one of the numerous research institutes founded by the Max Planck Society previously as Kaiser Wilhelm Institute. It is mainly financed by the Government of the German Federal Republic. Its first director was Fritz Wüst after whom the iron oxide phase wüstite is named. Its present director is Prof. H. J. Engell, a physical chemist known for his book *The Reduction of Iron Ores.*

Figure 4.63: Johann Wilhelm II (1690–1716).

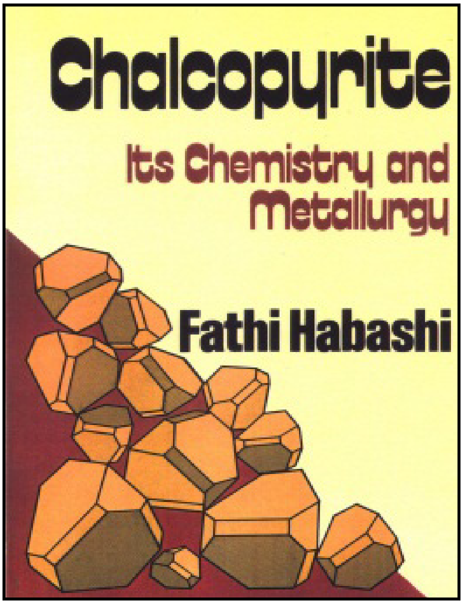


Figure 4.64: Publisher: McGraw-Hill International.

The Institute is organized in six departments:

- Physical Metallurgy & Materials Science
- Metal Working
- Metal Physics
- Refractories & Ceramics
- Physical Chemistry
- Chemical Metallurgy

I visited the Chemical Metallurgy Department. The laboratories are very well equipped and the researchers seem to be alert and highly skilled. Total staff members are 250, budget about 14 million DM [1977]. In cooperation with the Verein Deutscher Eisenhüttenleute, the Institute publishes two journals *Stahl und Eisen*, and *Archiv für das Eisenhüttenwesen*. Düsseldorf is an important centre for iron and steelmaking. It is the seat of August Thyssen plants, the Vereins Deutscher Eisenhüttenleute, Verlag Stahleisen, and others.

BOCHUM

Bochum is in the Ruhr District which was one of the world's densest and most important industrial concentrations. It is in the neighbourhood of Essen and Dortmund. Its huge anthracite basin provided coal for its own heavy industries (steel, machinery, and chemicals) and for the industries of other countries. It is the home of the Mining Museum

Figure 4.65: Mining Museum.

Bergbau Museum

This is the largest museum in the world devoted exclusively to mining (Figures 4.65–4.67). It was founded in 1928. Its director in 1977 was Dr. W. Kroker and a co-worker Dr. Andreas Hauptmann. In the past few years a group of archaeologists from this museum made interesting discoveries related to copper mining and smelting by the Ancient Egyptians in the Timma Valley in the Sinai Peninsula. The Museum includes a Library and an important documentation centre for the mineral industry. Bochum is the seat of Friedrich Krupp steel plants.

Figure 4.66: Entrance to Mining Museum.

Figure 4.67: Inside Mining Museum.

Chapter 5

German Democratic Republic

First contact with scientists from the German Democratic Republic was at the International Congress on Phosphorus Chemistry organized by the *Institut Mondial du Phosphate* and held in Boston, Massachusetts in 1980. The conference was devoted to minor elements in phosphate rock: uranium, rare earths, and fluorine. Dr. Helfried Richter from the Agrochemical Kombinat in Piesteritz was among the participants, and was known by his work on the recovery of lanthanides from phosphate rock. He organized my visit to the German Democratic Republic.

Entry to the German Democratic Republic was not easy if a visa was not obtained in advance. There was no diplomatic mission of GDR in Ottawa; the East German Ambassador in Washington is in charge of Canadian affairs. Similarly, there was no Canadian diplomatic mission in East Berlin; the Canadian ambassador in Warsaw was in charge of East German affairs. It was not possible to get a visa from the GDR consular mission in Sofia where I was spending three weeks on a study mission because this would require an approval from Berlin and this would take three weeks. Although the host in GDR Dr. Richter requested a Business Visa at the entry point of East Berlin, yet for some bureaucratic reason no such permission was deposited.

As a result on arrival at the East Berlin Airport in Schönefeld it was not possible to get permission to stay in East Berlin even though an intensive effort was made to convince the authorities of the business nature of my mission. It was only possible to get a transit visa to West Berlin and from there re-enter back to East Berlin by a one-day visa obtained at the border. My wife and I were asked to take a special taxi to Checkpoint Charlie in West Berlin and apply there at the border to enter East Berlin (Figures 5.1–5.4).

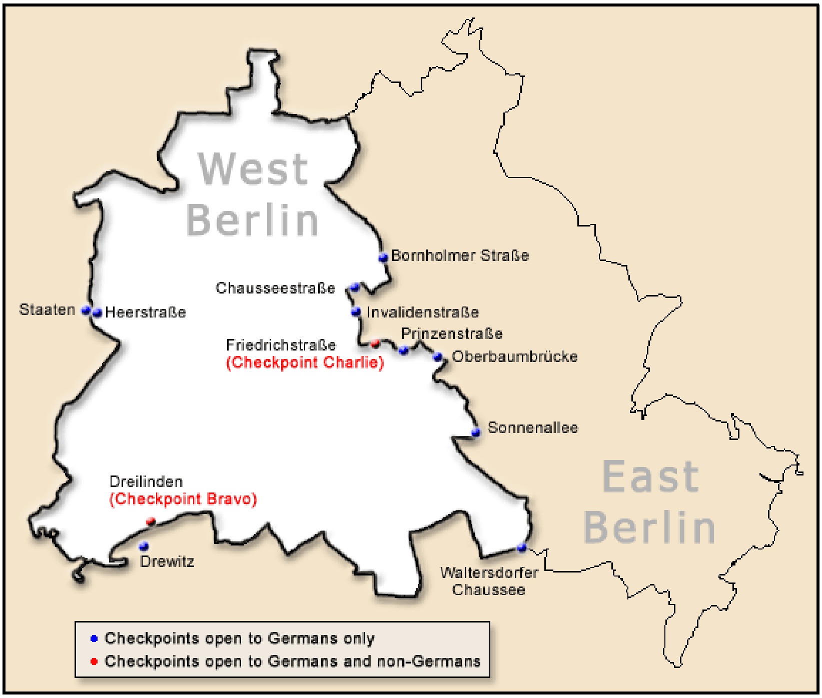


Figure 5.1: Checkpoint Charlie.

The trip was not easy and uncomfortable in such a deserted area. My wife and I had to drag our suite cases on a dirt road where the taxi left us. Finally, we entered East Berlin and were assigned a certain expensive hotel where we spent the night then next morning took the train to Leipzig. Incidentally, it was November 8 and our hotel was near the Ministry of Foreign Affairs where many black limousines were parking outside because of the celebrations of the anniversary of the Russian Revolution. On the way to the train station we passed through Kopenick District and this recalled to me the comedy of *Der Hauptmann von Kopenick*. My host Dr. Richter was able to secure later a two-day business visa for my stay. This permitted me to visit Piesteritz, Leipzig, and Freiberg in all hurry.

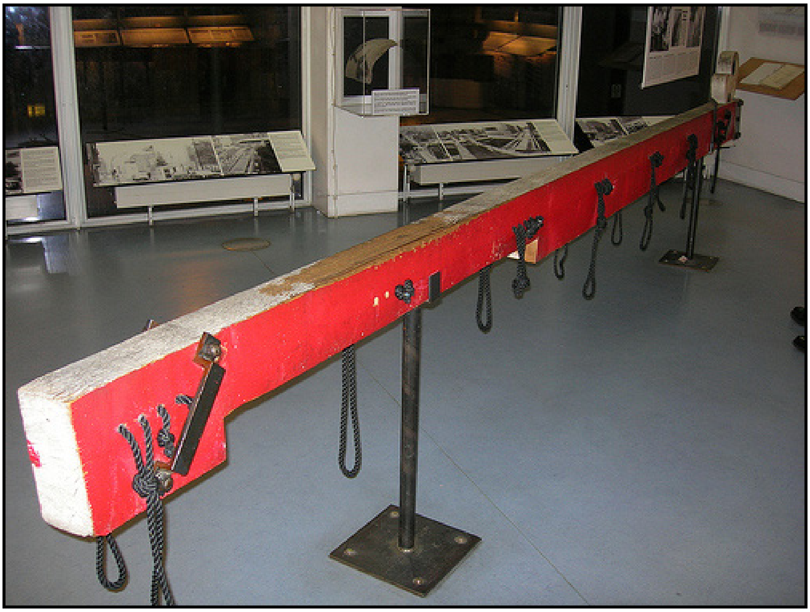


Figure 5.2: Checkpoint Charlie, 1987.

Figure 5.3: Checkpoint Charlie, 1987.

Figure 5.4: Checkpoint Charlie, 1987.

LEIPZIG

Leipzig is the largest city in Saxony and an important historical and trade centre. It was one of the major European centres of learning and culture in fields such as music and publishing. The Leipzig Trade Fair, started in the Middle Ages, became an event of international importance. The City Hall is an impressive building (Figure 5.5). The German National Library was founded in Leipzig in 1912.

The foundation of the University of Leipzig in 1409 initiated the city's development into a centre of German law and a location of the Reichsgericht (Supreme Court) (Figure 5.6) where the Bulgarian Georgi Dimitroff (1882–1949) head of Comintern operations in Western Europe and his collaborators, accused of burning the Reichstag on February 27, 1933, was tried. The fire took place shortly after Adolf Hilter became Chancellor in January of the same year. The day after the fire, Hitler asked for and received from President Hindenburg the Reichstag Fire Decree, signed into law thus suspending most civil liberties in Germany and was used to ban publications not considered friendly to the Nazi cause.

Figure 5.5: City Hall.

Figure 5.6: Reichsgericht.

Figure 5.7: Gottfried Wilhelm Leibniz (1646–1716).

The philosopher and mathematician Gottfried Wilhelm Leibniz (1646–1716) (Figure 5.7) was born in Leipzig, and attended the university from 1661 to 1666. Johann Sebastian Bach (1685–1750) (Figure 5.8), Felix Mendelssohn (1809–1847) (Figure 5.9), and Richard Wagner (1813–1883), lived there.

Napoleon met his defeat in 1813 in the Battle of Nations when he fought against German, Austrian, and Russian armies one year after the disastrous Russian campaign of 1812 and one year before his exile to Elba. The huge monument (Figure 5.10) to the 120 000 killed in this battle is a symbol of Leipzig.

A distinguished professor at the Chemistry Department of the University of Leipzig was Wilhelm Ostwald (1853–1932) (Figure 5.11), Nobel Prize winner in 1909 for his work on the catalytic oxidation of ammonia, and founder of physical chemistry (with Van't Hoff).

Figure 5.8: Johann Sebastian Bach (1685–1750).

Figure 5.9: Felix Mendelssohn (1809–1847).

Karl Marx University

The University of Leipzig was called the Karl Marx University between 1953 and 1991. Host: Prof. Gerhardt Werner, Head of Analytical Chemistry Department was a school mate of Dr. Richter. At his invitation, I gave a seminar in German about recent advances in extractive metallurgy on November 11, 1987.

Figure 5.10: Monument to the Battle of Nations.

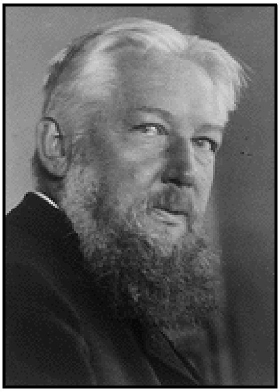


Figure 5.11: Wilhelm Ostwald (1853–1932).

LUTHERSTADT WITTENBERG

Wittenberg (Figures 5.12–5.13) is a small medieval town on the River Elbe takes honour in being “Lutherstadt” since Martin Luther spent most of his life there; he was born in Eisleben and is buried there. It is half way between Berlin and Leipzig. At my visit in 1987, the only hotel available was a two-star hotel! Luther House is now a museum (Figure 5.14).

Figure 5.12: Wittenberg Main Square.

Figure 5.13: View of Wittenberg.

The Castle Church boasts the famous theses door (Figure 5.15) and the graves of Luther and Philipp Melanchthon (1497–1560).

Figure 5.14: Door of the Castle Church where Luther nailed his thesis.

Martin Luther (1483–1546) (Figure 5.16) was a German monk, priest, professor of theology at the University of Wittenberg and main figure of the Protestant Reformation. He strongly disputed the claim that salvation could be purchased with money. He confronted indulgence salesman Johann Tetzel with his *Ninety-Five Theses* in 1517. His refusal to retract his writings at the demand of Pope Leo X in 1520 and the Holy Roman Emperor Charles V at the Diet of Worms in 1521 resulted in his excommunication by the pope and condemnation as an outlaw by the Emperor. It also made it a crime for anyone in Germany to give Luther food or shelter. It permitted anyone to kill Luther without legal consequence.

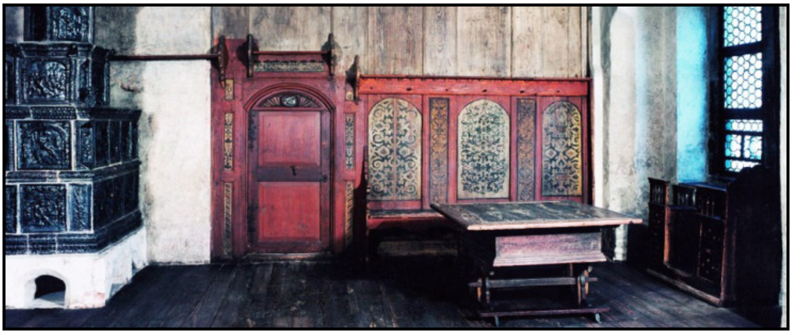


Figure 5.15: One of the rooms in Luther House.

Figure 5.16: Martin Luther monument.

Frederick III, Elector of Saxony, had him intercepted on his way home and escorted to the security of the Wartburg Castle at Eisenach. During his stay at Wartburg, Luther translated the New Testament from Greek into German. The reforms provoked disturbances. A band of monks arrived Wittenberg preaching revolutionary doctrines such as the equality of man.

This helped the uprising of the German Peasants' War of 1524–1525, during which many atrocities were committed. There was widespread burning of convents, monasteries, bishops' palaces, and libraries. Luther sympathized with some of the peasants' grievances, but reminded them to obey the temporal authorities. He condemned the violence and called for the nobles to put down the rebels.

Luther's translation of the Bible made it more accessible, causing a tremendous impact on the Church and on German culture. His marriage to Katharina von Bora set a model for the practice of clerical marriage, allowing Protestant priests to marry. In his later years, while suffering deteriorating health, he became anti-semitic, writing that Jewish homes should be destroyed, their synagogues burned, and their money confiscated.

Philipp Melanchthon (1497–1560) (Figure 5.17), was a German reformer, Professor of Theology at the University of Wittenberg, collaborator with Martin Luther and stands next to Luther and Calvin as a reformer and theologian of Protestantism.

Figure 5.17: Philipp Melanchthon monument.

AGROCHEMIE PIESTERITZ

Piesteritz is an important industrial centre near Wittenberg. The plant obtains natural gas by a pipeline from Siberia. The basic production units are: ammonia, nitric acid, elemental phosphorus, and calcium carbide. The major products are: fertilizers, detergents, and polymers based on calcium cyanamide. The plant had 8 300 workers.

Half way between Wittenberg and Leipzig is another chemical complex at Bitterfeld. It is similar to the Piesteritz plant with the additional sulfuric acid manufacture, phosphoric acid, and cement by the Müller–Kühne Process. A third chemical complex is at Leuna about 40 km west of Leipzig. The Japanese built a large ammonia unit at Piesteritz using US technology (Kellogg design). A meeting was held with Dr. Helfried Richter, Dr. Albert Krause, and Dr. Kietmar Zobel but no plant visit was permitted.

FREIBERG

The geographic region of Saxony has undergone great changes in boundaries and political status during the past centuries. It was a Duchy in the Carolingian Empire, raised to an Electorate in the Holy Roman Empire of the German Nation, became a Kingdom with Dresden as its capital, then Province in the Kingdom of Prussia with Magdeburg as its capital, and finally the State of Saxony after 1918 when it joined the Weimar Republic and Dresden became again capital. Silver was discovered in 1470 at Schneeberg which lies in the hills south of Zwickau. As a result, Zwickau became a prosperous town. In the early 19th century, coal mining added to its prosperity.

School of Mines

Freiberg is half way between Karl-Marx-Stadt (formerly Chemnitz) and Dresden. There is no direct train connection between Leipzig and Freiberg; one must change in Dresden or take train to Nossen then a bus to Freiberg. The region is famous of the porcelain manufactured at Meissen, the medieval mining and metallurgical works in the Erzgebirge, and the first School of Mines (founded 1765). Among its notable metallurgy and chemistry professors were Christlieb Gellert (1713–1795), Wilhelm Lampadius (1772–1842), Ferdinand Reich (1799–1882), Clemens Winkler (1838–1904) the discoverer of germanium, and Karl Ledebur (1837–1906).

Due to the absence of Prof. Klaus Hein, my host was his assistant Dozent Dr. Heinz-Jürgen Lange (Prof. A. Lange's son, known for his work on tin). Freiberg has one of the best mining museums in the world with an important collection of minerals. Freiberg was visited again after unification of Germany.

Chapter 6

Unified Germany

AACHEN

Aachen (Figures 6.2–6.7) is the capital of Westphalia region which forms part of the industrial Ruhr district and the great Westphalia coal basin. It was known during Roman times because of the many hot springs (Figure 6.8). This was one of the reasons why Charlemagne chose it as capital of the Holy Roman Empire. After the congress of Vienna in 1815 most of Westphalia became a province of Prussia. There is no airport in Aachen. It can be reached from Cologne Airport by bus or train or by bus from Maastricht Airport.

Figure 6.1: Germany today, provinces and major cities.

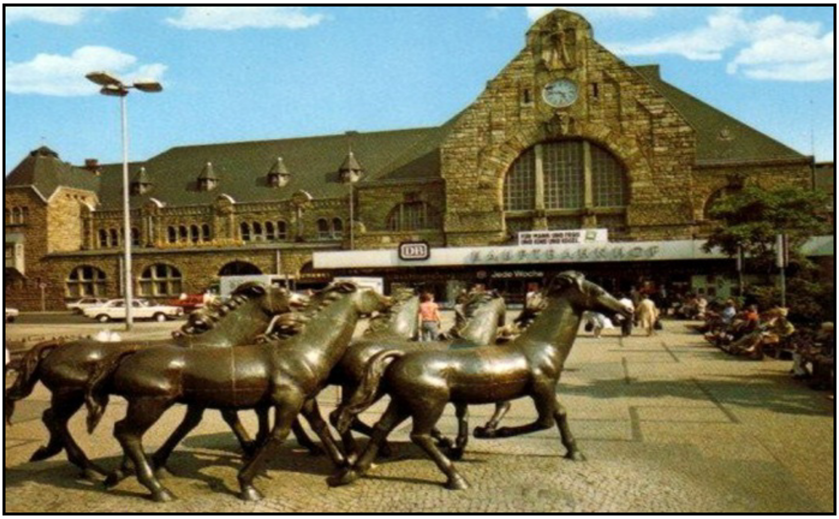


Figure 6.2: Aachen Railway Station.

Figure 6.3: Aachen Cathedral.

Figure 6.4: Charlemagne's throne in the Palatine Chapel.

Figure 6.5: City Hall.

Figure 6.6: Monument to Charlemagne in front of the City Hall.

Technische Hochschule Aachen

On February 4, 1858 the Prussian Crown Prince Friedrich Wilhelm, together with Princess Victoria and her husband who had just married in London, arrived in Aachen where they were greeted at the Town Hall by Lord Mayor and a delegation from the towns of the Rhineland. The Mayor presented the Crown Prince with 5 000 Taler to be used for charitable purposes. The Prince accepted the money and decided that it should be used as basis for erecting a polytechnic college in the Rhine province.

A School of Mines was planned in Aachen in 1864 by the Prussian Ministry of Commerce. However, in 1870 the Ministry of Education created a Technische Hochschule (Figure 6.9) with three specializations: civil engineering, mechanical engineering, and chemical technology, and smelting. In 1880 mining was added to chemical technology and smelting in a new department to be named Department of Mining, Smelting, and Chemistry. Because of the important brown coal deposits in the region the school was successful and in 1897 it received a new building that it occupies today.

Figure 6.7: Part of the old city wall.

Figure 6.8: Hot springs in Aachen.

Figure 6.9: Technische Hochschule Aachen.

The Department of Mineral beneficiation, Coke Production, and Briquetting (*Institut für Aufbereitung, Kokerei und Brikettierung*) is headed by Prof. Heinz Hoberg (Figure 6.10), assisted by numerous coworkers, to mention a few: Dr. Schneider, Dipl. Ing. Jörg Julius, Dipl. Ing. Jost Götte, Dipl.

Ing. Andreas Jungmann, Dipl. Ing. Gorny, Dipl. Phys. Kornelia Schepe, and others. Among the problems studied:

- Separation of solid waste (metal, glass, paper, plastics.
- Beneficiation of brown coal (large deposits in the Ruhr Districts near Aachen).
- Mechanical activation by grinding applied to niobium–tantalum and tin ores.

The Department has important projects with Bolivia. Incidentally my visit coincided with the visit of Prof. Eberhard Heidenreich from the Technical University of Dresden, German Democratic Republic.

Figure 6.10: Professor Heinz Hoberg in Quebec City, 1982.

The Institut für Metallhüttenwesen und Elektrometallurgie is headed by Prof. Joachim Krüger (Figure 6.11), successor to Prof. Helmut Winterhager who retired few years ago. This is one of the largest departments in the world dealing with pyrometallurgy and electric furnaces. It includes 9 candidates for doctorate, 4 engineers, 17 technicians, and 40 students. The administrative task is taken over completely by Dr. Ing. Klaus-Werner Krone (official title Chief Engineer).

Speciality of the Department is high vacuum and high temperature technology, e.g., refining of iron scrap by melting at 1 700 °C under high vacuum so that copper and tin are volatilized and recovered, similarly removal of zinc from copper. Pilot plant under study: chlorination of TiO_2

in a fluidized bed in a plasma system. Other projects: titanium powder by the hydride process, selective reduction of zinc ferrite in a rotary kiln followed by leaching in dilute H_2SO_4. Specially equipped laboratories for gas analysis, mass spectrometry, X-rays, etc.

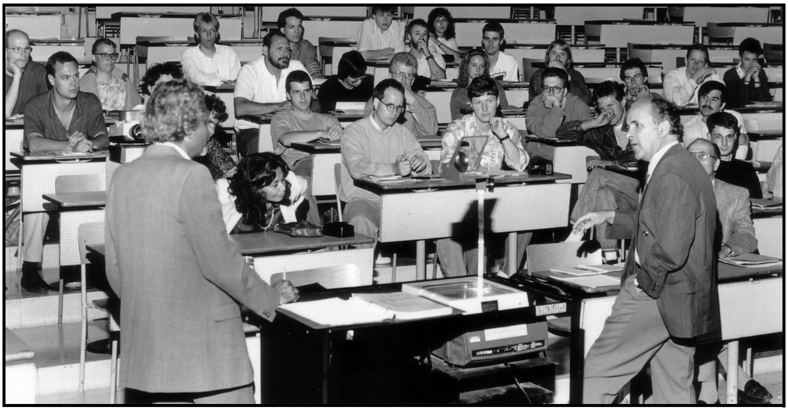


Figure 6.11: Professor Joachim Krüger [standing right] and his students during a visit Laval University in 1991.

Figure 6.12: Members of IMPC Council 1993. From left: Paolo Massacci [Rome], Eric Forssberg [Stockholm], John Herbst [Salt Lake City], Roberto Villas Bôas [Rio de Janeiro].

Institut für Eisenhüttenwesen

A short visit was made to Prof. Tarek Al-Gammal (of Egyptian origin) specialist in iron and steelmaking.

International Mineral Processing Congress

IMPC was held in Aachen in 1993 and hosted by Prof. Heinz Hoberg of the Technische Hochschule (Figures 6.12–6.20).

Figure 6.13: Photo by Nadia Habashi, 1997.

Figure 6.14: Turkish delegation at IMPC.

Figure 6.15: Delegates at the Congress.

Figure 6.16: Professor and Frau Hoberg.

Figure 6.17: Prof. Zeki Dogan [2nd from left], Prof. and Mrs. Güven Önal from İstanbul Technical University.

Figure 6.18: Polish delegation. From right, Halina Mulak.

Figure 6.19: Kazakh delegation. From left: Vladimir Studensov, Abier Omarov.

Figure 6.20: From left: Hans Grybek [Essen], Fernando Lins [Rio de Janeiro], Tom Meloy [USA].

HEIDELBERG

Heidelberg on the Nekar is a former residence of the Electorate of the Palatinate and is the home of the University of Heidelberg. Heidelberg castle and its neighbouring settlement were taken over by the house of Hohenstaufen. Conrad of Hohenstaufen became Count Palatine of the Rhine (German: Pfalzgraf bei Rhein). In 1225, Ludwig I, Duke of Bavaria obtained the Palatinate, and thus the castle came under his control. In 1386, the University of Heidelberg was founded by Rupert I, Elector Palatine. Heidelberg's library, founded in 1421, is the oldest public library in Germany.

Figure 6.21: Heidelberg on the Neckar and the castle on the top of the hill.

Figure 6.22: Heidelberg bridge, 2009.

Figure 6.23: Entrance to Heidelberg bridge.

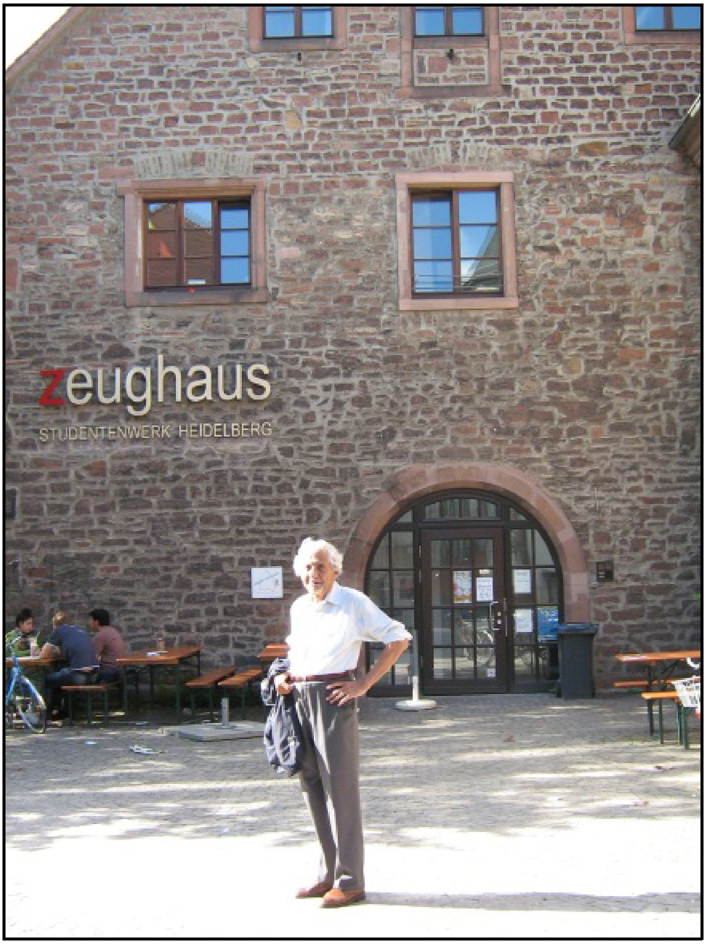


Figure 6.24: Prison for university students.

Figure 6.25: In Hauptstraße, 2009.

Figure 6.26: Karl Gottfried Nadler (1809–1849).Heidelberg poet and lawyer, assassinated at the young age of 40 because of his political views. Photo by Nadia Habashi, 2009.

Figure 6.27: Old City Gate. Photo by Nadia Habashi, 2009.

Bunsen and Kirchhoff

Robert Bunsen (1811–1899) was born in Göttingen and studied chemistry at its University, graduating in 1831. After teaching in Marburg and Breslau (now Wrocław in Poland), he settled down in Heidelberg to succeed Leopold Gmelin. Together with Gustav Kirchhoff (1824–1887) (Figure 6.28) he developed the spectroscope in 1858 (Figure 6.29), which they used to discover two metals: cesium in 1860 in the mineral water of Durkheim, and rubidium in 1861 in the mineral carnallite from Saxony. Bunsen, also known for the burner he invented, received many medals and awards. A plaque on the wall of the building in Main Street [Hauptstraße] where spectral analysis was discovered (Figure 6.30).

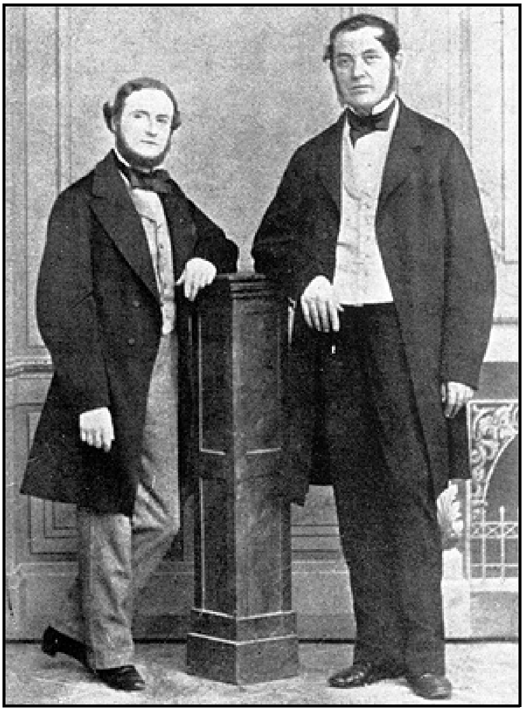


Figure 6.28: Gustav Kirchhoff (right) and Robert Bunsen.

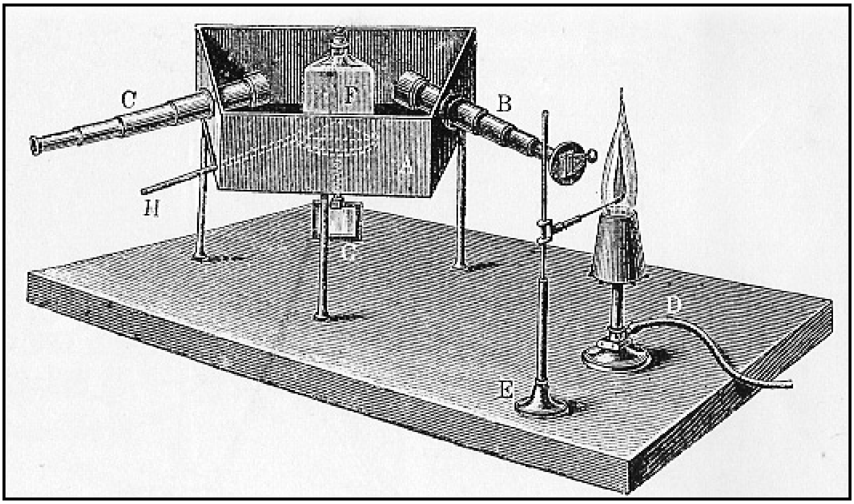


Figure 6.29: The first spectroscope developed by Bunsen and Kirchhoff.

Gustav Kirchhoff was born in Königsberg, East Prussia [now Kaliningrad in Russia], and graduated from the University of Königsberg in 1847. He moved to Berlin, then Breslau, then Heidelberg in 1854. In 1875 he went back to Berlin.

Figure 6.30: A plaque on a building in Hauptstraße where Kirchhoff discovered with Bunsen spectral analysis.

Figure 6.31: Robert Bunsen facing the building where spectral analysis was discovered in Heidelberg Hauptstraße.

Figure 6.32: Robert Bunsen monument. Photo by Nadia Habashi, 2009.

Carl Bosch Museum

Carl Bosch Museum was inaugurated in May, 1998. It is located on the mountain near the castle in a villa built by BASF as a residence for its Chief Executive Officer (Figures 6.34–6.35). The museum shows the most interesting highlights of the life of Bosch. The display covers IG Farben's role during the Third Reich and the development of high-pressure technology from its beginnings in the laboratory to the creation of gigantic industrial complexes.

Figure 6.33: Monument to rubidium at Bunsen monument. Photo by Nadia Habashi, 2009.

The Museum portrays both Bosch's private life and his professional career. Even as a boy he gained some technical experience in his father's plumbing workshop. Because of his studies in mechanical engineering he was rather skilled in being a process technician. Another section is dedicated to Bosch's activities as founder of the ammonia synthesis plants at Oppau and at Leuna–Merseburg. The original incentive for ammonia synthesis was the enhancement of crop yields, but this changed during World War I.

Additional features in the Museum include the knowledge of materials, safety standards at work, a competent process control, and the advent of a new profession: the chemical technician. The "high-pressure workshop," equipped with a lathe, tools, fittings, and high-pressure pipes, illustrates the new dimension an industrial technician was confronted with in those days.

The construction and manipulation of high-pressure reactors required new empirical and theoretical knowledge, as well as new approaches to education and training. The construction of the most important elements of an ammonia producing plant, like the inner part of the reactor, the ammonia separator, and the mole-pump gives the visitor an impressive idea of this new industrial technology.

Figure 6.34: Carl Bosch Museum.

Figure 6.35: Carl Bosch (1874–1940).

Figure 6.36: Example of high pressure reactors [photo by Nadia Habashi, 2009].

Bosch's technical and scientific achievements are well documented by his honours and distinctions and by his 1931 Nobel Prize. Documents of his active struggle against National Socialist anti-Semitic policy are preserved there. Bosch devoted much spare time to various scientific hobbies. His crystal and insect collections became so large that he bought a nearby house and converted it into the "House of Collections." As an amateur astronomer, he built a small observatory in his house. A unique part of the Museum is the large high-pressure equipment displayed in the open air outside the building (Figures 6.36–6.37).

Bosch was born in Cologne, studied metallurgy and mechanical engineering at the Technische Hochschule in Berlin then chemistry at Leipzig University graduating in 1898. In 1899 he entered the employ of BASF in Ludwigshafen and participated in the development of the then new industry of synthetic indigo.

When World War I began in 1914, Germany poured its resources into the war effort. Synthetic ammonia, was converted into nitric acid at the Oppau plant and then delivered to the explosives industry. Chlorine and phosgene, important intermediates used to manufacture dyes and drugs among other things, were used as poison gas by the army. After several expansions of the Oppau ammonia facilities, the government ordered the construction of a second major production plant.

Figure 6.37: Example of high pressure reactors [photo by Nadia Habashi, 2009].

A plant in eastern Germany, away from the danger of air raids, was commissioned and started operation in 1917 at Leuna near Merseburg. At the end of the War in 1918, the situation in Germany was alarming. The Kaiser had abdicated, reparations, the dismantling of factories, a scarcity of coal, and inflation prevented economic recovery. BASF was occupied by French troupes, German dye manufacturers lost their leading position on world markets. Production facilities, subsidiaries, associated companies, and sales companies abroad were confiscated, as were the patents registered abroad. Reparations imposed by the victors hampered economic recovery.

Bosch received many honours and awards and in 1931 he was awarded the Nobel Prize for Chemistry, jointly with Friedrich Bergius, for their contributions to the invention and development of chemical high pressure methods. Bosch received this honour for converting a laboratory procedure into a large-scale industrial process. He became President of the Kaiser Wilhelm Society in 1937.

WEINHEIM

Weinheim is a suburb of Heidelberg that can be reached by tram from Bismarck Platz (Figures 6.38–6.39). It is the home of Verlag Chemie.

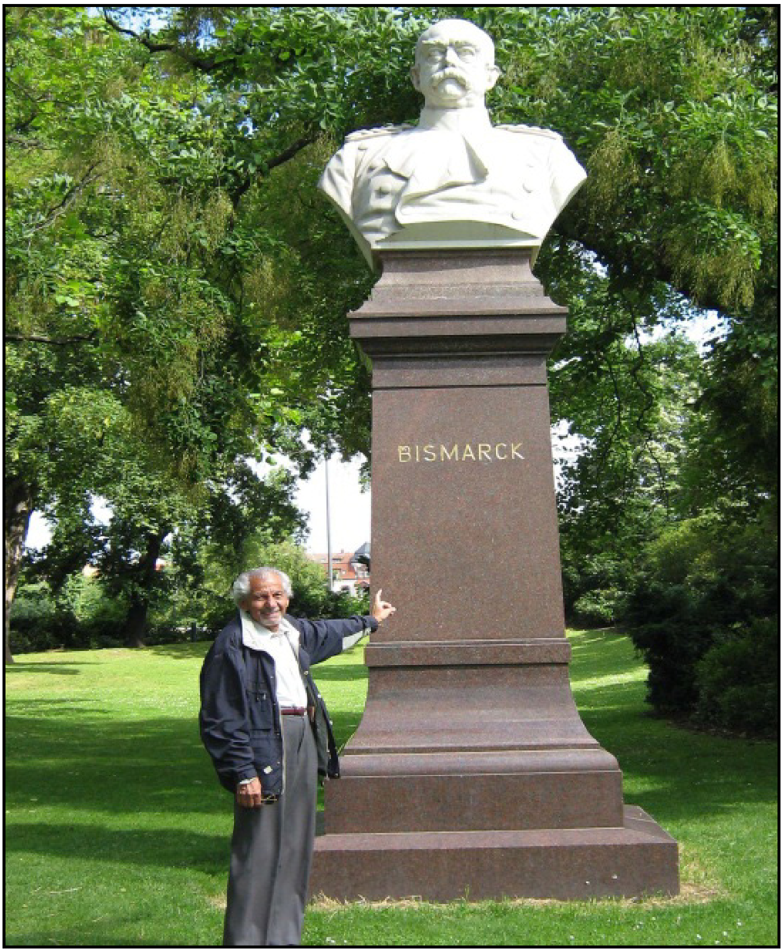


Figure 6.38: Bismarck Square. Photo by Nadia Habashi.

Figure 6.39: Transportation from Bismarck Square to Weinheim.

Verlag Chemie

Verlag Chemie was founded in Berlin with a branch in Leipzig in 1921 as the publishing house for three societies:

- Deutsche Chemische Gesellschaft
- Verein Deutscher Chemiker
- Verein zur Wahrung der Interessen der chemischen Industrie Deutschlands

Two personalities were instrumental in this venture: Carl Bosch and Carl Duisberg. In1921, Verlag Chemie took over publication of *Chemische Zentralblatt*, which is the German equivalent to *Chemical Abstracts*. Gradually, it published important chemistry books and periodicals.

During World War II, the building in Berlin was destroyed. After the war, it was decided to move the publishing activities to Heidelberg to be near to the President of the German Chemical Society at that time the Austrian chemist Richard Kuhn (1900–1967) who was professor of chemistry at the University and Nobel Prize Winner in 1938. In 1947, Verlag Chemie moved again, this time to Weinheim.

The publication of *Ullmanns Enzyklopädie der technischen Chemie* started in 1914 by a publisher in Berlin and was taken over by Verlag Chemie. It went through numerous editions, the last of which (the Fifth) was published in English in 1981. After the fall of the German Democratic Republic, VCH took over in 1991 Akademie Verlag, which was the publishing house for the Academy of Sciences of the German Democratic Republic in Berlin. In 1995, John Wiley in New York acquired 90% of VCH. Among the notable Wiley publications is *Kirk-Othmer's Encyclopedia of Chemical Technology.*

Handbook of Extractive Metallurgy

The idea of *Handbook* goes back to 1963 while I was working on my *Principles of Extractive Metallurgy*[1]. At that time, it became evident that there was a shortage of a comprehensive reference works on extractive metallurgy. Although the idea of *Principles* was based on hydro-, pyro-, and electrometallurgy, there must be available a large reference volume or volumes describing all metals systematically.

Viktor Tafel's *Lehrbuch der Metallhüttenkunde*[2] in two volumes in the First Edition 1927 and 1929, and in three volumes in the Second Edition between 1951 and 1954 was already out of date and out of print. In English, there was Donald M. Liddell's *Handbook of Nonferrous Metallurgy* in two volumes (First Edition 1926, Second Edition 1945). This is not only out of date and out of print but was written in a redundant style with useless diagrams and pictures. Both Tafel and Liddell books were concerned only with nonferrous metallurgy.

Chemical engineers had *Perry's Chemical Engineer's Handbook* since 1934. It went through six editions and is a very useful reference work. Physical metallurgists have an impressive collection of twenty volumes *ASM Metals Handbook*. Extractive metallurgy in thus lagging behind.

In the late 1980s, the German *Encyclopedia of Industrial Chemistry* known by its founder Fritz Ullmann (1875–1939) (Figure 6.40) became available in English. In November 1995 while on a mission to Nancy in France, I stopped at Heidelberg to visit Verlag Chemie in Weinheim (Figure 6.41) to discuss a proposed *Handbook of Extractive Metallurgy* to be derived from Ullmann. After much discussions the approval was granted and editorial work started. The *Handbook*, written by 284 authors, was published in 1997. Another visit to VCH–WILEY, the former Verlag Chemie, took place in 2009 (Figure 6.42).

[1] Volumes 1 and 2 were published in 1969 and 1970, volume 3 in 1986 by Gordon & Breach Science Publishers in New York, London, and Paris. Volume 4 published in 1998 by Métallurgie Extractive Québec.

[2] *Textbook of Smelting.*

Figure 6.40: Fritz Ullmann (1875–1939) taught technical chemistry at the Technische Hochschule Berlin, now Technische Universität. Between 1914 and 1922 he published the first edition of the *Enzyklopädie der Technischen Chemie* in 12 volumes.

Figure 6.41: Left to right: Karin Sora, Fathi Habashi, and Christina Dyllic discussing the *Handbook*. Photo by Nadia Habashi, 1995.

Figure 6.42: Senior editors at WILEY–VCH: Dr. Peter Gregory and Gudrun Walters, 2009.

MANNHEIM

Mannheim is located at the confluence of the River Rhine and the River Neckar. The Rhine separates Mannheim from Ludwigshafen. The 60 m high Water Tower is Mannheim's landmark (Figures 6.43–6.44). Completed in 1886, it once served as a reservoir for drinking water. There is monument to Bismarck near the railway station (Figure 6.45).

Figure 6.43: Mannheim's Water Tower.

Figure 6.44: Water tower, 1997.

Figure 6.45: Bismarck monument, 1997.

FRANKFURT 2006

Figure 6.46: Frankfurt Airport, 2006.

Figure 6.47: Frankfurt Airport [Photo by Fathi Habashi, 2006].

Figure 6.48: View of Frankfurt.

Saint Bartholomew's Cathedral

Saint Bartholomew's Cathedral (Figure 6.49) was constructed in the 14th and 15th centuries on the foundation of an earlier church from the Merovingian time. From 1356 onwards, kings of the Holy Roman Empire were elected in this church, and from 1562 to 1792, the Roman-German emperors were crowned here. Today it is the main church of Frankfurt.

Saint Paul's Church

Saint Paul's Church (Figure 6.50) was established in 1789 as a Protestant church but was not completed until 1833. It was the seat of the first democratically elected Parliament met in 1848 to write a constitution for a united Germany but failed because of the intervention of the monarchs of Prussia and Austria who ended the democratic experiment by force of arms.

Figure 6.49: Saint Bartholomew's Cathedral.

Figure 6.50: Saint Paul's Church.

Römer

Römer (Figure 6.51) is the name of houses that form the Frankfurt City Hall. Located on the upper floor is the Kaisersaal where the newly crowned emperors held their banquets.

Figure 6.51: Römer.

In front of the City Hall is the spot where Nazi sympathizers on May 10, 1933 burnt books of Jewish authors and other intellectuals — a campaign organized by student associations and supported by government authorities. This took place four months after Adolf Hitler was appointed Chancellor. A plaque on the floor was installed in 2001 citing the words written in 1820 by the Jewish poet who converted to Christianity later Heinrich Heine (1797–1856), "*Dort wo man Bücher verbrennt, verbrennt man auch am Ende Menschen*" [Where they have burned books, they will end in burning human beings] (Figure 6.52).

Historically, the first Book Burning ceremony in Germany took place in 1817 at Wartburg Castle near Eisenach where Martin Luther took refuge after protesting the Roman Catholic Church. Students from the University of Jena were bitter about the repressive situation that resulted after the Congress of Vienna in 1815. They burned books of reactionary literary works and symbols of Napoleon. That is why few years later Heinrich Heine wrote his warning about book burning.

Figure 6.52: The spot in front of the City Hall where Nazi sympathizers on May 10, 1933 burnt books which did not correspond with Nazi ideology.

In the surrounding square the Zeil is Frankfurt's central shopping street and one of the most crowded in Germany. Figure 6.53 shows the Emperors of the Holy Roman Empire at the City Hall of Frankfurt.

Eschenheim Tower

The Eschenheim Tower (Figure 6.54) was erected at the beginning of the 15th century and served as a city gate as part of the late-medieval fortifications of Frankfurt.

Goethe's House

The three-story residence of the Goethe family in Old Frankfurt has been restored and is next door to the Goethe Museum (Figures 6.55–6.56). It was there that Goethe was born and spent his youth before leaving in 1765 when he moved to Leipzig to study law, returning sporadically thereafter.

Figure 6.53: Emperors of the Holy Roman Empire at the City Hall of Frankfurt.

Figure 6.54: Eschenheim Tower.

Figure 6.55: Johann Wolfgang von Goethe (1749–1832).

Figure 6.56: A view of one of the rooms in Goethe's House, 2006.

Figure 6.57: Checkpoint Charlie in 1997.

BERLIN 1997

In 1997, my wife and I visited again Checkpoint Charlie, where a museum was constructed telling the story of this era and those who were shot trying to cross from East Berlin to the West (Figure 6.57).

Figure 6.58: Kaiser Wilhelm Memorial Cathedral.

Major landmarks are the bombed Cathedral (Figure 6.58), Brandenburg Gate a former city gate rebuilt in the late 18th century (Figure 6.59), Victory Column to commemorate the Prussian victory in the Prusso-Danish war of 1864 (Figure 6.60). The 8.3-m gilded figure at the top was added after further Prussian victories in wars against Austria and France. The figure represents the Goddess of Victory (Figure 6.61). National Gallery (Figure 6.62), Reichstag (Figure 6.63), Pergamon Museum (Figure 6.64).

Figure 6.59: Brandenburg Gate.

Figure 6.60: Victory Column.

Figure 6.61: Goddess of Victory on top of the Column.

Figure 6.62: National Gallery.

Figure 6.63: Reichstag.

Figure 6.64: Pergamon Museum.

Figure 6.65: Alexander von Humboldt University.

Figure 6.66: Charlottenburg Castle.

Dahlem

Dahlem is the district in Berlin where Max Planck Institute is situated (Figures 6.67–6.68). Professor Franz Pawlek (1903–1994) study at his home was visited (Figure 6.69).

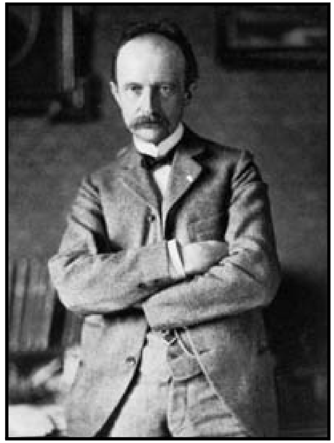


Figure 6.67: Max Planck (1858–1947), 1918 Nobel Prize winner in physics.

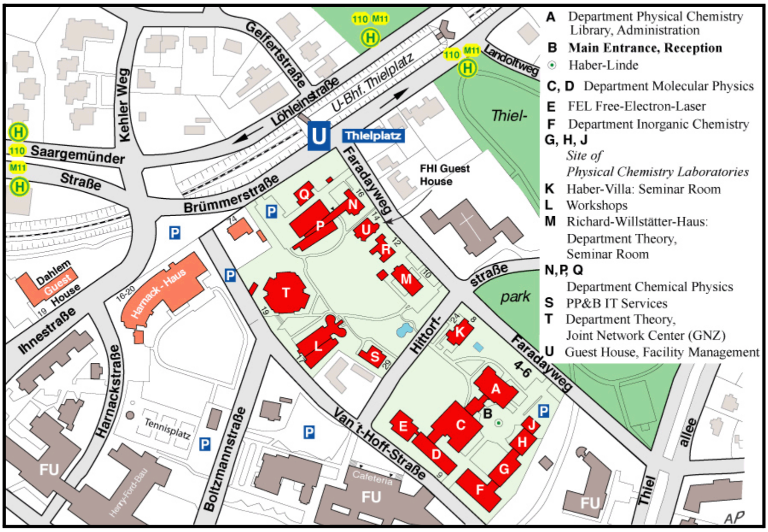


Figure 6.68: Max Planck Institute in Berlin-Dahlem.

Figure 6.69: Rudolf and Brigitte Pawlek at their home in Berlin, Dahlem. Photo by Nadia Habashi, 1997.

Figure 6.70: Brigitte and Rudolf Pawlek at Sanssouci Palace in Potsdam. Photo by Nadia Habashi, 1997.

POTSDAM

Potsdam was the residence of the Prussian kings and German Kaisers until 1918. It is the home of Sanssouci Palace (Figures 6.70–6.71). The Potsdam Conference, the major post-World War II conference between the victorious Allies, was held in the Cecilienhof (Figure 6.72)

Figure 6.71: Brigitte and Rudolf Pawlek at Sanssouci Palace in Potsdam. Photo by Fathi Habashi, 1997.

Cecilienhof was the last palace built by the Hohenzollern family. Emperor Wilhelm II had it erected for his son, and the crown prince's wife Duchess Cecilie of Mecklenburg-Schwerin. It was the location of the Potsdam Conference between 17 July and 2 August 1945, now a museum and hotel (Figures 6.73–6.75).

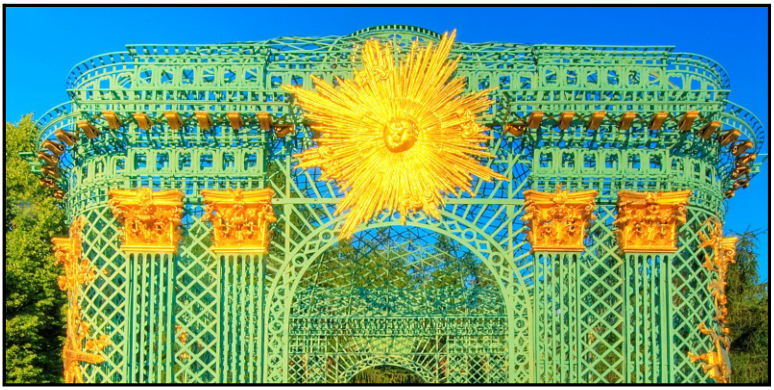


Figure 6.72: Details from the Gitter Pavilion.

Figure 6.73: Entrance to Cecilienhof.

The Conference was held in occupied Germany after her unconditional surrender on May 8, 1945. Participants were representatives from the three nations: Joseph Stalin [Soviet Union], Winston Churchill [United Kingdom], and Harry S. Truman [United States]. They gathered to decide how to administer punishment to the defeated Nazi Germany. The goals of the conference also included the establishment of post-war order, peace treaties issues, and countering the effects of war.

Figure 6.74: Conference table at Cecilien Hof where Roosevelt, Churchill, and Stalin met towards the end of World War II, 1997.

Figure 6.75: Historic photograph showing the representatives of the three countries meeting at the Round Table after the surrender of Germany.

Figure 6.76: City Hall.

MUNICH 2005

Munich (Figures 6.76–6.80) is the capital of Bavaria located on the River Isar north of the Bavarian Alps and is the third largest city in Germany, behind Berlin and Hamburg.

Figure 6.77: Frauen Church.

Figure 6.78: Monument in Marie Square.

Figure 6.79: Old City Gate.

Figure 6.80: National Theatre with the monument of Maximilian I.

In the 17th century, the Duke of Bavaria became a Prince-elector of the Holy Roman Empire. When Napoleon invaded Germany he founded the Confederation of the Rhine as his Protectorate. In 1805, he made Maximilian I (1756–1825) king of Bavaria (Figure 6.81).

When he was defeated at Waterloo, a German Confederation was created by the Congress of Vienna (1814–1815) with the emperor of Austria as president. Austria started to interfere in the affairs of the German states, creating friction with Prussia. Bavaria opposed the movement towards a united Germany under the leadership of Prussia, and in 1866 sided with Austria in the Austro-Prussian War. With the defeat of Austria she was compelled to cede a portion of her territory to Prussia and pay a large indemnity. This also resulted in the creation in 1867 of the North German Confederation with the King of Prussia as president.

Figure 6.81: Maximilian I (1756–1825) in front of the National Theatre.

Bavaria is the largest state by area, forming almost 20% of the total area of Germany. Bavaria was, for the most part, unaffected by the Protestant Reformation. The Kingdom of Bavaria existed from 1806 to 1918. Munich is the home of the German Museum and the castle of King Ludwig II. It is also famous for its Oktoberfest.

Hochbräuhaus Beer Hall

After World War I, the city was at the centre of much political unrest. In 1923, Adolf Hitler, supported by General Erich Ludendorff, and others, claimed the overthrow of the Weimar Republic while the government officials were meeting in the Beer Hall (Figures 6.82–6.83). The revolt failed, resulting in Hitler's arrest and the temporary crippling of the Nazi Party.

Figure 6.82: Hochbräuhaus Beer Hall.

Figure 6.83: Hochbräuhaus Beer Hall.

Count Rumford

The American-born Benjamin Thompson (1753–1814) (Figure 6.84), was born in Rumford, Massachusetts, better known as Count Rumford, was philanthropic, a brilliant social reformer, a superb organizer, and an exceptionally innovative scientist. After the War of Independence he left with the British in 1776. He spent much of his life as an employee in the Arsenal of the Bavarian government where he received his title, "Count of the Holy Roman Empire." Rumford is known primarily for the work he did on the nature of heat which he conceived during the boring of cannons. He is honoured in Munich by a statue (Figure 6.85) and a garden in his name.

Figure 6.84: Benjamin Thompson (1753–1814) known as Count Rumford.

Bavaria Monument

Bavaria Monument (Figures 6.86–6.88) is a bronze statue cast between 1844 and 1850 at the orders of Ludwig I (1786–1868) son of Maximilian I of Bavaria. It was a technological masterpiece because of its size: 18.5 m high and weighs 87.36 tons. It rests on a stone base 8.92 m high. An internal circular staircase leads up to a platform in the head[1]. The statue stands in front of the Hall of Fame — a memorial to distinguished figures of Bavarian history.

[1] The Statue of Liberty in New York was dedicated in 1886; it weighs 204 tonnes, of which 27 tonnes are copper and the rest steel. Heel to top of head is 34 m.

Figure 6.85: Monument to Count Rumford. Photo by Nadia Habashi, 2005.

Figure 6.86: Hall of Fame with Bavaria in front.

Figure 6.87: Bavaria bronze statue.

Figure 6.88: In front of Bavaria by Fathi Habashi, 2005.

Neuschwanstein

Neuschwanstein is reached by train from Munich Main Railway Station via Füßen [2 hours], then by bus to downtown [20 minutes], then climbing for 45 minutes to the castle (Figure 6.89). The castle was built in the 19th century on the hill above the village of Hohenschwangau by Ludwig II, King of Bavaria (1845–1886) (Figure 6.90,) grandson of Maximilian I, as a retreat and as a homage to Richard Wagner (Figure 6.91), whose music he greatly admired and whom he had invited to settle in Munich.

Figure 6.89: Schloß Neuschwanstein.

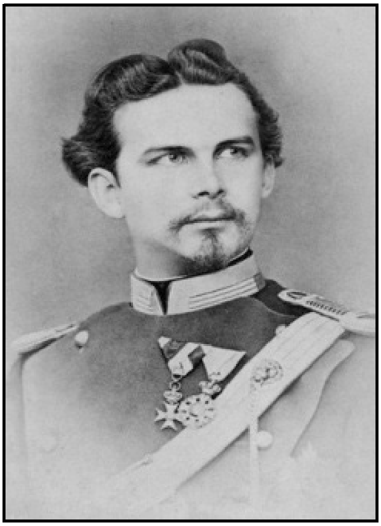


Figure 6.90: Ludwig II King of Bavaria (1845–1886).

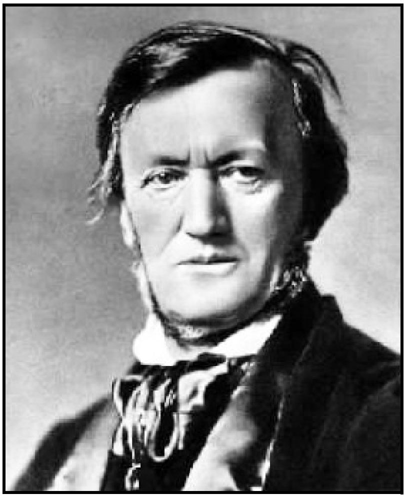


Figure 6.91: Richard Wagner (1813–1883).

FREIBERG

Freiberg (Figures 6.92–6.94) was founded by Margrave Otto known as "Otto the Rich" (1070–1123) (Figure 6.95) where silver mining was carried out for more than 800 years along the "Freyen Berg" [Free Mountain] at the foot of the Erzgebirge [Ore Mountains].

Figure 6.92: A view of Freiberg.

Figure 6.93: Location of Hotel, Schloß, and Main Square.

Figure 6.94: Main Square with the monument of the founder of the city and City Hall.

Figure 6.95: Margrave Otto the Rich (1070–1123), founder of Freiberg.

Figure 6.96: Ratsapotheke (Council Apothecary).

The School of Mines

Freiberg is the seat of the Mining Academy (Figure 6.98) founded in 1765, whose professors contributed greatly to the technical literature on geology, mineralogy, mining, and metallurgy. Many of these works were immediately translated into English, French, Russian, and Italian as soon as published. Two metals were discovered at the Academy: indium in 1863 and germanium in 1886. Of the distinguished professors at the Academy one may mention Gellert, Werner, Lampadius, Reich, Plattner, Richter, Ledebur, and Winkler. Streets in the city are named in their honour.

Figure 6.97: Cathedral.

Figure 6.98: The Mining Academy today.

Figure 6.99: Plaque commemorating the discovery of indium by Professor Ferdinand Richter at the Mining Academy.

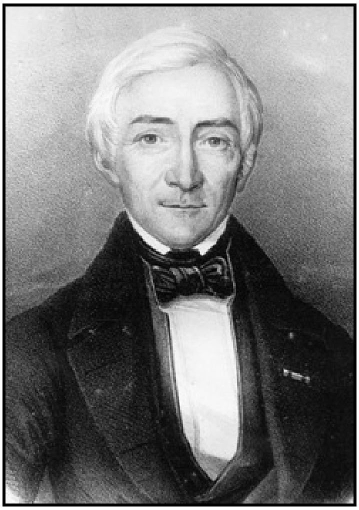


Figure 6.100: Ferdinand Richter (1799–1882), discoverer of indium.

Figure 6.101: Plaque on the residence of Professor Gellert.

Figure 6.102: Christlieb Ehregott Gellert (1713–1795), first Professor of Metallurgical Chemistry at the School of Mines.

Figure 6.103: Ledebur Building.

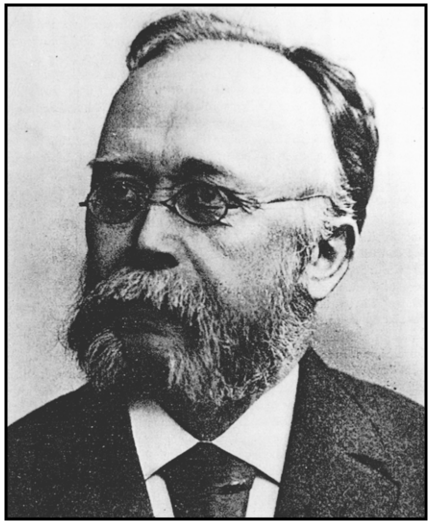


Figure 6.104: Karl Heinrich Adolf Ledebur (1837–1906).

Figure 6.105: Werner Building.

Figure 6.106: Abraham Werner (1749–1817).

Figure 6.107: Clemens Winkler (1838–1904), discoverer of germanium.

Figure 6.108: Winkler Street.

Cultural Heritage Symposium

The Tenth International Symposium on Cultural Heritage in Geosciences, Mining, and Metallurgy, subtitled: Libraries – Archives – Museums – Collections, was held September 29 to October 3, 2009 in Freiberg, Germany. About 80 participants took part mainly from Germany and Austria but also few from Canada, Mexico, Poland, and USA. About 40 papers were presented, divided in two parallel sessions. Chairperson of the Organizing Committee was Angela Kissling at the Georgius Agricola Library of the Technical University Mining Academy Freiberg. Paper presented: "Gold Museum"; an abstract is published in the Abstract Book.

FREUDENSTEIN CASTLE

Terra Mineralia is a large mineral collection belonging to rich a Swiss family originally from Saxony, was donated to Freiberg to be permanently displayed in the 800 years old Freudenstein Castle after it has been renovated (Figures 6.109–6.110). The Museum opened in 2004 as one the largest and most modern museums of its kind in the world. The Museum opened in 2004 (Figures 6.111–6.112).

Figure 6.109: Entrance to the castle.

Figure 6.110: The court inside the castle.

Figure 6.111: Museum Terra Mineralia.

Figure 6.112: Touring Terra Mineralia.

The archives of the mining activities during the 500 years operations are saved there (Figure 6.113). Silver was found in the area in 1168 which caused a boom in the development of the town. The Mining Museum tells in detail the story of mining in the region (Figure 6.114).

EXCURSION

An excursion in the Erzgebirge Region on the border with the Czech Republic famous for its silver mining history concluded the symposium activities (Figure 6.115).

The excursion included the following stops:

- Marienberg: Horse capstan for ore transportation from mine (Figure 6.116)
- Schneeberg: St.Wolfgang Church
- Annaberg-Buchholz: St. Mary Berg Church, St. Ann Church which contains many paintings and models describing miners at work (Figures 6.117–6.118)
- Frohnauer Hammer (Figures 6.119–6.120)
- Uranium–Wismut plant

Figure 6.113: Visit to the Archives.

Figure 6.114: Mining Museum.

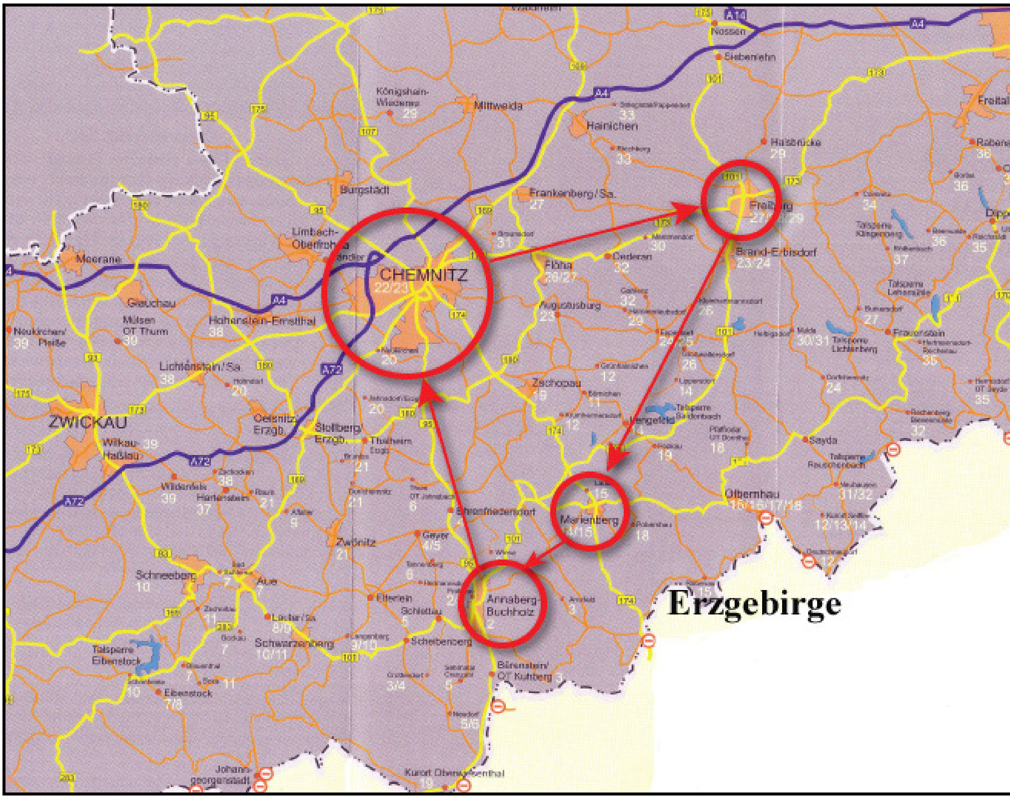


Figure 6.115: Excursion in the mining district of Freiberg.

Figure 6.116: Horse capstan for ore transportation from mine at Marienberg.

Figure 6.117: A wood carved miner at Annaberg Church.

Figure 6.118: A painting showing a miner at work in Saint Ann Church, Annaberg.

After World War II, the Soviet Union became interested in the East German uranium occurrences as a source for its nuclear weapons program. They discovered significant resources and started mining in 1946. In 1947 the Soviet company “Wismut” (Wismut, named after the German word for the metal bismuth) was formed. In the following years the company became the most important source for uranium for the Soviet Union and several tens of thousands of people were employed. Safety and environmental standards were very low leading to the exposure of many thousands of workers to dangerous levels of radon leading to lung cancer. At the end of 1953 the company was liquidated and the Soviet–German company Wismut was newly founded with the Soviet Union and the German Democratic Republic owning 50% each.

Figure 6.119: Frohnauer Hammer operated by a water wheel.

Figure 6.120: Frohnauer Hammer shop.

Uranium production of the Wismut had its peak from the mid 1960s to the early 1970s reaching nearly 7 000 tonnes of uranium per year. After that it declined to 3 500 tonnes in the last normal production year 1989. Through the political and economical changes in East Germany and the following reunification of Germany, uranium mining was stopped in December 1990. The Federal Government of Germany took over the ownership of the East German and Soviet stocks of the company and transformed it into the Wismut GmbH in 1991. This new company is responsible for re-cultivating the former mining and milling sites (Figures 6.121–6.124).

Cultural Heritage conferences were as follows:

1st	1993	Freiberg, Germany
2nd	1995	Leoben, Austria
3rd	1997	St. Petersburg, Russia
4th	1998	Banská Štiavnica, Slovakia
5th	2000	Golden, Colorado, USA
6th	2002	Idria, Slovenia
7th	2003	Leiden, Netherlands
8th	2005	Schwaz, Tyrol, Austria
9th	2007	Quebec City, Canada
10th	2009	Freiberg, Germany

Figure 6.121: Uranium–Wismut plant.

Figure 6.122: Uranium–Wismut plant.

Figure 6.123: Uranium–Wismut plant.

Figure 6.124: Uranium–Wismut plant.

Chemnitz

Chemnitz was known from 1953 to 1990 as Karl-Marx-Stadt although Karl Marx (1818–1883) was born in the Rhineland. The city is famous for the large Karl Marx monument (Figure 6.125). Inscribed on the wall in the background is Marx's famous appeal from the *Communist Manifesto*, "Workers of all nations unite...", in German, French, and Russian.

Figure 6.125: Karl Marx monument at Chemnitz.

DRESDEN

Dresden on the River Elbe (Figures 6.126–6.129) was the capital of the Kingdom of Saxony between 1806 and 1918. The Kingdom was part of the German Empire from 1871. It became a republic in 1918 after the end of World War I and the abdication of King Frederick Augustus III.

Figure 6.126: Dresden on the Elbe.

Figure 6.127: Elbe River.

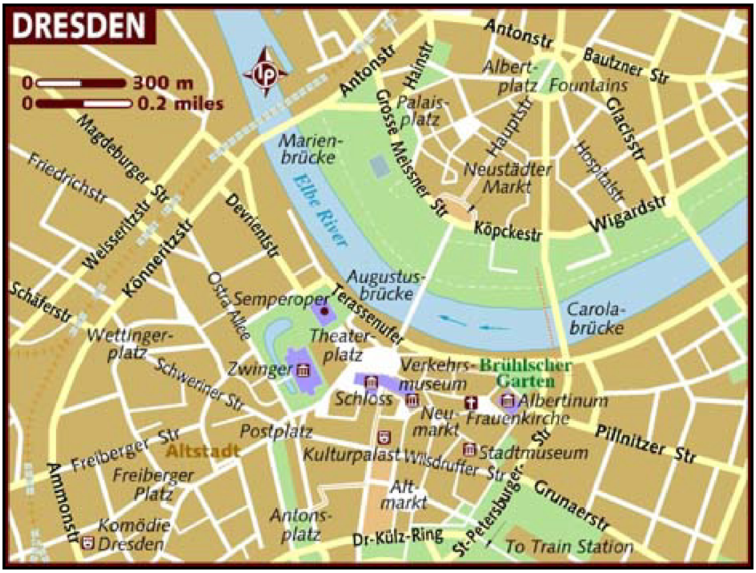


Figure 6.128: Map of Dresden.

Figure 6.129: Ibis Hotel.

Dresden has been the residence of sovereigns and kings already since 1425, was badly destroyed during World War II but now nearly completely rebuilt. Many of the buildings were created during the regency of Frederick Augustus I who was simultaneously also king of Poland. Between the years 1697 and 1763, the Electors of Saxony were also elected Kings of Poland in personal union. Frederick II of Prussia invaded Saxony in 1756, precipitating the Seven Years War. The Prussians quickly defeated Saxony and incorporated the Saxon army into the Prussian army. At the end of the Seven Years War, Saxony once again became an independent state.

In 1806, French Emperor Napoleon abolished the Holy Roman Empire and decreed the Electorate of Saxony a kingdom in itself. Elector Frederick Augustus III became King Frederick Augustus I. Frederick Augustus remained loyal to Napoleon during the wars that swept Europe in the following years. He was taken prisoner by the allies in 1813 but was restored to his throne at the Congress of Vienna in 1815.

Figure 6.130: King Johann (1498–1532) ruled from 1525 to 1532.

Figure 6.131: Details from King Johann monument.

Figure 6.132: Monument of Frederick Augustus I (1670–1733), King of Saxony from 1694 to 1733, became King of Polish in 1697 and Grand Duke of Lithuania.

Figure 6.133: Monument to Frederick Augustus I.

Figure 6.134: Frederick August II (1696–1763) ruled from 1733 to 1763 became King of Poland from 1734 to 1763.

The Mural

Dresden has a unique historical document in form of a large mural depicting the rulers of Saxony (Figures 6.135–6.154).

Figure 6.135: A general view of the long mural in Dresden showing the electors of Saxony.

Figure 6.136: Beginning of the mural.

Figure 6.137: Details 2.

Figure 6.138: Details 3.

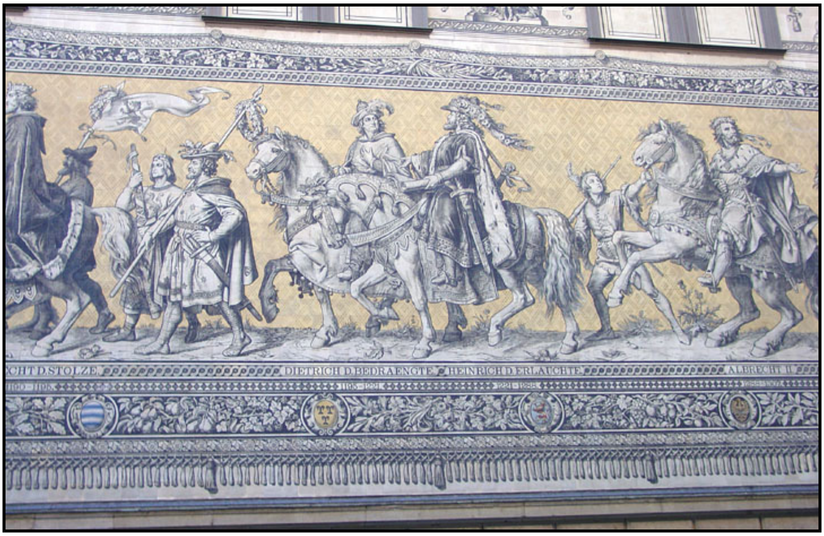


Figure 6.139: Details 4.

Figure 6.140: Details 5.

Figure 6.141: Details 6.

Figure 6.142: Details 7.

Figure 6.143: Details 8.

Figure 6.144: Details 9.

Figure 6.145: Details 10.

Figure 6.146: Details 11.

Figure 6.147: Details 12.

Figure 6.148: Details 13.

Figure 6.149: Details 14.

Figure 6.150: Details 15.

Figure 6.151: Details 16.

Figure 6.152: Details 17.

Figure 6.153: Details 18.

Figure 6.154: Last part of the mural, 19.

FRAUENKIRCHE

Dresden Frauenkirche (Church of Our Lady) (Figures 6.155–6.156) is a Lutheran church built in the 18th century, was destroyed during World War II. It was reconstructed in 2004, its interior in 2005.

Figure 6.155: Frauenkirche with Luther's monument in front.

Figure 6.156: Martin Luther monument.

ZWINGER PALACE

Zwinger is a museum complex that contains the Old Masters Picture Gallery, the Dresden Porcelain Collection, the Armoury, and the Royal Cabinet of Mathematical and Physical Instruments. The German word Zwinger means outer ward of a concentric castle. It was for the cannons that were placed between the outer wall and the major wall. The location was formerly part of the Dresden fortress.

Figure 6.157: Zwinger Palace.

Figure 6.158: Zwinger.

Figure 6.159: Zwinger.

Figure 6.160: View of the royal palaces.

Figure 6.161: Window details.

Figure 6.162: Opera House.

Figure 6.163: How much wrong was Marx actually? Photo by Nadia Habashi, 2009.

Figure 6.164: Dresden music city. Photo by Nadia Habashi, 2009.

Figure 6.165: Dresden art city. Photo by Nadia Habashi, 2009.

Figure 6.166: An ancient door. Photo by Nadia Habashi, 2009,

HAMBURG

Hamburg on the river Elbe (Figures 6.167–6.171) is the second largest port in Europe after the Port of Rotterdam. It was a member of the medieval Hanseatic League and a free imperial city of the Holy Roman Empire.

Figure 6.167: Elbe River.

Figure 6.168: Dammtor Railway Station.

Figure 6.169: Hamburg Port.

Figure 6.170: Congress Centrum Hamburg.

Figure 6.171: City Hall.

Copper conference

Copper 2010 conference was held in Hamburg June 6–10, 2010 at the Congress Centrum (Figures). It is the seventh in a series of international conferences devoted to the economics, mineral beneficiation, extractive metallurgy, recycling, environmental aspects, and applications of copper. About 600 participants took part (Table 6.1).

Table 6.1: Copper conferences.

Conference	Year	Location
1	1987	Viña del Mar, Chile
2	1991	Ottawa, Canada
3	1995	Santiago, Chile
4	1999	Phoenix, Arizona
5	2003	Santiago, Chile
6	2007	Toronto, Canada
7	2010	Hamburg, Germany

Figure 6.172: G. Devos and L. Piesanowski [Belgium/Luxemburg].

Figure 6.173: Corby Anderson [USA] and Zenish Abisheva [Kazakhstan].

Figure 6.174: Professor from Liège [left], and from Wrocław, Poland.

Figure 6.175: Prof. Konishi from Osaka, Japan.

Figure 6.176: Prof. Isabel from San Luis Potosí, Mexico.

Figure 6.177: Prof. Vinals, Barcelona.

Figure 6.178: Memorial park for Jewish deportation point [photo by Fathi Habashi, 2009].

Figure 6.179: Memorial park for Jewish deportation point [photo by Fathi Habashi, 2009].

Figure 6.180: Memorial plaques on sidewalk for Nazi victims [photo by Fathi Habashi, 2009].

Name Index

I

J

K

L

M

N

O

P

R

S

T

U

V

W

Z

Subject Index