Fathi Habashi

2015

My Trips to Central Europe

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 978-2-922686-31-9

Fathi Habashi, *My Trips to Central Europe.*

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

1. Czechoslovakia (Czech Republic and Slovakia) 1
2. Hungary 96
3. Switzerland 142

Name Index 148

Subject Index 150

Chapter 1

Czechoslovakia

(Czech Republic and Slovakia)

Historical Background 1
Jan Hus 5
Czech Republic 7
Prague 7
Karlštejn 41
Kutná Hora 43
Bruntál 45
Ostrava 46
Brno 50
Austerlitz 54
Příbram 56
Jáchymov 59
Karlovy Vary 62
Slovak Republic 64
Košice 64
Levoče 80
Krásna Hôrka 80
Beltiar Palace 83
Banská Štiavnica 85
Sered and Ziar nad Hronom ... 90
Bratislava 91

HISTORICAL BACKGROUND

When King Ludwig of Bohemia (1505–1526) died at the young age of 21 in the Mohasz battle against the Turks, the rule of Bohemia went over to Ferdinand I (1503–1564) of Habsburg who married Ludwig's sister Anna. Bohemia, Moravia, as well as a part of Silesia, northern parts of the Kingdom of Hungary, Slovakia, and Carpathian Ruthenia became part of the Austro-Hungarian Empire (Figure 1.1). During World War I, the Czechs and Slovaks sided against Austria–Hungary, that is why after the war Czechoslovakia came into being in 1918, when the old Austro-Hungarian Empire was dismantled. The Czechs of Bohemia and Moravia, and the Slovaks of Slovakia, combined to form the new state (Figure 1.2). Fifteen years later, Adolph Hitler came to power in Germany and within five years, he has consolidated his position and built the defeated country back into a formidable military power.

The lands confiscated from Germany after World War I, and other areas of the Continent that had sizeable German populations, were Hitler's first territorial goals. In 1938, the Sudetenland of Western Czechoslovakia, with its three million German-speaking people, became part of the Third Reich. Slovakia was occupied in 1939 by Horthy Government in Hungary. During World War II [1939–1945], Bohemia and Moravia were occupied by Germany and the Czechoslovak Government went into exile in London.

Figure 1.1: Austro-Hungarian Empire in 1914.

Figure 1.2: Czechoslovak Republic from 1918 to1938 was composed of Bohemia, Moravia–Silesia, Slovakia, and Ruthenia [Sub-Carpathians Rus]. Prague as capital.

After World War II, the Czechoslovak Republic was formed again while the eastern province of Slovakia known as Ruthenia was taken by the Soviet Union. In 1960, the Czechoslovak Republic became a Socialist Republic (Figure 1.3). After the collapse of the Soviet Union, she became in 1989 a Federal Republic. Czechoslovakia was the only Eastern European country that had a Western-type democracy between the First and the Sec-

ond World Wars. Czechoslovakia has a rich mining and metallurgical heritage. Her scientists and historians are active writing it down and publishing it. On January 1, 1990, the Federal Republic was split peacefully into Czech Republic and the Slovak Republic.

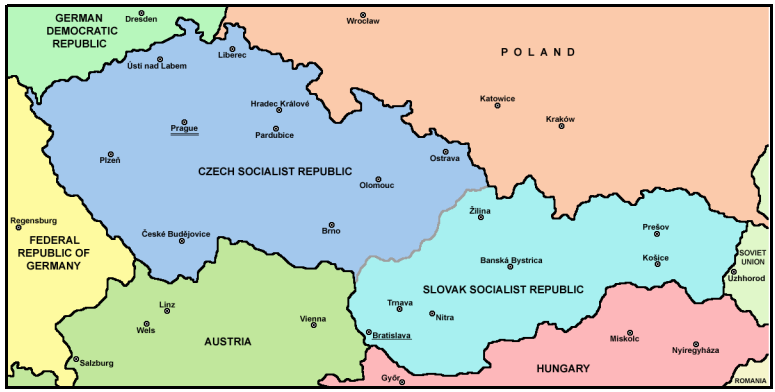


Figure 1.3: In 1993, Czechoslovalia split into Czech and Slovak republics.

The Czech Republic maintained the same flag before splitting while the Slovak Republic used another similar flag (Figures 1.4–1.5).

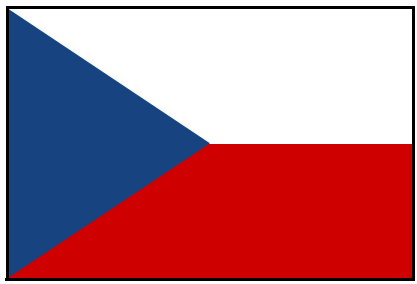


Figure 1.4: Flag of Czech Republic.

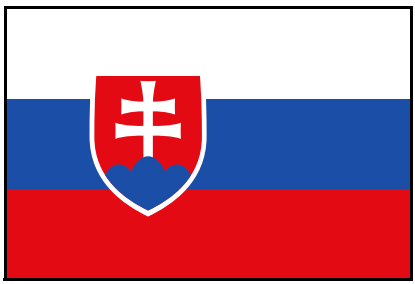


Figure 1.5: Flag of Slovak Republic.

As a result of extensive migrations during the Austro-Hungarian imperial period and thereafter due to changing of boundaries, the ethnic composition of Czechoslovakia became mixed with different nationalities which included Germans, Hungarians, Poles, Ukrainians, and others (Figure 1.6). The Czech and the Slovak languages are very similar. A Czech can easily understand a Slovak and vice versa. Polish language is also similar to both and communication can take place between individuals without an interpreter. Czechoslovakia is unique among European countries in the large number of castles (2 500), mineral springs and health spas (1 300), and museums. Like Romania and Hungary, there is a large population of gypsies.

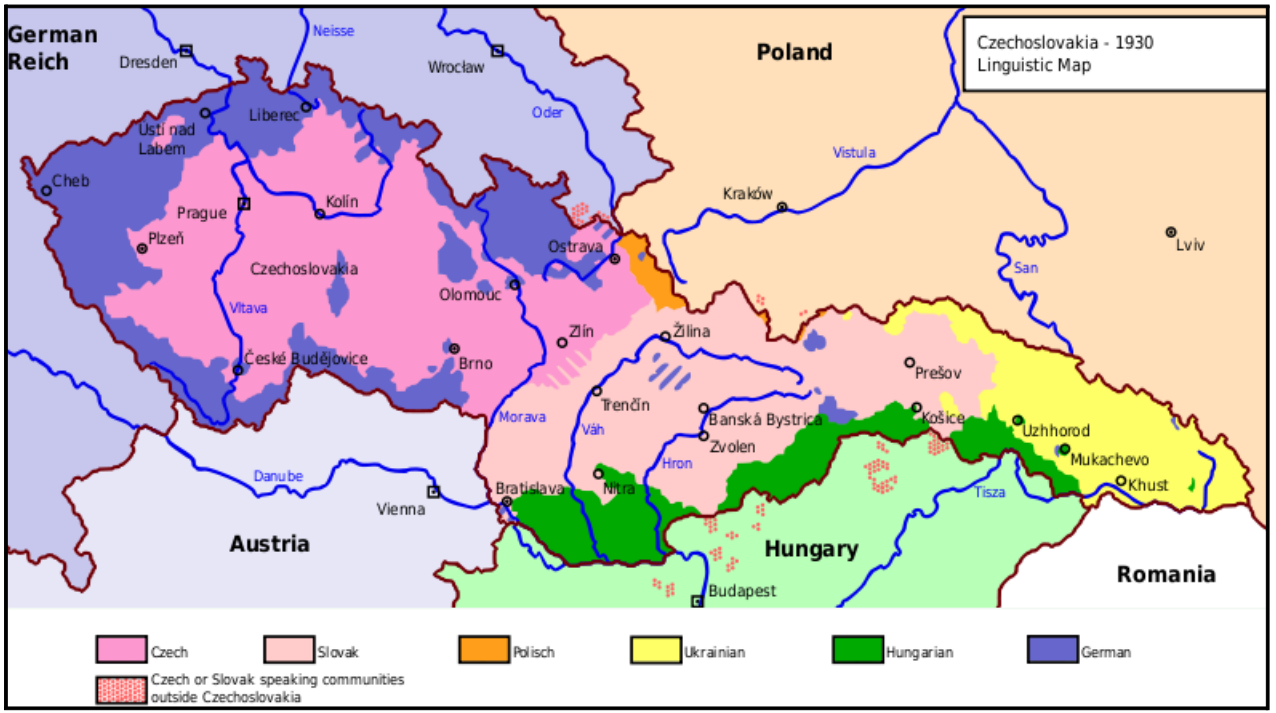


Figure 1.6: Ethnic composition of Czechoslovakia.

Jan Hus

Jan Hus (ca. 1369–1415) (Figure 1.7) was a Czech priest, philosopher, reformer, and Rector at Charles University in Prague. He was influenced by the writings of John Wycliffe (1328–1384) and was burned at the stake for heresy against the doctrines of the Catholic Church. He was a key predecessor to the Protestant movement of the 16th century, more than a century before Martin Luther. Between 1420 and 1431, the Hussite forces defeated five consecutive papal crusades against followers of Hus. A century later, as many as 90% of the inhabitants of the Czech lands were non-Catholic and followed the teachings of Hus and his successors. Jan Hus Day on July 6, the anniversary of the martyrdom of Jan Hus, is a public holiday in the Czech Republic. Jan Hus Memorial (Figure 1.9) on the Old Town Square in Prague was erected in 1915.

Figure 1.7: Jan Hus (ca. 1369–1415).

Figure 1.8: Jan Hus Square in Prague.

Figure 1.9: Jan Hus Memorial on the Old Town Square in Prague.

Table 1.1: Trips to Czechoslovakia.

Dates	Cities visited	Purpose of visit
June 26–July 4, 1990	Košice	Conference *Interprogress Metalurgia*
	Prague	Cultural visit
May 12–June 14, 1991	Prague	Technical University
	Košice	Short course on extractive metallurgy at Technical University Košice
	Banská Štiavnitca	Museum
	Levoča	Cultural visit
	Bratislava	Slovak Academy of Sciences
June 17–July 1, 1998	Prague	Cultural visit
	Kutná Hora	Cultural visit
	Bruntál	Metallurgical plant
	Ostrava	Conference on Environment and Mineral Processing
	Brno	Cultural visit
	Slavkov	Cultural visit
May 5–9, 2000	Prague	Cultural visit
	Jáchymov	History of mining in Joachimsthal
	Příbram	History of mining in Příbram
	Karlovy Vary	Cultural visit
April 2007	Košice	Seminar at the Technical University Košice

CZECH REPUBLIC

Prague

The Czech Republic is surrounded by Germany, Poland, Slovakia, and Austria (Figure 1.10). The capital Prague is on the River Vltava [Moldau in German] (Figures 1.11–1.15). Prague was founded in the middle of the Ninth Century and was in the Middle Ages larger and more important than Paris and London. It was the capital of the Holy Roman Empire in the Fourteenth Century during the reign of Charles IV, King of Bohemia (1346–1378) who founded in 1348 the university in Prague known by his name.

Figure 1.10: Map of the Czech Republic.

Figure 1.11: General view of Prague on the Vltava River.

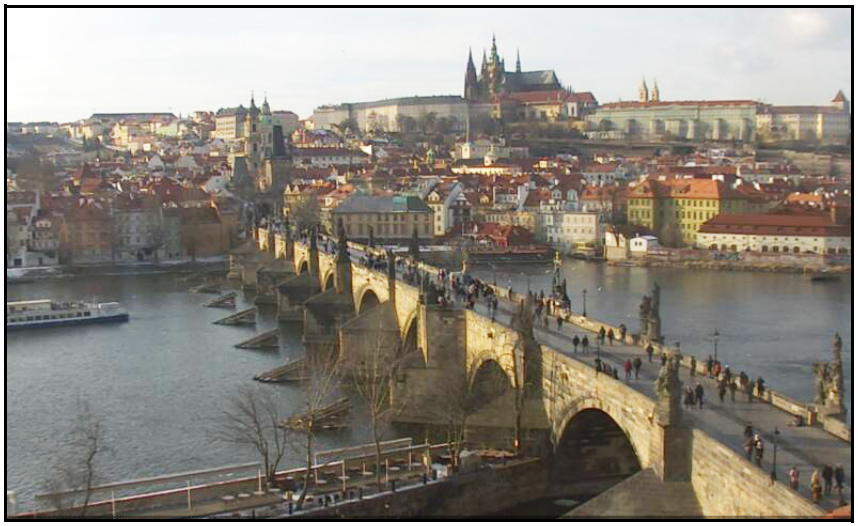


Figure 1.12: Karl's bridge on the Vltava River.

Figure 1.13: With Dr. Vladimir Dufek in Prague [Photo by Nadia Habashi, 1998].

Figure 1.14: Clock at the City Hall.

Figure 1.15: General view of a Prague square.

Wenceslas Square

The square is named after Saint Wenceslas — the patron saint of Bohemia (Figures 1.16–1.17). It has been home to various events in Czech history — from invading Russian tanks in 1968 to masses of protesters in 1989 that led to Czechoslovakia's independence from the Eastern block countries.

Figure 1.16: Wenceslas Square with the monument of Saint Wenceslas.

Figure 1.17: Wenceslas Square with the National Museum at the far end.

Figure 1.18: Ambassador Hotel, 1990.

National Museum

The beginnings of the museum goes back to 1796, when the Society of Patriotic Friends of the Arts was founded by a group of prominent nobles to promote art and natural sciences in the spirit of the French Revolution. In 1949, the national government took over the museum. Museum at present contains items concerning the areas of mineralogy, palaeontology, mycology, botany, entomology, zoology, anthropology, numismatics, and archaeology. It has also an important collection of meteorites.

Figure 1.19: National Museum behind Saint Wenceslas monument.

Figure 1.20: View from the National Museum.

Figure 1.21: Entrance Hall at the National Museum.

National Technical Museum

The National Technical Museum was founded in 1908 to document the history of technology (Figures 1.22–1.25).

Figure 1.22: National Technical Museum.

Figure 1.23: Van't Hoff work displayed at the Technical Museum [Photo by Nadia Habashi, 1991].

Figure 1.24: Agricola and his work displayed at the Technical Museum [Photo by Nadia Habashi, 1991].

Figure 1.25: Transportation Hall at the Technical Museum [Photo by Nadia Habashi, 1991].

Prague Castle

Prague Castle is claimed to be the largest castle in the world. It was the residence of the Kings of Bohemia and the Holy Roman Emperors. Today, presidents of the republic have had their offices. It also houses the Czech Crown Jewels (Figure 1.26).

Figure 1.26: Prague Castle.

Institute of Chemical Technology

Prague is the seat of the Institute of Chemical Technology. There is a similar institute in Pardubice (100 km east of Prague). This institute is divided into four faculties:

- Chemical Technology
- Chemical Engineering
- Biotechnology and Food Technology
- Water treatment and Fuels

The faculty of Chemical Technology is composed of the following departments: Inorganic Chemistry, Inorganic Technology, Organic Chemistry, Organic Technology, Chemical Metallurgy & Corrosion, Materials, and Silicates. The department of Chemical Technology and Corrosion was visited. Chairman: Prof. Ladislav Dubeček, a Russian-educated physical metallurgist, a highly cultured academic with no language talents. Prof. Miroslav Pedlik is an extractive metallurgist of wide experience in nickel and aluminum metallurgy. He was in Moa, Cuba for many years, was a consultant to the Iranian Government, and speaks English and Spanish fluently. Dr. André Macenauer, a corrosion specialist. Not far from Prague at Panenské Břežany is the Institute of Scientific Research on Materials which is said to have a high reputation.

Charles University

In 1344, during the final years of the reign of Jan Luxemburg Prague's bishopric was elevated to an archdiocese. The Bohemian lands thus became ecclesiastically independent of the Rhineland's Mainz. After the death of his father, Charles IV (Figure 1.27) consolidated his rule over the Empire and the entire Bohemian kingdom. The conditions were thus ripe for Prague to fulfil the idea of a university. In the Middle Ages the Church was the exclusive provider of education. During his stay in France, King Charles IV visited lectures at the University of Paris and became familiar with the university. He became acquainted with the Abbott Pierre de Rosier, who became the Pope Klement VI. He played an important role in the establishment of the Prague University.

In the Papal Bull of January 26, 1347 in Avignon, Klement VI declared that general studies in every permitted area shall flourish. It was of the utmost importance that the pope emphasised "in every permitted area," for it was to this that one could also grant theological degrees — a right that was far from guaranteed. On April 7, 1348 the King of Bohemia and the Roman Empire Charles IV founded a university in Prague the seat of his reign. At that time it was the first university in Central Europe and consisted of four faculties: law, philosophy, theology, and medicine. None of these had their

own building. Lessons were held in monasteries and often in the residences of professors. The university was given its first building in 1364.

Figure 1.27: Monument to Charles IV in Prague. Photo by Nadia Habashi, 1998.

From 1419 to 1434, the three faculties, medicine, law, theology ceased to exist and in 1556, the Jesuits arrived to Prague and founded the college of St. Clement. In 1654 Emperor Ferdinand III integrated the Karolinum and the Klementinum into one four-faculty university (Universitas Carolo-Ferdinandea).

In 1882, a law was passed to divide the bilingual university into respective German and Czech sections. On November 17, 1939 the Nazis closed down all Czech universities in the Protectorate of Bohemia and Moravia. After a six-year period of the enforced closure, activities of Charles University were reinstalled by President Beneš and the German university was closed. In the post war period other faculties came into existence, while the Theology Faculty was excluded from the union of faculties.

The university participated in the 1968 uprising against the Soviet domination and a wave of repression hit most non-conformist professors and students. In 1989, demonstrations by university students on the day commemorating the events of November 17, 1939 instigated the fall of the communist regime. This date marks the storming of Czech universities by the Nazi and killing of students. It is known as "International Students' Day" and is celebrated every year. In 1990, the university's autonomy in research and instruction was restored and the three theology faculties: Catholic, Evangelical, and Hussite were incorporated into the university union.

Bedřich Smetana

A monument to the gifted Prague composer Bedřich Smetana (1824–1884) was next to our hotel (Figure 1.28).

Figure 1.28: Monument to Czech composer Smetana. Photo by F. Habashi, 1998.

Art nouveau in Prague

Art Nouveau appeared in the early 1880s and vanished during World War I. It was a brief but brilliant art movement and style of decoration and architecture that made Prague one of the most beautiful cities in the world (Figures 1.29–1.65).

Figure 1.29: Art nouveau in Prague.

Figure 1.30: Art nouveau in Prague.

Figure 1.31: Art nouveau in Prague.

Figure 1.32: Art nouveau in Prague.

Figure 1.33: Art nouveau in Prague.

Figure 1.34: Art nouveau in Prague.

Figure 1.35: Art nouveau in Prague.

Figure 1.36: Art nouveau in Prague.

Figure 1.37: Art nouveau in Prague.

Figure 1.38: Art nouveau in Prague.

Figure 1.39: Art nouveau in Prague.

Figure 1.40: Art nouveau in Prague.

Figure 1.41: Art nouveau in Prague.

Figure 1.42: Art nouveau in Prague.

Figure 1.43: Art nouveau in Prague.

Figure 1.44: Art nouveau in Prague.

Figure 1.45: Art nouveau in Prague.

Figure 1.46: Art nouveau in Prague.

Figure 1.47: Art nouveau in Prague.

Figure 1.48: Art nouveau in Prague.

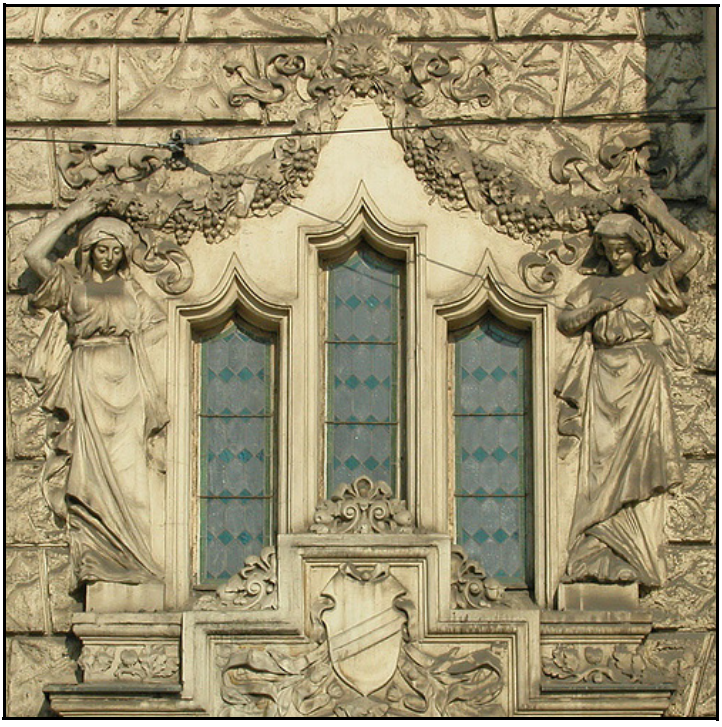


Figure 1.49: Art nouveau in Prague.

Figure 1.50: Art nouveau in Prague.

Figure 1.51: Art nouveau in Prague.

Figure 1.52: Art nouveau in Prague.

Figure 1.53: Art nouveau in Prague.

Figure 1.54: Art nouveau in Prague.

Figure 1.55: Art nouveau in Prague.

Figure 1.56: Art nouveau in Prague.

Figure 1.57: Art nouveau in Prague.

Figure 1.58: Art nouveau in Prague.

Figure 1.59: Art nouveau in Prague.

Figure 1.60: Art nouveau in Prague.

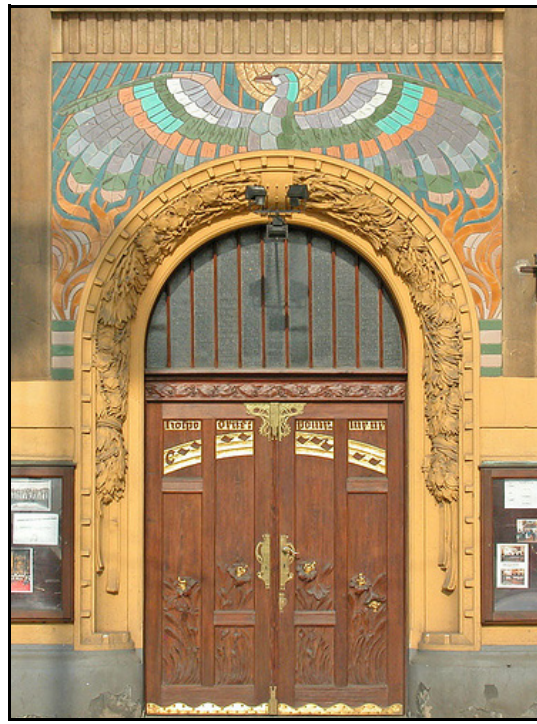


Figure 1.61: Art nouveau in Prague.

Figure 1.62: Art nouveau in Prague.

Figure 1.63: Art nouveau in Prague.

Figure 1.64: Art nouveau in Prague.

Figure 1.65: Art nouveau in Prague.

Karlštejn

Karlstein in German is a large Gothic castle (Figures 1.66–1.67) founded 1348 AD by Charles IV, Holy Roman Emperor-elect and King of Bohemia (Figure 1.68). Located about 30 km southwest of Prague, it is an important tourist attraction.

Figure 1.66: Karlštejn Castle.

Figure 1.67: Karlštejn Castle.

Figure 1.68: Karel IV [Karl, Charles] of Luxemburg.

Kutná Hora

Not far from Prague is Kutná Hora, to the west, which was an important silver mining district in the 13th and 14th centuries. About 20 tons of silver were extracted every year and this contributed to the prosperity of the Kings of Bohemia. Kutná Hora was the second most important town after Prague in the Kingdom of Bohemia in the Middle Ages. It was in the same period that the King Wenceslas II decided to take the existing denarii out of circulation, close the mints in Prague, Brno and other locations, and introduce a new currency system based on the so-called Prague groschen (Figure 1.69). This coin, struck in Kutná Hora from high-quality silver, was to become one of medieval Europe's most valuable currencies in the centuries that followed.

Figure 1.69: Prague groschen.

The currency reform enabled King Wenceslas II to win the Polish crown, and soon afterwards the Hungarian throne. The King of Bohemia became one of the most influential and powerful monarchs. Moreover, the proceeds from mining activities were utilised to finance architectural and artistic projects. The Italian Court (Figure 1.70) in Kutná Hora became the central mint of the Czech Lands, where the groschen was struck under the supervision of Italian mint masters. In the mid 14th century the large St. James church was erected (Figure 1.71). The town was home to approximately sixty thousand inhabitants, and people from all over Europe came to work in the silver mines and workshops operating at that time.

During the Hussite wars, Kutná Hora witnessed a series of disputes between the affluent burghers and the nobility concerning silver mining and religious beliefs. In a fierce battle fought outside Kutná Hora's walls in 1422, the Czech Hussite commander and his troops of Prague residents defeated the army led by King Sigismund. In 1496, Kutná Hora became the scene of miners' riots which ended in the execution of their leaders.

Figure 1.70: The Italian Court.

Figure 1.71: St. James church.

With the gradual exhaustion of silver deposits, the town's importance began to wane. In 1547, the local mint halted production of the groschen and less than two centuries later it had discontinued its operations altogether. By the end of the century more than 600 structures had been erected in the town, many of them were genuine architectural masterpieces. Amongst them was the Cathedral of St. Barbara (Figure 1.72), patron saint of miners. The miners, whose dangerous profession often threatened them with death without holy sacraments, esteemed her as their patron saint. The Cathedral was completed in the mid-16th century. Its construction was interrupted for more than half a century owing to the Hussite wars.

In 1620 the Jesuit Order settled in Kutná Hora with the aim of overseeing the re-conversion to Catholicism there. By this time the mines were becoming exhausted and there was a lack of means for further furnishings and the maintenance of their cathedral. In 1626 the cathedral was placed under the administration of the Jesuits. They built their college in its vicinity. Their activity, however, came to an end in 1773, when the order was abolished.

Figure 1.72: Santa Barbara church.

Bruntál

Bruntál (Figure 1.73), known to Germans as Freudenthal, was a medieval gold mining town famous of its castle. During Austro-Prussian War in 1866, the town was occupied by the Prussian Army and the Castle served as a hospital for soldiers.

Figure 1.73: Main Square, Bruntál.

HMZ started in 1976 as a part of the National Enterprise of Ore Mines for processing polymetallic ores of nonferrous metals from nearby deposits. After the 1989 revolution the mines were shut down and the original plans were abandoned. In 1990 the independent state enterprise HMZ was established to produce tungsten powder and cobaltous carbonate from cemented carbide (Figure 1.74). This production was extended in 1991–1993 to include cobalt sulfate for animal feed and calcium chloride for pharmaceutical and food industries. In 1993, the Czech Government approved the privatisation project of HMZ as joint stock company. Production of magnesium chloride hexahydrate from Slovakian magnesite was later added.

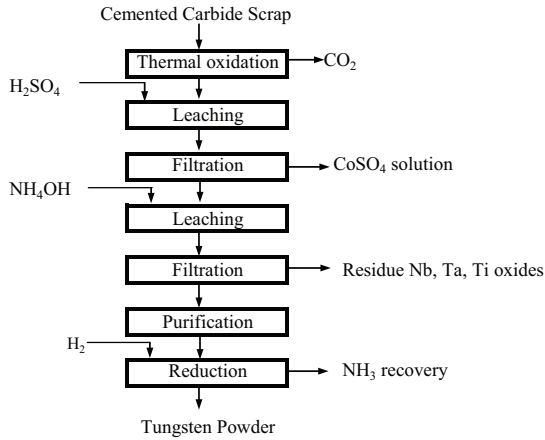


Figure 1.74: HMZ process for processing cemented carbide scrap.

Ostrava

Ostrava is an old coal mining town in Moravia and at present is an important cultural (Figures 1.76–1.77) , industrial and university centre. It is famous for high quality crystal glass products (Figure 1.78). At the end of World War II, Ostrava was liberated by the Soviet Army (Figure 1.79). In the outskirts of the city there is a large rock remaining from the Ice Age (Figure 1.80).

Figure 1.75: With Bruntál engineers. From right: Jan Palme, Jiři Lazniča. Photo by Nadia Habashi 1998.

Figure 1.76: Ostrava Museum.

Figure 1.77: Ostrava Theatre.

Figure 1.78: Chandeliers and other glass products are widely available in Ostrava.

Figure 1.79: Russian monument for the liberation of Ostrava April 30, 1945. Photo by Nadia Habashi, 1998.

Figure 1.80: Ice Age rock. Photo by Nadia Habashi, 1998.

Mining Museum

The Museum (Figure 1.81) was founded in 1905 and was opened on December 4th 1993 on St. Barbara's day. In 1843 Viennese banker Salomon Mayer Rothschild bought this mine and he willed it to his son Salomon Anselm. The shaft was renamed after him as mine Anselm. The mine is situated near a confluence of the rivers Odra and Ostravice.

Figure 1.81: Entrance to Ostrava Mining Museum. Photo by Nadia Habashi, 1998.

The Mining University

The Mining University was originally founded in Příbram in 1849 after the Hungarian uprising and teaching in the Mining Academy in Schemnitz was converted from German to Hungarian. In 1951, the school was moved to its present location Ostrava-Poruba and specialized in coal mining and steelmaking.

Brno

Brno, the capital of Moravia, is the second largest city in the Czaech Republic after Prague (Figures 1.82–1.84). It was the home Gregor Mendel (1822–1884) (Figure 1.85), the friar at the Augustinian Abbey of Saint Thomas of German descent who is accredited for founding the science of heredity. His name is given to the University of Agriculture and Forestry in Brno where a his bust also stands (Figure 1.86). He also appears on at least two postage stamps issued in his honour (Figures 1.87–1.88).

Figure 1.82: Brno fountain in the market place.

Figure 1.83: A fountain in Brno.

Figure 1.84: Entrance to the Academy of Music in Brno. Photo by Fathi Habashi, 1998.

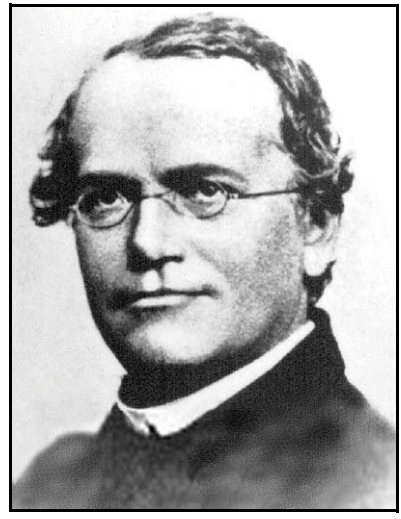


Figure 1.85: Gregor Mendel (1822–1884).

Figure 1.86: Mendel's bust at University of Agriculture and Forestry in Brno.

Figure 1.87: Austrian stamp honouring Mendel.

Figure 1.88: City State Danzig stamp.

Austerlitz

It was in Austerlitz [the present Czech name is Slavkov] 20 km south east of Brno that Napoleon won one of his major battles, the Battle of Austerlitz on December 2, 1805 (Figures 1.89–1.93). The battle is commemorated in Paris in the Gare Austerlitz and the in Place Vendôme where the Column was modelled after Trajan's Column in Rome, to celebrate the victory of Austerlitz; its veneer of 425 spiralling bas-relief bronze plates were made out of cannons taken from those captured at Austerlitz. In this battle Napoleon defeated the Austrian and Russian armies.

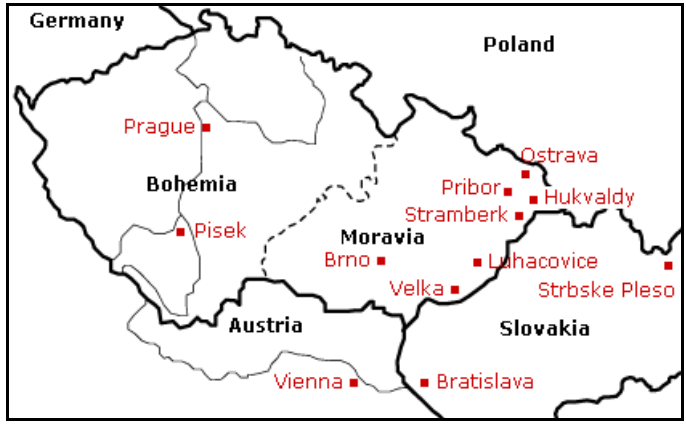


Figure 1.89: Austerlitz is 20 km SE of Brno in Moravia.

Figure 1.90: The battle ground of Austerlitz with the monument in the centre.

Figure 1.91: Monument to the Battle of Austerlitz.

Figure 1.92: The Battle of Austerlitz by François Gérard (1770–1837), in Versailles.

Figure 1.93: Austerlitz castle where the peace agreement was signed.

Příbram

Příbram (Figure 1.94) is located on the Litavka River 60 km south-west of Prague. The city was an important mining district where a Mining Museum now displays the mining heritage of the area (Figures 1.95–1.96). The School of Mines that was founded here in 1849 was moved to Ostrava after World War II. The Chapel of the Svatá Hora shrine (Holy Mountain) dedicated to Virgin Mary is a landmark (Figure 1.97).

Figure 1.94: A general view of Příbram.

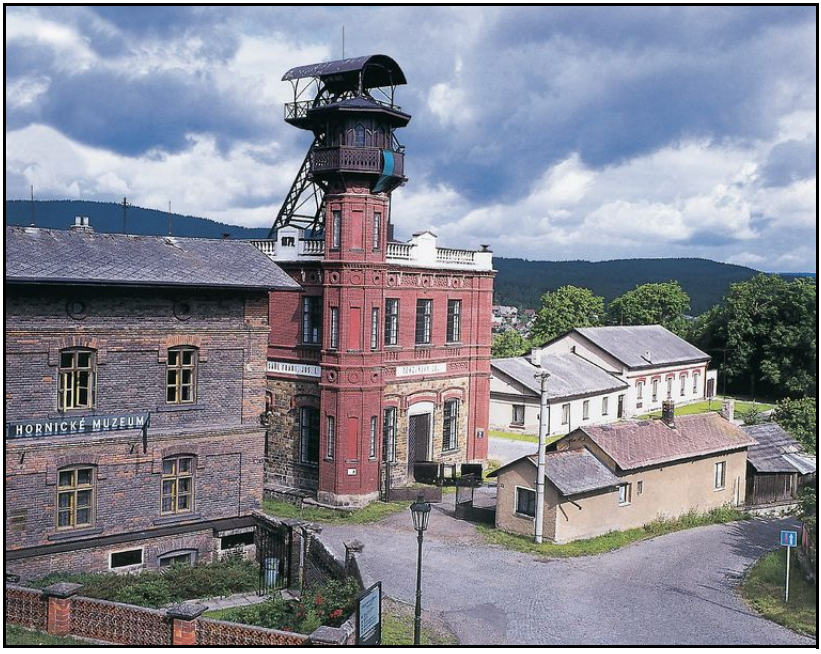


Figure 1.95: Mining Museum.

Figure 1.96: Entrance to the Mining Museum [Photo by Nadia Habashi, 2000].

Figure 1.97: Chapel of the Svatá Hora shrine (Holy Mountain) dedicated to Virgin Mary.

Jáchymov

Joachimsthal (Figure 1.98) (Joachim's Valley) is Jáchymov in Czech and the Erzgebirge (Ore Mountains) is Krušné Hory[1]. The history of uranium is closely connected with the silver mining town Joachimsthal in the Erzgebirge on the border between Saxony and Bohemia (Figure 1.99). The town was founded in 1516 when few years earlier silver was discovered. The town was named after its patron Saint Joachim, Mary's father. The word "dollar" is derived from "Thaler," the large silver coin minted at Joachimsthal during the sixteenth century (Figures 1.100–1.101).

Figure 1.98: A view of Jáchymov.

[1] The German names are used here in the text when the Kingdom of the Lands of Czech consisting of Bohemia, Moravia, and Silesia were part of the Austrian Empire while the Czech names after World War I when the Republic of Czechoslovakia was founded.

Figure 1.99: Location map of the Ore Mountains [Erzgebirge] showing Joachimsthal and Freiberg.

Figure 1.100: A replica of the 1520 Thaler issued in 1967 during Expo Montreal showing St. Joachim on one side.

Figure 1.101: The tower remaining from Joachimsthal Mint [May 2000].

Georgius Agricola (1494–1555), the medical doctor from Chemnitz, used to visit the mines in the region to examine the miners. A plaque marks his visits (Figure 1.102). As a result of his visits to this region, Agricola became interested in mining and metallurgy and wrote a number of books on these subjects that were used for over two centuries after his death.

It was there in Joachimsthal that uranium was discovered but uranium industry went through many stages of prosperity and depression with different industrial products other than uranium until finally uranium became the most sought after metal during World War II which started in Europe in 1939. It was from there that the Austrian government permitted that 100 kg of the waste material from the Joachimsthal uranium-based pigment factory to be dispatched to Paris for the Curies. Marie Curie succeeded in the isolation of polonium in 1898 followed by radium in December of the same year. Between 1898 and 1902, the Curies then purchased 11 tonnes of the residue from the Austrian government to process them for the production of radium and for further research.

Figure 1.102: A plaque in Joachimsthal marking Agricola's visits to the town.

Karlovy Vary

Karlovy Vary (German: Karlsbad, English: Carlsbad) is a spa city situated in western Bohemia, approximately 130 km west of Prague and a short drive from Joachimsthal. It is named after King of Bohemia and Holy Roman Emperor Charles IV, who founded the city in 1370. It is historically famous for its hot springs (Figures 1.103–1.104) and jewellers selling deep red garnets (Figure 1.105).

Figure 1.103: Spa city Carlsbad.

Figure 1.104: Spa city Carlsbad.

Figure 1.105: Garnets from Bohemia.

SLOVAK REPUBLIC

Košice

Košice has only 250 000 population [1991] but is one of the most beautiful cities of Europe. It was recognized by UNESCO as a World Heritage City. It is the seat of the only Metallurgy Faculty in Slovakia. There is also a university in the city founded in 1657, an impressive Opera House (Figure 1.107), a Cathedral (Figure 1.108), and numerous museums.

Figure 1.106: Map of Slovak Republic showing the capital Bratislava in the west and Košice in the east.

Figure 1.107: Košice Opera House.

Figure 1.108: Cathedral.

Košice was saved from the Tatar invasion in the Thirteenth Century, and in the Fifteenth Century she was an important trade centre and one of the largest towns in Central Europe. Its growth was barred by the Turkish invasion of Europe in the Sixteenth Century when the trade routes from the Balkan to the Baltic had to be shifted westward. The invasion also led to the rebuilding of the town into a huge anti-Turkish fortress. The nobility from Hungary sought refuge there.

Historical sites are very well marked in Košice, e.g., there is a memorial plaque on the building where the Russian Marshal Kutuzov was accommodated on his way from Austerlitz [now Slavkov in Moravia, Czech Republic] back to Russia after losing the battle with Napoleon (Figure 1.109). Košice was liberated by the Soviet Army at the end of World War II (Figure 1.110).

East Slovak Artistic Casting Museum

This museum is also in the centre of town and is housed in a 15th century building in form of a tower 45 metres high known as Urban Tower (Figure 1.111). The collection shows the skill of the Slovak blacksmith of the Middle Ages and the Renaissance: An excellent collection of bells, crosses, candle holders, kitchen ovens, farm tools, swords, cannons, statues, metallurgical crucibles and tongs, decorative picture frames, jewellery, etc. There is a copy of a Czech translation of Agricola's book *De Re Metallica*, extensive drawings showing methods for bell castings, etc.

Figure 1.109: Memorial plaque on the building where the Russian Marshal Kutuzov was accommodated on his way from Austerlitz [now Slavkov in Moravia, Czech Republic] back to Russia.

Figure 1.110: Russian war memorial for World War II.

Figure 1.111: Urban Tower.

A church bell installed in the tower has been dedicated to Saint Urban, the patron of vine-dressers. The bell weighing 7 tons was cast in 1557. In 1966 the tower was damaged by fire and the Bell was destroyed as well. The re-constructed tower was re-opened in 1971 and serves now as an exhibition of foundry work. The renovated bell is now located in the front of the tower (Figure 1.112).

Technical University of Košice

Technical University of Košice (Figures 1.113–1.114) was founded in 1950. Rector: Dr. Ivan Hrivňák, professor of welding engineering and President of the International Welding Society. The University is composed of four faculties: Mining, Metallurgy, Civil Engineering, and Law. Dean of the Faculty of Metallurgy is Dr. Ivan Imriš, professor of extractive metallurgy (Figure 1.115). His wife, Ludmilla Komorova, is a professor of physical chemistry. The faculty is composed of the following departments: Chemistry, Physics, Mathematics, Metallurgy and Materials, and Fuels. Head of Metallurgy Department: Miroslav Štofko (Figure 1.116). Tomas Havlik

became Chairman in 2000 (Figure 1.117). Other senior faculty members is Jiří Schmiedl (Figure 1.118). A seminar was organized in 2007 (Figure 1.119).

Figure 1.112: Urban bell.

Figure 1.113: Technical University.

Figure 1.114: Leaving the residence of the Technical University. Photo by Nadia Habashi, 1991.

Figure 1.115: With Dean Ivan Imriš at home, 1991.

Figure 1.116: With Miroslav Štofko at home, 1991.

Figure 1.117: With Tomas Havlik at TMS conference in Anaheim, California. Photo by Nadia Habashi 1996.

Figure 1.118: With Jiří Schmiedl at TMS conference in Las Vegas, Nevada. Photo by Nadia Habashi 1995.

This Seminar will be held on

April 12, 2007

at 09:00 a.m.

at

University Main Building
Letná 9, Košice

room 435

Seminar Programme

09:00 **Karel Tomášek**, *dean of faculty, Technical University of Košice*
Welcome speech

09:10 **Fathi Habashi,** *Laval University in Quebec, Canada*
The Future of Extractive Metallurgy

09:50 **Olof Forsén,** *Helsinki University of Technology, Espoo, Finland*
Concentrated Cupric Chloride Solutions: Possibilities Offered in Copper Production

10:20 Coffee break

10:40 **Tomáš Havlík,** *Technical University of Košice, Faculty of Metallurgy*
The Microwave Leaching of Chalcopyrite

11:10 **Heikki Jalkann,** *Helsinki University of Technology, Espoo, Finland*
Challenge of Modeling of High-temperature Processes - BOF as an Example

11:40 **Andrea Mišikufová,** *TechnicalUniversity of Košice, Faculty of Metallurgy*
The Processing of Aluminum Industrial Wastes

12:10 **Ivan Imriš,** *Technical University of Košice, Faculty of Mechanical Engineering*
Energy Recovery From Waste and Biomass by Plasma Process

Seminar Organizing Committee

Technical University of Košice
Faculty of Metallurgy
Department of Non-Ferrous Metals and Waste Treatment
Letná 9, 04200 Košice
SLOVAKIA

Contact persons:

Martina Laubertová
e-mail: martina.laubertova@tuke.sk
phone: +421 55 602 2400
fax: +421 55 602 242

Zuzana Hoang Trung
e-mail: zuzana.hoang.trung@tuke.sk
phone: +421 55 602 2426
fax: +421 55 602 242

Magdaléna Štofková
e-mail: magdalena.štofkova@tuke.sk
phone: +421 55 602 2402
fax: +421 55 602 242

http://www.tuke.sk/hf-knkaso

Figure 1.119: Seminar 2007.

Technical Museum

The museum is located in the centre of town in an old palace (Figure 1.120); director: Ing. Maria Šarudyova (Figure 1.121).

Figure 1.120: Slovak Technical Museum.

Figure 1.121: With Museum Director Ing. Maria Šarudyova. Photo by Nadia Habashi, 1991.

In this museum, the visitor can learn about the most important inventions and discoveries in the making of iron, copper, and gold, metal casting

and metal forming. Among exhibitions from the early days of metallurgy in Slovakia there are copper, bronze, and iron products of ancient foundries and blacksmiths, medieval artistic castings, hammer mills, an old bellow (Figure 1.122) and models of water wheels used for powering the hammer mill.

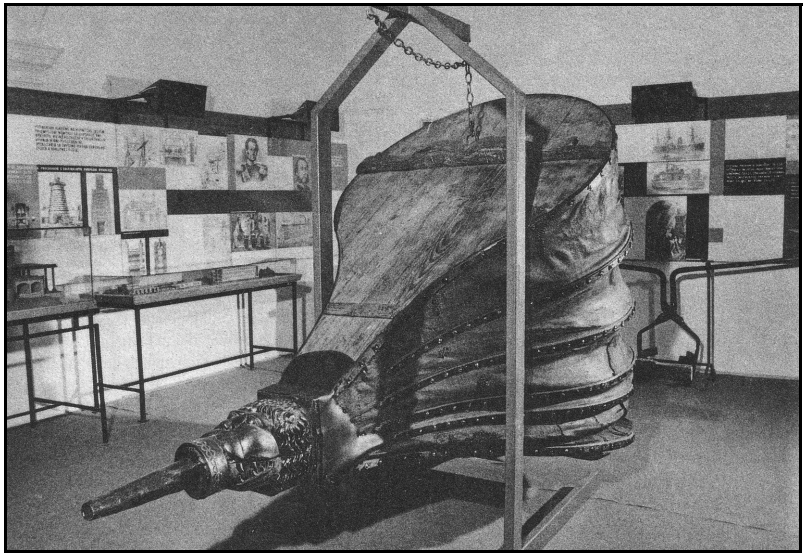


Figure 1.122: A large Middle Age bellow for blowing air in a blast furnace.

The exhibition concerning today's metallurgy explains the significance of the East Slovak Steel Works on a 1:1 000 scale model of the Works (Figure 1.123), a working model of a blast furnace and an electric panel showing the function of air heaters for a blast furnace. Other branches of metal making such as powder metallurgy, rolling and pressing of metals, production of aluminum, titanium, lead and silver, high frequency tempering, surface finishing, production of ferroalloys, etc. are also shown. The 1:50 scale model of a Siemens–Martin furnace is also interesting. Owing to the courtesy of metallurgical plants in Slovakia the exhibition is also furnished with original tools such as ingot forms, vessels, rolling and casting tools and samples of different metallurgical products and techniques.

The Museum includes, besides metallurgy exhibits and artistic castings (Figures 1.124–1.126), an excellent underground mine model (Figure 1.127) with all old and modern equipment, as well as other exhibits on energy, astronomy and others.

Figure 1.123: Model of a blast furnace plant.

Figure 1.124: A statue of a metal worker at the Museum.

Figure 1.125: A 1580 cast bronze door at the Museum.

Figure 1.126: Details from the centre of the bronze door.

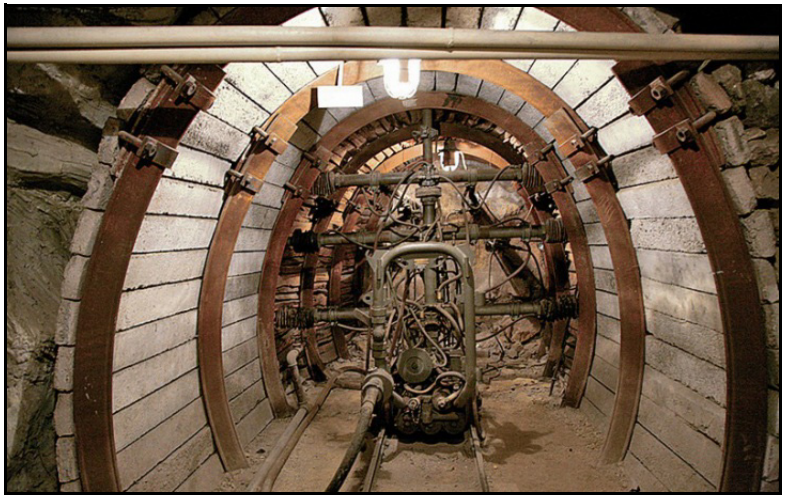


Figure 1.127: Mining section at the Slovak Technical Museum.

Figure 1.128: Demonstrating forging of red hot iron at Medzev.

Medzev Forge

Medzev is a Middle Age settlement 25 kilometres west of Košice famous of its numerous iron works that produced iron articles for home, agriculture, and war effort. Its products were exported all over Europe. There were 107 forges scattered in the forest of the region operated for at least 400 years. Only one of the old forges is restored and kept operating for demonstrating purposes (Figure 1.128). One can see a water wheel with controlled water supply to operate its bellows for the coal bed where iron is heated, and power an iron hammer for forged red hot iron.

East Slovakian Museum

A small but excellent museum housed in an imposing palace (Figure 1.129), displays the history of the Slovak people from ancient time to the present day. There is an important collection of 2 500 gold coins dating back to the 18th century that was discovered in a box buried under a building in Košice (Figure 1.130). The treasure was discovered in 1935 when the building was reconstructed.

Slovak Academy of Sciences

The Slovak Academy of Sciences was founded in 1942, closed after WWII, and then re-founded in 1953. Host: Dr. Peter Balaž, Department of Geotechnics.

Figure 1.129: East Slovakian Museum.

Figure 1.130: Part of the 18th-century gold coins discovered in Košice.

Levoče

Levoče is a small beautiful Middle Age town, 50 km northwest of Košice, founded about 1245 and flourished between the 14th and 17th centuries when it ranked among the largest towns not only of Slovakia but also in the whole of Hungary, and was an important centre of trade, crafts, and art. At that time Slovakia was part of Hungary and was known as Upper Hungary It is famous of the carved wood alter at Saint James Church, 19 m high and 6 m wide — the largest wood-carved Gothic alter in the world (Figure 1.131). Other works of the artist are preserved in a museum. The old Town Hall is also an excellent museum with paintings, swords, old books, etc.

Krásna Hôrka

This is a castle (Figure 1.132) built in the 13th century to protect the trade route in the district and is 65 km west of Košice. It gradually changed into a Renaissance feudal residence; its owners from 1585 to 1945 were the rich and influential Hungarian lords the Andrassy family. The castle is now converted into a museum devoted to the development of the feudal culture and military techniques in medieval time (Figures 1.133–1.134).

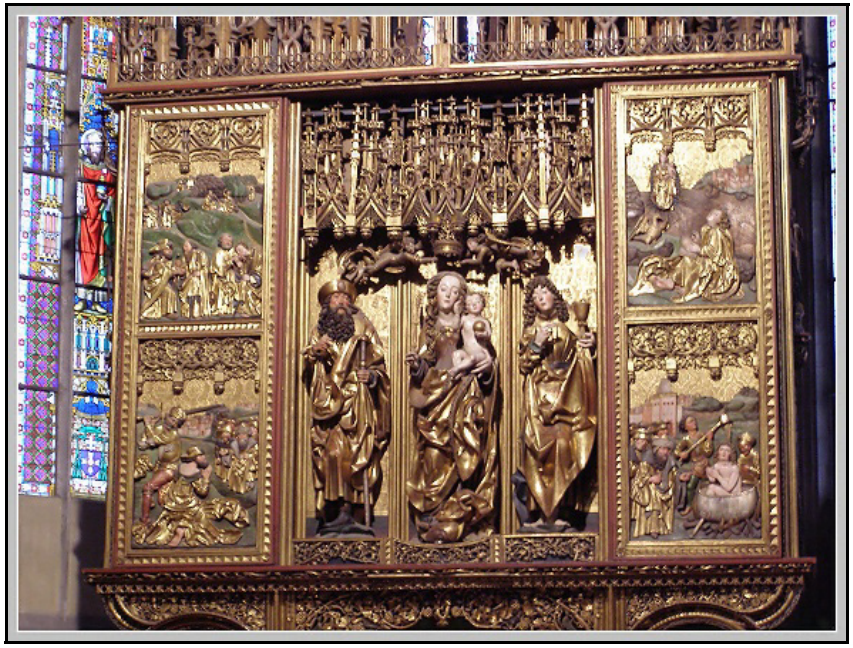


Figure 1.131: Part of the carved wood alter at Saint James Church.

Figure 1.132: Krásna Hôrka.

Figure 1.133: Furniture inside the castle.

Figure 1.134: Furniture inside the castle.

Beltiar Palace

In the neighbourhood of Krásna Hôrka is the Beltiar Palace (Figures 1.135–1.138) that also belongs to the Andrassy family and dates back from the Thirteenth Century. It is said to have a library containing 20 000 books dating from the 18th and 19th centuries, a large ceramic and porcelain collection, classical style furniture, paintings. Napoleon spent a night there during his campaign in Austerlitz.

Figure 1.135: Beltiar Palace.

Figure 1.136: Beltiar Palace Library.

Figure 1.137: Inside Beltiar Palace showing a portrait of Napoleon.

Figure 1.138: Inside Beltiar Palace.

Banská Štiavnica

Banská Štiavnica (Figure 1.139) (Banská means mining, during the Austrian Empire it was known as Schemnitz) was an important mining town in the Middle Ages, had the world's first mining school, the world's first use of gunpowder in its mines in 1640s, the world's first scientific conference (held in 1786, i.e., nearly three quarters of a century before the first International Chemistry Congress held in Karlsruhe in 1860), the world's first scientific society, and the world's first year book on mining. A great part of these activities was due to the distinguished Austrian metallurgist Ignaz von Born (1742–1791) (Figure 1.140) who was Mines Superintendant in Schemnitz.

Figure 1.139: General view of Banská Štiavnica.

The School of Mines was founded in 1736 and after World War I when Czechoslovakia got her independence it was transferred to Miskolc in Hungary. The building of the school was restored and now used as a secondary school (Figure 1.141).

Figure 1.140: Ignaz von Born (1742–1791).

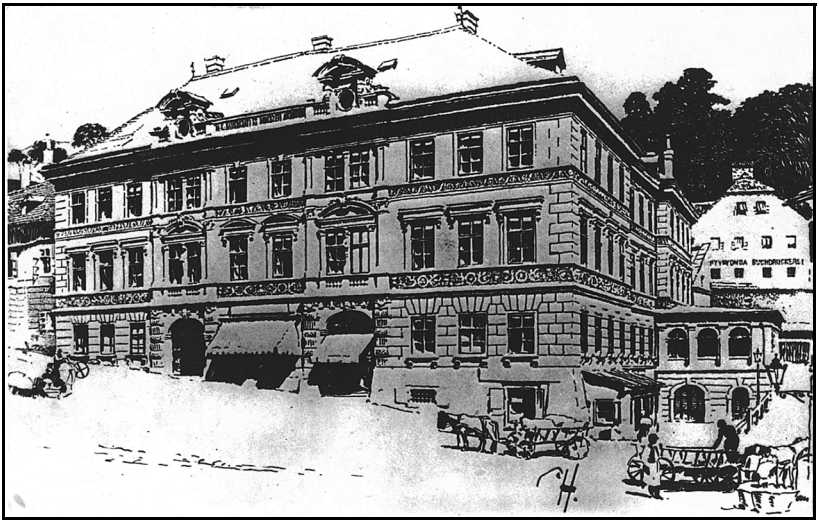


Figure 1.141: The building housing the former School of Mines.

Mining Museum Library & Archives

Figure 1.142: Meeting with former Museum Director Jan Jancsy [second from right] and actual Director Ivan Herčko [first from left].

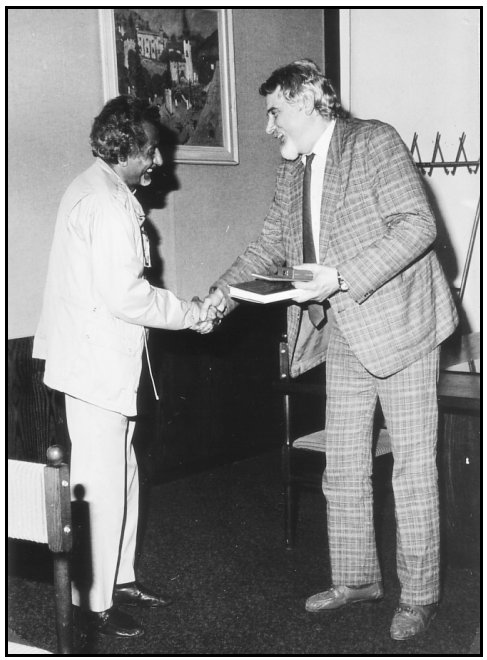


Figure 1.143: Museum Director Ivan Herčko presents souvenirs to the writer.

Figure 1.144: A souvenir letter for the visit signed by Director Ivan Herčko.

Figure 1.145: Examining old books at the Museum. Photo by Nadia Habashi 1991.

Figure 1.146: With Museum Director Ivan Herčko.

Not far from Banská Štiavnica are Kremnitz, the seat of mint during the Austrian-Hungarian Monarchy, and Banská Bystrica, another important old mining town. Lead–silver–copper ores were depleted and the old smelter lies in ruins. However, the town is full of historic monuments related to mining and metallurgy, and was recognized by UNESCO as a World Heritage.

Mining Museum

This is an old mine that is no longer in exploitation and used as a museum. The underground gallery is 112 km long. At the entrance, there is a memorial plaque noting the visit of Prince Leopold in July 1764 and his brother Crown Prince Joseph. Both became Emperors of Austria and Hungary. The mine was one of the largest mines in Europe for gold, silver, copper, mercury, and antimony. It is well-illuminated contains mining equipment, old and new, models and explanations, methods of breaking rocks by burning wood before using gun powder, ore transportation, mine ventilation, water pumping, etc.

Kammerhof

The numerous museums in Banská Štiavnica are administered by Ing. Ivan Herčko, who occupies the same office that was used by Born. The

National Museums Office (the building is known as Kammerhof) has a large library of books on mining, metallurgy, law, etc., well organized and in charge of which is a capable archivist. Ing. Herčko is the successor of Dr. Jan Jancsy whose family resided in Banská Štiavnica nearly four centuries and he is a graduate of the University of Budapest. Attached to the National Museums is Ing. Milan Hock who made an excellent M.Sc. Thesis on the history of mineral dressing under Prof. Josef Vozar at the Slovak Academy of Science in Bratislava. The units belonging to the National Museums that were visited were the following.

Berggericht

This is a German word meaning Mining Court and the building functioned as such from the Fifteenth Century, and was a former seat of the Mining and Forestry Academy and later the first mining museum in Slovakia (from 1927). Today, there is a mineralogical exhibit.

Klopaka

This word translates the "Clapper"; built in 1681. Miners were awoken by the sound of the wooden hammer against the wooden board. Today, it is an excellent mining museum showing mining tools, mine surveying, mining lamps, boring and blasting, models of mineral dressing plants, stamp mills, etc.

Nový Zámok

This is the New Castle built in 1571 as a watchtower against the Turkish invasions, now it houses an excellent museum showing the anti-Turkish struggle in Slovakia: weapons, portraits, utensils, etc. The Turks never occupied Slovakia.

Antal Castle

This castle was founded in 1744 by Hungarian lords, contains over 4 000 oil paintings of people and pictures hanging on the walls; it seems that none of them were ever published in art or history books. None of them is available as reprint. The castle also houses a natural history museum.

Sered and Ziar nad Hronom

Niklova Huta, Sered

This nickel hydrometallurgical plant was founded in 1963 to produce nickel from imported Albanian laterite. The cost of transport is prohibitive: the ore is charged by ship to the Black Sea and there by barges through the

Danube to Sered. The process adopted is the Caron Process used in Cuba. Remarkably, however, there is no dust around the plant as in Moa, Cuba. The ore analyses 1.3% Ni, 45% Fe, 0.06% Co, 4–6% MgO. Reformed natural gas is used as a reducing agent for the ore. The residue after leaching is 50% Fe and 2.5% Cr; a mountain of this mineral is already there.

Products are 3 000 t/y electrolytic nickel, 60 t/y Co, 1 500 t/y $NiSO_4 \cdot 7H_2O$, and 20 t/y nickel powder by hydrogen reduction in a one-cubic metre autoclave. Electrolytic nickel is produced from H_2SO_4 solution, lead anodes and nickel cathodes. Cobalt is separated from the leach solution by precipitation with $(NH_4)_2S$. The plant is threatened of closing down because of its financial losses. There is interest in recovering the chromium from the residue but the technology seems to be unavailable and there is lack of capital. Meeting was held with Ing. Rudolf Melicher, Director of Research.

Aluminum Plant, Ziar nad Hronom

Ziar nad Hronom is next door to Sered and is the seat of the aluminum plant. Total production 200 000 t/year aluminum metal; people working in plant are 6 500. The plant is operated on a low-grade bauxite from Hungary and Yugoslavia and has two unique features:

- The use of the old Le Chatelier Process from treating the bauxite, i.e., heating with Na_2CO_3 at high temperature to form sodium aluminate — an energy intensive process that is threatening its shut down.
- The use of tube autoclaves (109 mm i.d., 1 600 metres long) in another circuit applying Bayer Process. The tube autoclaves were developed there and first piloted in the 1950s.

Bratislava

Bratislava lies on the Danube on the Eastern border with Austria; connected to Vienna by tram (20 minutes) and boat service on the Danube (Figures 1.147–1.150). The city was the coronation town of the kings and the queens of Hungary, has numerous palaces and museums, more than 150 scientific and research institutions, and is the seat of the Slovak Academy of Science.

Figure 1.147: Bratislava on the Danube. The castle on the top of the hill.

Figure 1.148: Main square.

Figure 1.149: National Theatre.

Figure 1.150: War Memorial.

Institute of Chemical Technology

Founded 1939 and has the following departments:

- Analytical Chemistry
- Inorganic Chemistry
- Inorganic Technology
- Automation of Chemical Processes
- Biochemical Technology
- Chemical Economics
- Physical Chemistry
- Plastics
- Silicates
- Nuclear Technology
- Mathematics
- Organic Chemistry
- Organic Technology
- Microbiology and Biochemistry
- Textiles, Cellulose, and Paper
- Central Chemical Laboratory

A meeting was held with Prof. Pavel Fellner, Chairman of the Inorganic Technology Department. Speciality in aluminum electrolytic process; a former co-worker of Prof. Kai Grjotheim in Oslo and Trondheim.

Figure 1.151: Mendeleev's Periodic Table at the Institute of Chemical Technology. Photo by Fathi Habashi, 1991.

Slovak Academy of Sciences

A meeting was held with Prof. Josef Vozar (Figure 1.152), of the Department of History. A distinguished Slovak historian who translated numerous German works on mining and metallurgy and published exten-

sively on these subjects. Now retired, spoke only German as foreign language.

Figure 1.152: With Prof. Josef Vozar [Photo by Nadia Habashi, 1991].

Chapter 2

Hungary

Introduction 96
Budapest..... 101
Miskolc..... 119
The Castle..... 111
Hungarian National Museum . 113
National Museum for Science and Technology 116
Casting Museum..... 118
Technical University of Miskolc 120
The Schemnitz Museum Library 126
Lillafüred..... 130
Eger 135
Rapeseed..... 139
Goulash..... 140

Figure 2.1: Flag of Hungary.

INTRODUCTION

Following a Roman occupation from AD 9 to 430, the foundation of Hungary was laid in the late 9th century by the Hungarian prince Árpád (ca. 845–907) (Figure 2.2), who unified the Magyars and the Avars in the Carpathian Basin. They originated from an ancient Uralic-speaking population that formerly inhabited the forested area between the Volga River and the Ural Mountains. Some historians believe that the Hungarians were descendants of the Huns from which the name Hungary is derived.

Árpád's great-grandson, Saint Stephen I (967–1038) (Figure 2.3), Christianized the Hungarians and received a crown from the Pope in 1000 AD. The settlement was pillaged by the Mongols in 1241–1242 but recovered during the rule of King Matthias (1443–1490). In 1526, near Mohács, the forces of the Kingdom of Hungary were defeated by Sultan Suleiman the Magnificent. The Ottoman victory led to the partition of Hungary between the Ottoman Empire and the Habsburg Monarchy. The Kingdom was occupied by Ottomans from 1541 to 1699 when it was then integrated into the Habsburg Monarchy.

Figure 2.2: Statue of Prince Árpád (845–907) in Heroes' Square in Budapest.

Figure 2.3: Monument of Saint Stephen (967–1038), king of Hungary, in Budapest.

Revolutions led by national heroes: Ferenc Rákóczi (1676–1735) (Figure 2.4) and Lajos Kossuth (1802–1894) (Figure 2.5) were suppressed. Finally, in 1867 the Austria–Hungary monarchic union was formed as a result of a Compromise [German: Ausgleich] under which the House of Habsburg agreed to share power with the separate Hungarian government (Figure 2.6).

The dual monarchy was dissolved on 31 October 1918 during World War I (Figure 2.7). Hungarian communists under Béla Kun (1886–1938) seized power in 1919 and proclaimed a Soviet Republic. In 1920, Admiral Miklós Horthy (1868–1967) (Figure 2.8) was declared Head of State and entered into an alliance with Nazi Germany.

In October 1944, he was forced to resign. After World War II, the Communists took over in 1947 until the so-called Counter Revolution of October 1956 which brought dictator János Kádár in power and the fleeing of tens of thousands of Hungarians to the West. In 1988 the system collapsed and Hungary became a Western democracy. A World War II Russian monument was erected on the top of the hill in Buda (Figures 2.9–2.10).

Figure 2.4: Ferenc Rákóczi (1676–1735).

Figure 2.5: Lajos Kossuth (1802–1894).

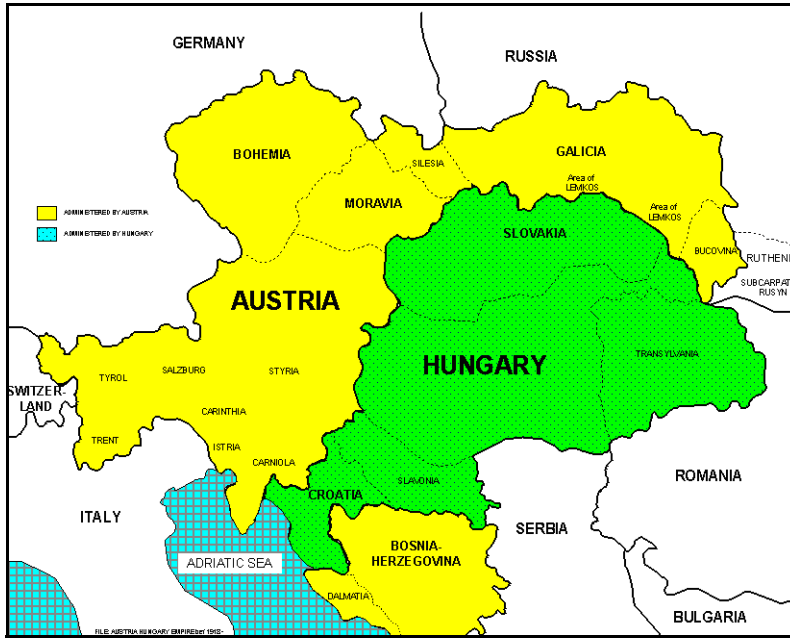


Figure 2.6: Hungary as part of the Austrian Empire.

Figure 2.7: Hungary today.

Figure 2.8: Miklós Horthy (1868–1967).

Figure 2.9: Liberation monument in remembrance of the Soviet liberation of Hungary from Nazi forces in 1947.

Figure 2.10: Details of Liberation monument.

Table 2.1: Visits to Hungary.

Dates	City	Purpose of visit
June 1990	Budapest	National Museum for Science and Technology
June 1991	Miskolc	Schemnitz Museum Library
April 2007	Miskolc	University of Miskolc
	Lillafüred	Metallurgy Museum
	Eger	Castle
	Budapest	Casting Museum, National Museum, departure by train to Belgrade

BUDAPEST

Budapest became a single city occupying both banks of the Danube with a unification in 1873 of west-bank Buda with east-bank Pest (Figures 2.11–2.13). Many bridges were constructed but were blown up at the end of World War II by retreating armies. They were re-built after the war sometimes in different design. Major landmarks are the Houses of Parliament (Figure 2.15), the Opera House (Figure 2.16), the Hero Square (Figure 2.17), and the numerous fountains (Figures 2.18–2.20) and statues for distinguished Hungarians (Figures 2.21–2.23).

Figure 2.11: Elizabeth Bridge on the Danube connecting Buda on the left bank and Pest on the right.

Figure 2.12: Chain Bridge, the first in Budapest.

Figure 2.13: One of the two lions at the entrance to the Chain Bridge.

Figure 2.14: Kekesi family on top of Gellert Hill in Budapest, 2007.

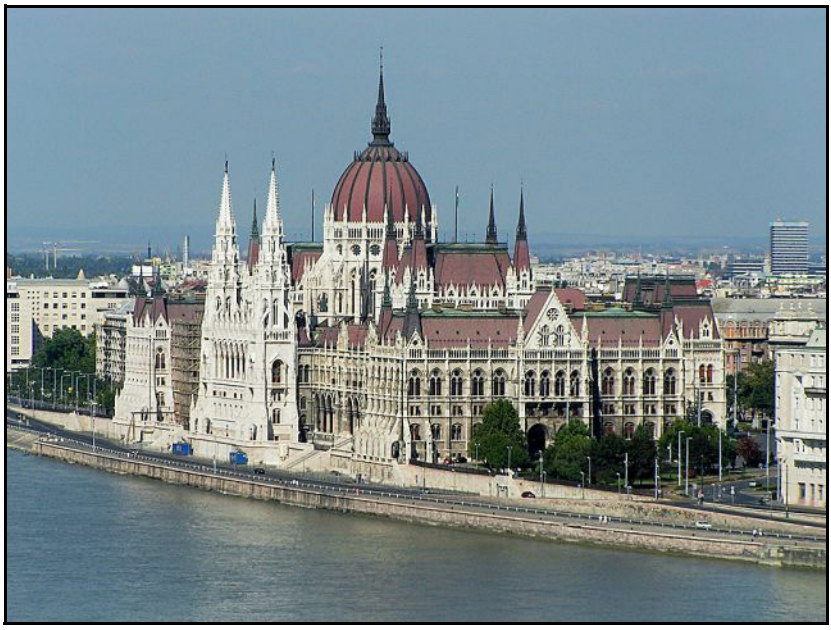


Figure 2.15: Parliament building.

Figure 2.16: Opera House.

Figure 2.17: Heroes' Square.

Figure 2.18: Railway Station.

Figure 2.19: Monument to War.

Figure 2.20: Monument to Peace.

Figure 2.21: King Matthias (1443–1490) is standing on the highest rock in hunting attire.

Figure 2.22: Monument to Elizabeth, Franz Josef's wife, crowned Queen of Hungary after the Ausgleich of 1867.

Figure 2.23: Monument to Dr. Ignaz Semmelweiss (1818–1865) pioneer of antiseptic procedures 20 years before Pasteur confirmed the germ theory. He died in a mental asylum at the young age of 47.

Baron József Eötvös de Vásárosnamény (1813–1871) was a Hungarian writer and statesman, spent many years in Western Europe, assimilating the new ideas both literary and political. He twice held the portfolio of public worship and instruction. In 1866, he was elected president of the Hungarian Academy. In 1879 a statue was erected in his honour at Pest in the square which bears his name (Figure 2.24). Eötvös collected works was published in 1891 in 17 volumes.

Figure 2.24: Eötvös monument.

Figure 2.25: Street lamps.

The Castle

The castle and palace complex of the Hungarian kings was completed in Buda in 1265 (Figure 2.27). There is a monument to the French-born soldier Prince Eugène (1663–1736) (Figure 2.28) who in 1697 liberated central Europe after a century and a half of Turkish occupation. He is also honoured in Vienna.

Figure 2.26: Street lamps.

Figure 2.27: The Castle, residence of the Kings of Hungary, now the President of the Republic.

Figure 2.28: Monument to Prince Eugene (1663–1736).

The Bastion (Figures 2.29–2.31) situated in Buda on the Castle hill, was built between 1895 and 1902. Its seven towers represent the seven Magyar tribes that settled in the Carpathian Basin in 896.

Hungarian National Museum

In 1848 the Hungarian National Museum (Figure 2.32) played a major role in the Hungarian Revolution. The monument of the Hungarian poet János Arany (1817–1882) is placed in the front where the crowd listened to speeches on the steps of the building. The Ethnographic Museum (Figure 2.33) documents the Hungarian culture.

Figure 2.29: The Bastion.

Figure 2.30: The Bastion.

Figure 2.31: The Bastion.

Figure 2.32: National Museum with the monument of the Hungarian poet János Arany (1817–1882).

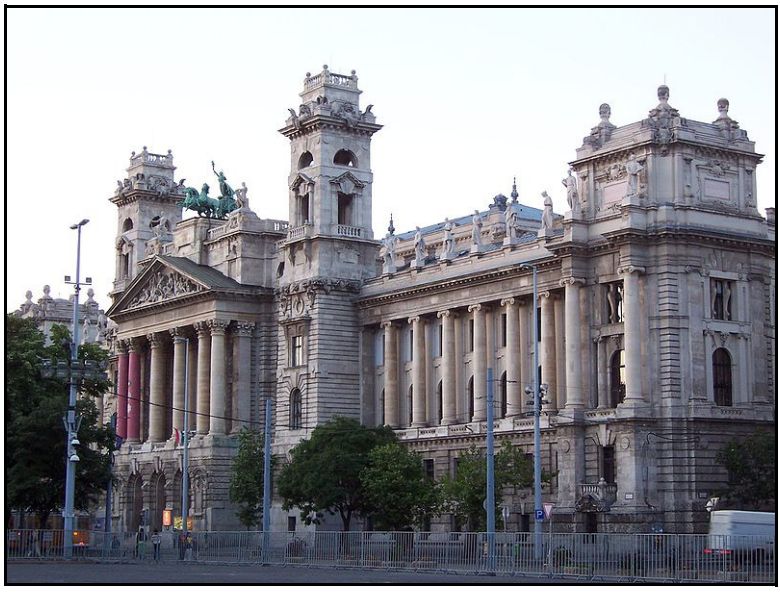


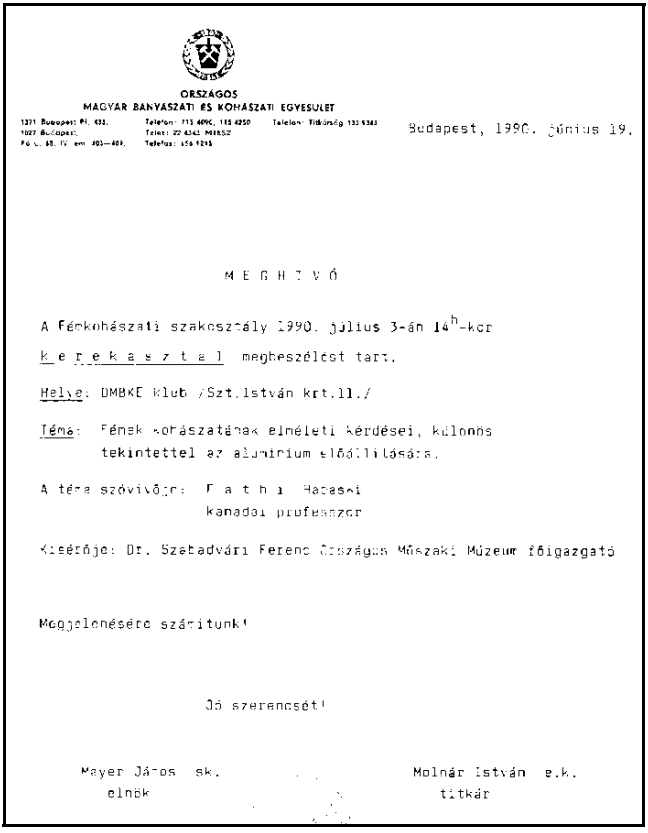
Figure 2.33: Ethnographic Museum.

Figure 2.34: National Museum for Science and Technology.

National Museum for Science and Technology

The National Museum for Science and Technology (Figure 2.34) documents the history of science and technology. Director Dr. Ferenc Szabadvary (1923–2006) (Figure 2.35), with whom a meeting was held in 1990, organized for me a lecture at the Hungarian Mining Society (Figure 2.36).

Figure 2.35: Dr. Ferenc Szabadvary (1923–2006), Museum Director.



ORSZÁGOS
MAGYAR BÁNYÁSZATI ÉS KOHÁSZATI EGYESÜLET

1371 Budapest Pf. 433. Telefon: 113 4090, 113 4250 Telefon: Titkárság 133 6383
1027 Budapest, Fő u. 68. I. em. 403—409. Telefax: 156 9295

Budapest, 1990. június 19.

M E G H Í V Ó

A Fémkohászati szakosztály 1990. július 3-án 14^{h}-kor

k e r e k a s z t a l megbeszélést tart.

Helye: OMBKE klub /Szt.István krt.11./

Téma: Fémek kohászatának elméleti kérdései, különös tekintettel az alumínium előállítására.

A téma szóvivője: P a t h a i Hatasai
kanadai professzor

Kísérője: Dr. Szabadvári Ferenc Országos Műszaki Múzeum főigazgató

Megjelenésére számítunk!

Jó szerencsét!

Mayer János sk.
elnök

Molnár István e.k.
titkár

Figure 2.36: Announcement for my lecture at the Hungarian Mining Society, 1990.

Casting Museum

The Casting Museum was originally a foundry and a machine shop established in 1844 in Buda by Ábrahám Ganz (1814–1867) (Figure 2.37), a Swiss-born Hungarian. The foundry closed in 1964 and was transformed into a museum (Figure 2.38).

Figure 2.37: Ábrahám Ganz (1814–1867).

Figure 2.38: Casting Museum Director Katalin Lengyelne-Kiss, 2007.

MISKOLC

The Turks burnt Miskolc in 1544 and the city had to pay heavy taxes. It was during these years that Miskolc became an important centre of wine-growing.

Figure 2.39: Main Square.

Figure 2.40: Monument to national hero Lajos Kossuth (1802–1894) in Elizabeth Square.

Technical University of Miskolc

In 1949 the University of Miskolc was founded (as a successor of the Academy of Mining, formerly in Selmecbánya [Schemnitz in German], which is now Banská Štiavnica, Slovakia. The university was visited in 1990 and in 2007 (Figures 2.41–2.50).

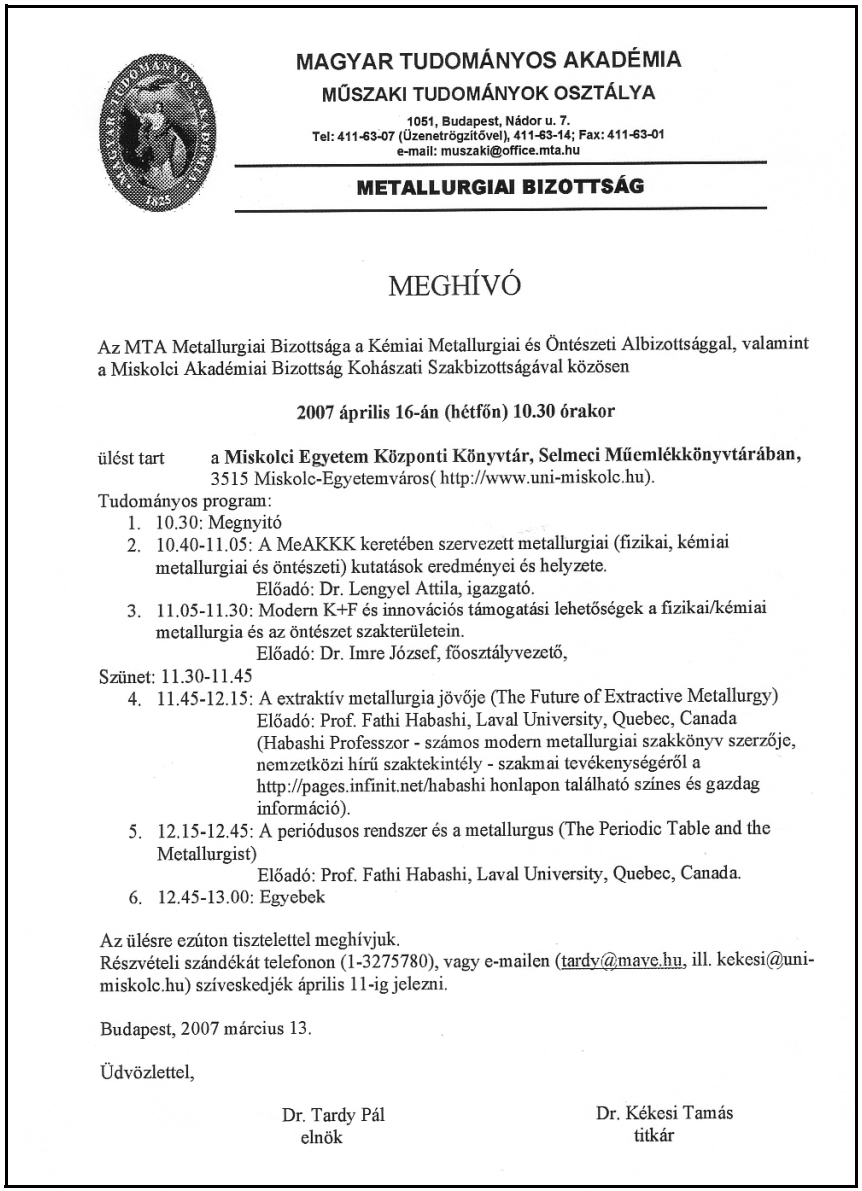
Figure 2.41: Emeritus Professor Zoltán Horváth and his wife at home, 1990.

Figure 2.42: Dean of the Faculty [left], 1990.

Figure 2.43: Vice Rector Otto Farkas, 1990.

Figure 2.44: Walking to the Technical University of Miskolc, 2007.

Figure 2.45: Dr. Ludmila Bokanyi, 2007.



MAGYAR TUDOMÁNYOS AKADÉMIA
MŰSZAKI TUDOMÁNYOK OSZTÁLYA
1051, Budapest, Nádor u. 7.
Tel: 411-63-07 (Üzenetrögzítővel), 411-63-14; Fax: 411-63-01
e-mail: muszaki@office.mta.hu

METALLURGIAI BIZOTTSÁG

MEGHÍVÓ

Az MTA Metallurgiai Bizottsága a Kémiai Metallurgiai és Öntészeti Albizottsággal, valamint a Miskolci Akadémiai Bizottság Kohászati Szakbizottságával közösen

2007 április 16-án (hétfőn) 10.30 órakor

ülést tart a **Miskolci Egyetem Központi Könyvtár, Selmeci Műemlékkönyvtárában,** 3515 Miskolc-Egyetemváros(http://www.uni-miskolc.hu).

Tudományos program:

1. 10.30: Megnyitó
2. 10.40-11.05: A MeAKKK keretében szervezett metallurgiai (fizikai, kémiai metallurgiai és öntészeti) kutatások eredményei és helyzete.
   Előadó: Dr. Lengyel Attila, igazgató.
3. 11.05-11.30: Modern K+F és innovációs támogatási lehetőségek a fizikai/kémiai metallurgia és az öntészet szakterületein.
   Előadó: Dr. Imre József, főosztályvezető,

Szünet: 11.30-11.45

4. 11.45-12.15: A extraktív metallurgia jövője (The Future of Extractive Metallurgy)
   Előadó: Prof. Fathi Habashi, Laval University, Quebec, Canada (Habashi Professzor - számos modern metallurgiai szakkönyv szerzője, nemzetközi hírű szaktekintély - szakmai tevékenységéről a http://pages.infinit.net/habashi honlapon található színes és gazdag információ).
5. 12.15-12.45: A periódusos rendszer és a metallurgus (The Periodic Table and the Metallurgist)
   Előadó: Prof. Fathi Habashi, Laval University, Quebec, Canada.
6. 12.45-13.00: Egyebek

Az ülésre ezúton tisztelettel meghívjuk.
Részvételi szándékát telefonon (1-3275780), vagy e-mailen (tardy@mave.hu, ill. kekesi@uni-miskolc.hu) szíveskedjék április 11-ig jelezni.

Budapest, 2007 március 13.

Üdvözlettel,

Dr. Tardy Pál
elnök

Dr. Kékesi Tamás
titkár

Figure 2.46: Seminar, "The Periodic Table and the Metallurgist."

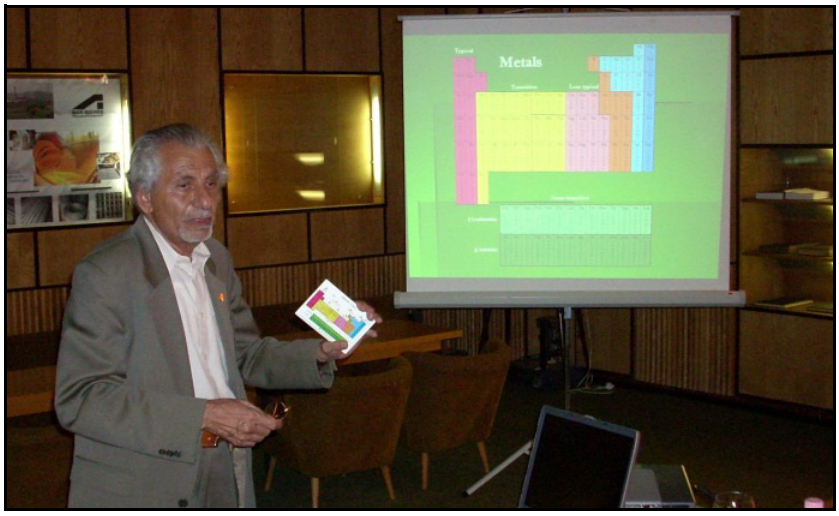


Figure 2.47: Technical University of Miskolc, 2007.

Figure 2.48: Tamás Kekesi, Tamás Török, Fathi Habashi, and Jenő Dúl [Department Chairman], 2007.

Figure 2.49: From left: Prof. Zoltán Gacsi [Dean], Fathi Habashi, Prof. Heikki Jalkanen [Helsinki], Prof. Tamás Török, 2007.

The Schemnitz Museum Library

After World War I, when the Austrian Empire was dismembered, Schemnitz became part of the newly created Czechoslovak Republic, and became known as Banská Štiavnica. This part of the former Czechoslovak Republic was historically known as Upper Hungary and in recent years as Slovakia. The newly created Republic of Hungary had no institutions teaching mining and metallurgy, but a College of Forestry at Sopron. As a result, the library of the Schemnitz Academy was moved to Sopron. When a university in Miskolc was founded, the mining and metallurgy books were moved to the newly founded university while those on forestry remained at Sopron.

The Museum Library (Figures 2.51–2.52) contains about 45 000 volumes mainly mining, metallurgy, chemistry, physics, mineralogy, geology, and mathematics. Most of the books are in German and the older ones are in Latin. The library represents one, if not the only, complete collection of mining and metallurgy books in the world, well preserved in a spacious, air-conditioned room, with numerous displays of the most important old books that date from the sixteenth century. The library Museum is separate from the modern university library that serves students and faculty. The director, Dr. László Zsámboki (Figure 2.53), translated and edited numerous old books on mining and mineralogy and published them with a facsimile of the original work (Table 2.2).

Faculty of Materials Science and Engineering

University of Miskolc

The

Verő József Medal

is awarded to

Prof. Fathi Habashi

on the occasion of visiting the Faculty of Materials Science and Engineering, **University of Miskolc, and presenting motivating professional lectures on the** subject of modern metallurgy.

April 17, 2007

Prof. Zoltán Gácsi, Dean
Faculty of Materials Science and **Engineering,**
University of Miskolc

Figure 2.50: The Verő József medal.

Figure 2.51: Entrance to the Schemnitz Museum Library.

Figure 2.52: Reading room in the Schemnitz Museum Library.

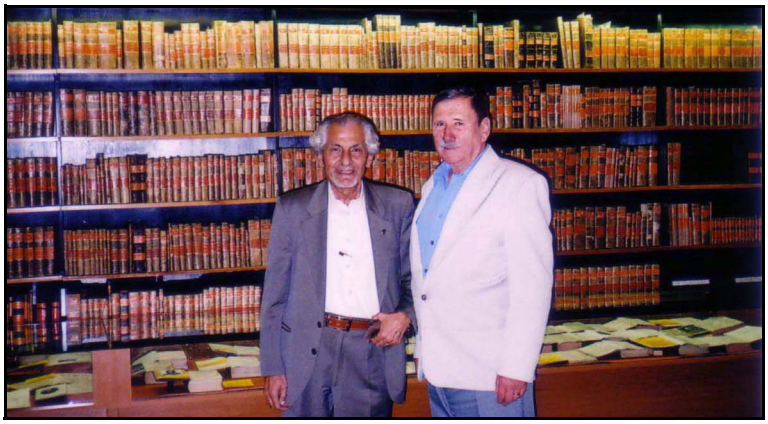


Figure 2.53: Dr. László Zsámboki, Director of Schemnitz Museum Library, 2007.

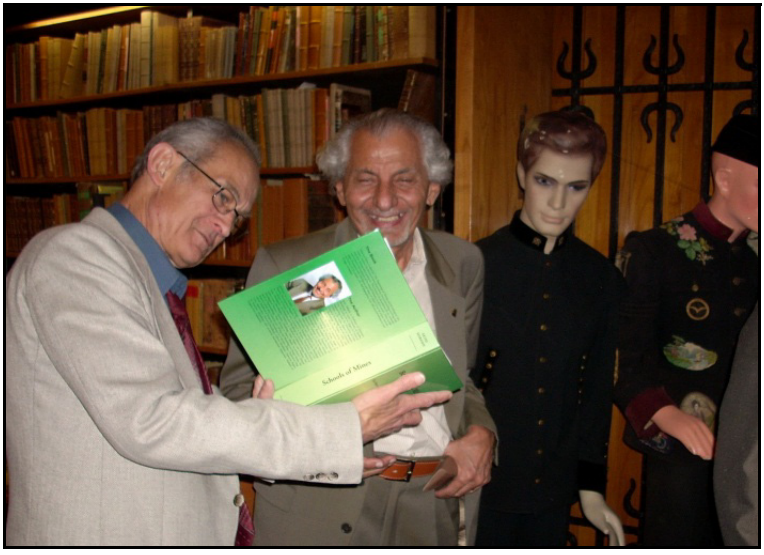


Figure 2.54: At the Library, 2007.

A catalogue of the library collection was published in 1973 together with a booklet describing the collection:

- I. Drahos, A. Kiss, A. Tarjan, *A Selmeci Müemlékkönyvtár Kötetkatalógusa*, Miskolc 1973, 177 pages. The catalogue contains an introduction and the list of books. The introduction is in Hungarian with German translation. Since most of the books are in German, a knowledge of Hungarian is not essential.

- L. Zsámboki, *Die Schemnitzer Gedenkbibliothek von Miskolc in Ungarn*, Miskolc 1978. The text is in German with summaries in French and Hungarian, illustrated, 108 pages.

Table 2.2: Reprints and translations of rare books conducted at the Museum Library, Miskolc.

Ulrich Rülein von Calw, *Bergbüchlein*, Worms 1518.	This is a facsimile of the original Old German text with Hungarian translation. Illustrated. English translation of title *The Mining Booklet*.
Johann Christian Lehmann, *Beschreibung eines Bergbohrers*, Leipzig 1750.	This is a facsimile of the original Old German text with Hungarian translation, a German commentary, and numerous remarks in German and Hungarian. Illustrated, 98 pages. English translation of title *Description of a Mining Drill*.
Giovanni Antonio Scopoli, *Crystallographia Hungarica*, Prague 1776.	Hungarian and German text (not a facsimile), illustrated, 193 pages. English translation of title *Hungarian Crystallography*.
Johann Engleitner, *Die Schleifsteinbruch Manipulation*, Waidhofen an der Ybbs 1806.	This book is printed in the Old German facsimile, modern German, and Hungarian translation with numerous coloured figures. It contains also a chapter on the history of grindstone mining at Waidhofen on the Ybbs in Austria, a biography of the author, and remarks on the book both in German and Hungarian. English translation of title *Manipulation of Grindstone Quarry*.

A short trip from Miskolc to Lillafüred and Eger (Figure 2.55).

Lillafüred

Lillafüred (Figure 2.56) is 12 km away from Miskolc is a resort area but was a centre of iron metallurgy. The first iron furnace was built around 1770 but did not survive. The second one was built in 1813 and can still be visited (Figure 2.57).

Iron Museum

The Iron Museum describes the history of iron production in the region (Figures 2.58–2.61).

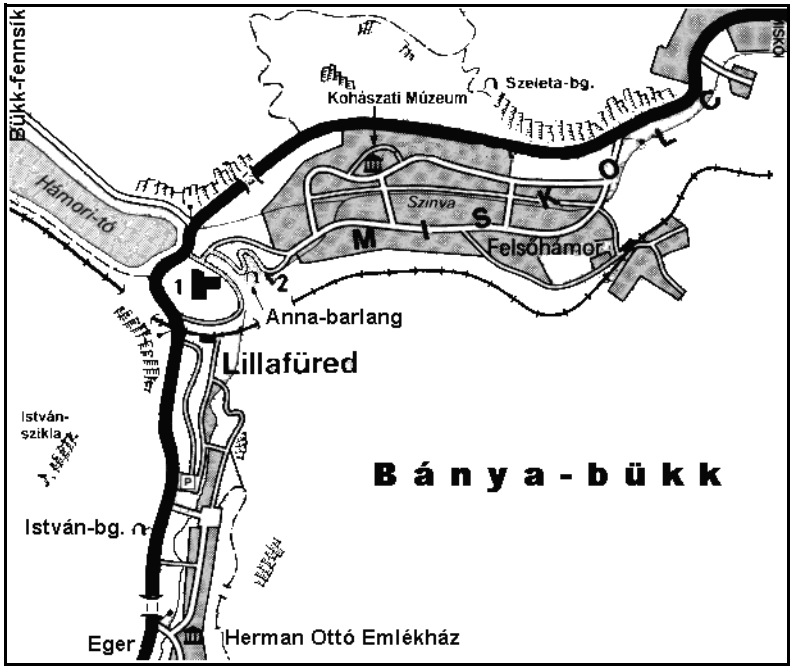


Figure 2.55: Miskolc and its surroundings.

Figure 2.56: Lillafüred.

Figure 2.57: Ruins of an 18th century blast furnace.

Figure 2.58: Iron Museum.

Figure 2.59: Iron Museum.

Figure 2.60: Iron Museum.

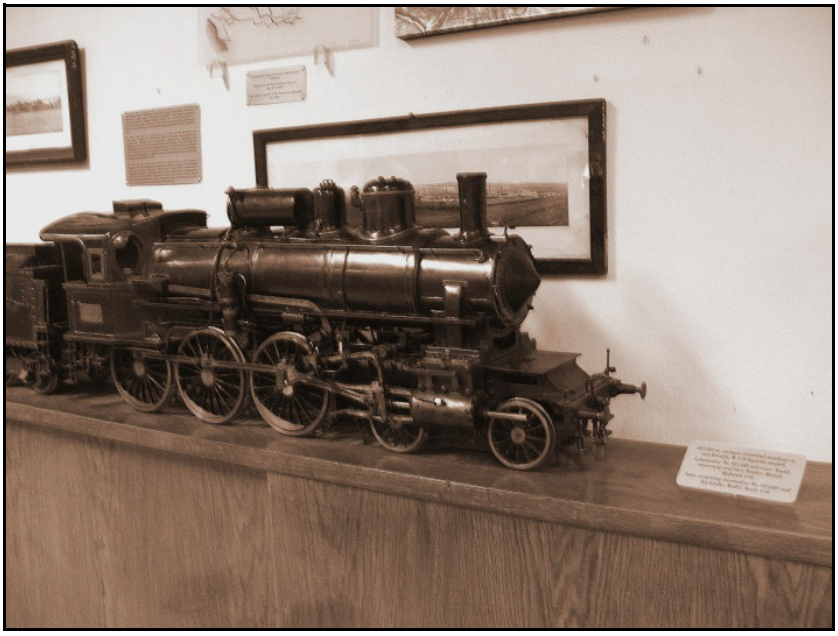


Figure 2.61: Iron Museum.

Eger

Eger's medieval fortress (Figure 2.62) recalls the struggle against the Ottoman armies. There is a mint in the fortress kept as a museum (Figure 2.63). Dobó Square (Figures 2.64–2.65), named after the national hero Baron István Dobó (ca.1502–1572) who, in 1552, stopped the advance of the Turks. The square includes the Bishop's Palace (Figure 2.66) and a magnificent iron gate at the Lyceum (Figure 2.67). Nearby the square is a 40 m high minaret of a Turkish mosque (Figure 2.68). There are hot springs under the town which function to this day.

Figure 2.62: Eger's fortress.

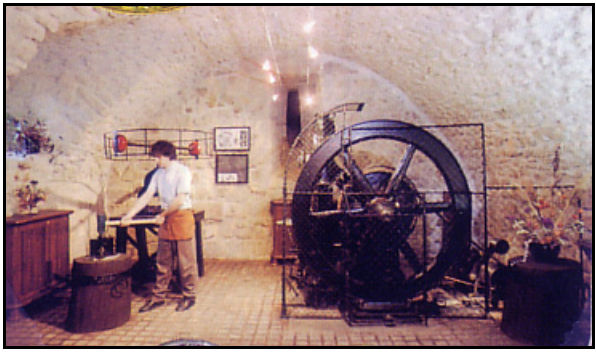


Figure 2.63: Mint museum in the castle.

Figure 2.64: Monument to István Dobó (ca.1502–1572) in the square.

Figure 2.65: Dobó Square.

Figure 2.66: The Bishop's palace.

Figure 2.67: Iron gate at the Lyceum.

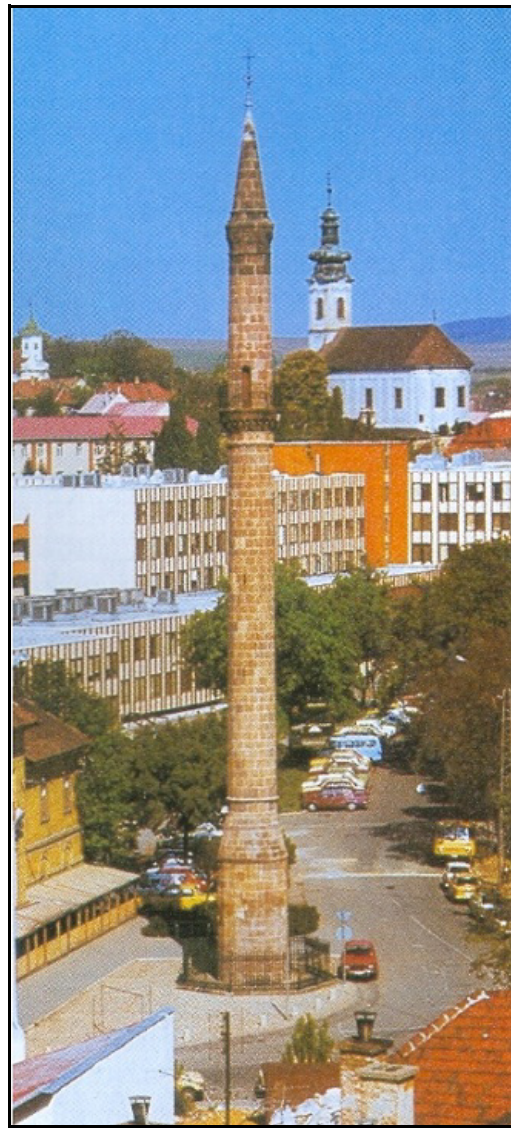


Figure 2.68: A 40-m high minaret of a Turkish mosque.

Rapeseed

Large fields for cultivation of rapeseed are everywhere in Hungary (Figures 2.69–2.71). Its processing for oil production as a bio-diesel produces rapeseed meal, a high-protein animal feed.

Figure 2.69: Rapeseed fields in Hungary.

Figure 2.70: Rapeseed.

Goulash

Goulash [gulyás in Hungarian] is a soup or stew of meat, noodles and vegetables especially potato, seasoned with paprika and other spices is the national dish (Figure 2.72).

Figure 2.71: Oil is obtained from rapeseed.

Figure 2.72: Hungarian goulash.

Chapter 3

Switzerland

Historical Introduction 142
Basel 143
Zürich 146

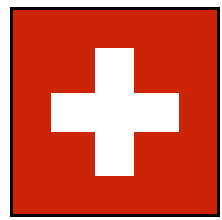


Figure 3.1: Flag of Switzerland.

Figure 3.2: Map of modern Switzerland

Historical Introduction

The territory comprising modern Switzerland (Figure 3.2) was originally inhabited by the Helvetic Celts who came under Roman rule in the 1st century BC and remained a Roman province until the 4th century AD. Under Roman influence important cities, such as Geneva, Basel, and Zürich,

were linked by military roads. After the decline of the Roman Empire, Switzerland was invaded by Germanic tribes. In 800, the country became part of Charlemagne's empire. It later passed under the rule of the Holy Roman emperors.

Between 1315 and 1388 the Swiss Confederates came under the Habsburgs then gained independence from the Holy Roman Empire in 1499. Ulrich Zwingli (Figure 3.3) and Jean Calvin (Figure 3.4) were the leaders of Reformation during the time of Martin Luther (1483–1546). Zwingli studied in Vienna and in Basel before becoming pastor in Zürich. After religious tensions provoked a violent uprising against Protestants in France, Calvin fled to Basel.

Figure 3.3: Ulrich Zwingli (1484–1531).

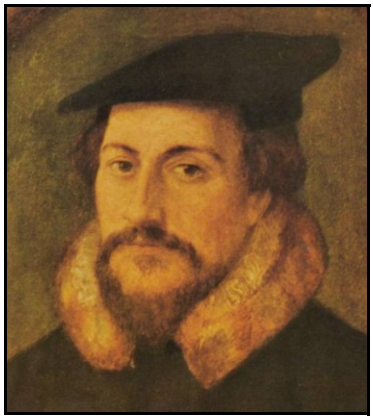


Figure 3.4: Jean Calvin (1509–1564).

Napoleon, invaded and annexed much of the country in 1797–1798, replacing the loose confederation with a centrally governed unitary state. After his fall, the Congress of Vienna in 1815 re-established the old confederation of sovereign states. In 1848, after a brief civil war between Protestant liberals, the majority of Swiss Cantons opted for a Federal State. Switzerland industrialized rapidly during the 19th century. During the two world wars Switzerland was neutral.

BASEL

Basel (Figures 3.5–3.8) is located on the river Rhine where the Swiss, French, and German borders meet. The University of Basel had such notables as Erasmus of Rotterdam and Paracelsus later taught. At the same time the new craft of printing was introduced to Basel by apprentices of Johann Gutenberg. Johann Froben operated his printing house in Basel and was

notable for publishing works by Erasmus and Agricola. My wife and I visited the city in 2005 to meet Dr. Felix Schaufelberger (Figure 3.9), a pioneer hydrometallurgist who visited Laval University few years earlier. Incidentally, the hotel gave free tram tickets to guests.

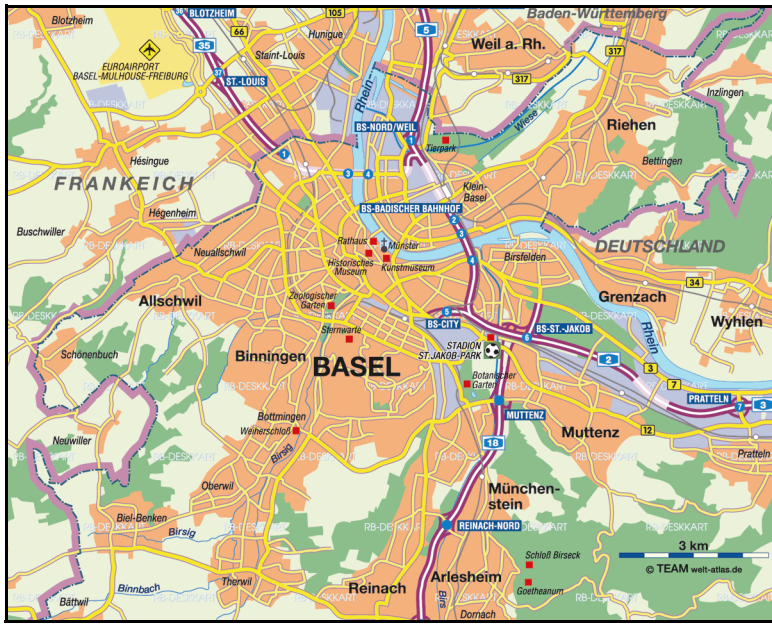


Figure 3.5: Basel on the River Rhine, Arlesheim in the south.

Figure 3.6: Basel Railway Station. From this station we took the train to Innsbruck.

Figure 3.7: General view of Basel.

Figure 3.8: Tram transportation in Basel.

Schaufelberger is well known for developing the process for the precipitation of copper, nickel, and cobalt from leach solutions by hydrogen under pressure — a process initially studied on a laboratory scale in Saint Petersburg by Vladimir N. Ipatieff (1827–1911) at the beginning of the 20th century. Schaufelberger studied thoroughly the chemistry of the process and

demonstrated its economic viability to the point that Canadian nickel coins, in circulation from 1962 to 2002, used this process.

Figure 3.9: Dr. Felix Schaufelberger (1921–2009) at home in Arlesheim, a Basel suburb, in summer 2005.

Graduating in 1946 from the Federal Institute of Technology in Zürich at the age of 25, Dr. Schaufelberger left for the United States to work for American Cyanamid Company. In the business of building ammonia and nitric acid plants, Chemical Construction Corporation, a subsidiary of American Cyanamid, had patents on the removal of CO impurity from synthesis gas, a mixture of hydrogen and nitrogen, using an ammoniacal copper formate solution. Occasionally, however, metallic copper precipitated in the gas absorption towers. Schaufelberger was to look into this problem.

Towards the end of 1948, Schaufelberger succeeded in precipitating pure copper from sulfate solution by reduction with hydrogen, in quantitative yield. He had also prepared the first samples of nickel and of cobalt metal powder. Few weeks later, unaware of this work, the President of Sherritt-Gordon Limited, then a small Canadian nickel mining company in Canada, together with his consultant, Professor Frank Forward from the University of British Columbia, came to Chemico to discuss the design and engineering of a nickel extraction process using an oxidative leach of nickel sulfide in ammonia solution. When Schaufelberger's research was discussed the visitors were convinced to adopt this technology. In April 1956 Chemico became part of Ebasco and Schaufelberger returned to Switzerland to conduct other research.

ZÜRICH

Zürich is the largest city in Switzerland located at the northwestern tip of Lake Zürich. It was founded by the Romans and in 1519, was the centre

of the Protestant Reformation in German-speaking Switzerland, led by Ulrich Zwingli. The city is home to a large number of financial institutions. The conference of International Union of Pure and Applied Chemistry was held in May 1955 at the Eidgenössische Technische Hochschule [Federal Institute of Technology]. A one-day visit to the conference was arranged. Albert Einstein graduated and taught at the ETH.

Name Index

A

Agricola, Georgius 61, 144
Arany, János 113, 115
Árpád 96, 97

B

Balaž, Peter 79
Beneš, Edvard 18
Bokanyi, Ludmila 123
von Born, Ignaz 85

C

Calvin, Jean 143
von Calw, Ulrich Rülein 130
Charles IV 7, 18, 62
Curie, Marie 61

D

Dobó, István 136
Dubeček, Ladislav 17
Dufek, Vladimir 9
Dúl, Jenő 125

E

Einstein, Albert 147
Elizabeth of Hungary 108
Eötvös de Vásárosnamény, József 109
Erasmus, Desiderius 143
Eugene of Savoy 111

F

Farkas, Otto 122
Fellner, Pavel 94
Ferdinand I 1
Ferdinand III 18
Forward, Frank 146
Froben, Johann 143

G

Ganz, Ábrahám 118
Grjotheim, Kai 94

H

Habsburg 143
Havlik, Tomas 68, 72
Herčko, Ivan 87
Hock, Milan 90
Horthy, Miklós 1, 98
Hrivňák, Ivan 68
Hus, Jan 5

I

Imriš, Ivan 68, 71
Ipatieff, Vladimir N. 145

J

Jalkanen, Heikki 126
Jancsy, Jan 87

K

Kádár, János 98
Karel IV 42
Kekesi, Tamás 103, 125
Klement VI 17
Komorova, Ludmilla 68
Kossuth, Lajos 98, 119
Kutuzov, Mikhail Illarionovich 66

L

Lehmann, Johann Christian 130
Lengyelne-Kiss, Katalin 118
Ludwig of Bohemia 1

Luther, Martin 5, 143
Luxemburg, Jan 17

M

Macenauer, André 17
Matthias (King) 96, 108
Melicher, Rudolf 91
Mendel, Gregor 50

P

Palme, Jan 47
Paracelsus 143
Pedlik, Miroslav 17

R

Rákóczi, Ferenc 98
Rothschild, Salomon Mayer 50

S

Šarudyova, Maria 74
Schaufelberger, Felix 144, 146
Schmiedl, Jiří 69, 73
Scopoli, Giovanni Antonio 130
Semmelweiss, Ignaz 109
Sigismund (King) 43
Smetana, Bedřich 19
Stephen I (Saint) 96, 97
Štofko, Miroslav 68, 71
Suleiman the Magnificent 96
Szabadvary, Ferenc 116

T

Török, Tamás 125

V

Vozar, Josef 90, 94

W

Wenceslas (Saint) 11
Wycliffe, John 5

Z

Zsámboki, László 126, 129
Zwingli, Ulrich 143, 147

Subject Index

A

Academy of Mining 120
Academy of Music in Brno 52
Agricola work 15
Ambassador Hotel 12
American Cyanamid Company 146
Ammoniacal copper formate solution 146
Antal Castle 90
Antiseptic procedures 109
Arlesheim 144
Art nouveau in Prague 20–41
Artistic castings 75
Augustinian Abbey 50
Ausgleich 108
Austerlitz 54, 83
Austro-Hungarian Empire 1, 98
Avars 96

B

Banská Bystrica 89
Banská Štiavnica 85, 120, 126
Basel Railway Station 144
Bastion 114–115
Bellow 75
Beltiar Palace 83
Bergbüchlein 130
Berggericht 90
Bilingual university 18
Bishop's palace 137
Bratislava 91
Brno 50
Bronze door 76
Bruntál 45
Buda 98, 102
Budapest 101

C

Canadian nickel coins 146
Capital of the Holy Roman Empire 7
Carlsbad 62
Caron Process 91
Carpathian Basin 96
Casting Museum 66, 118
Catalogue of library collection 129
Cathedral 66
of St. Barbara 45
Cemented carbide 46
Chain Bridge 102
Charlemagne's empire 143
Charles University 5, 17
Chemical Construction Corporation 146
Clock at the City Hall 10
Cobaltous carbonate 46
College of Forestry 126
Congress of Vienna 143
Crystal glass products 46
Crystallographia Hungarica 130
Czech Crown Jewels 16
Czech Republic 3

D

Danube 92, 102
Die Schleifsteinbruch Manipulation 130

E

East Slovak Steel Works 75
East Slovakian Museum 79
Ebasco 146
Eger 135

Eidgenössische Technische
Hochschule 147
Elizabeth Bridge 102
Erzgebirge 59
Ethnographic Museum 113

F

Federal Institute of Technology 146
Freudenthal 45

G

Gare Austerlitz 54
Germanic tribes 143
Gold coins 79
Gold mining town 45
Goulash 140
Groschen 43
Gunpowder 85

H

Habsburg Monarchy 96
Helvetic Celts 142
Heredity science 50
Heroes' Square 105
HMZ 46
Houses of Parliament 101
Hungarian
Academy 109
Mining Society 116
National Museum 113
Huns 96

I

Ice Age rock 49
Institute
of Chemical Technology 17, 94
Iron gate 138
Iron Museum 130
Italian Court 43

J

Jáchymov 59
Jesuits 45

K

Kammerhof 89
Karlovy Vary 62
Karlštejn 41
Košice 64
Krásna Hôrka 80, 81
Kremnitz 89
Kutná Hora 43

L

Le Chatelier Process from treating
bauxite 91
Levoče 80
Liberation monument 100
Library collection catalogue 129
Lillafüred 130
Litavka river 56

M

Magnesium chloride 46
Magyars 96
Manipulation of Grindstone Quarry 130
Medzev Forge 79
Metal worker 76
Meteorites 13
Minaret of a Turkish mosque 139
Mining Academy
in Schemnitz 50
Mining Court 90
Mining Museum 50, 89
Library 87
Mining school 85
Mining University 50
Mint
museum 135

Miskolc 85, 119
Mohács 96
Mohasz battle 1
Moldau 7
Mongols 96
Monument
  to Peace 107
  to war 106
Museum
  Science and Technology 116

N

National Enterprise of Ore Mines 46
National Technical Museum 14
National Theatre 93
Nickel hydrometallurgical plant 90
Niklova Huta 90
Nový Zámok 90

O

Opera House 65, 101
Ore Mountains 59
Ostrava 46, 56
Ostrava Museum 47
Ostrava Theatre 48

P

Pardubice 17
Periodic Table 94
Periodic Table and the
    Metallurgist 124
Pest 102
Place
  Vendôme 54
Prague 7
Prague Castle 16
Prague square 11
Příbram 56
Protestant Reformation 147

Q

Queen of Hungary 108

R

Rapeseed 139
Rare books 130
Red garnets 62
Rhine river 144
Russian war memorial 67
Ruthenia 2

S

Schemnitz 85, 120, 126
Schemnitz Museum Library 126
School of Mines 56
Science of heredity 50
Selmecbánya 120
Sherritt-Gordon 146
Slavkov 54
Slovak Academy of Sciences 79, 94
Slovak Republic 3
Slovakia 126
Society
  Patriotic Friends of the Arts 13
Sopron 126
Soviet liberation of Hungary 100
Spa city 62
St. James church 43
Street lamps 111
Sudetenland 1
Svatá Hora 56

T

Technical Museum 74
Technical University
  Košice 68
  Miskolc 120
Thaler 59
Tube autoclaves 91

Tungsten powder 46

U

Underground mine model 75
UNESCO World Heritage City 64
UNESCO World Heritage Site 89
University
  British Columbia 146
  Prague 7
Uralic-speaking population 96
Uranium 59
Urban Tower 68

V

Van't Hoff work 15
Vltava river 7

W

Waidhofen on the Ybbs 130
War Memorial 93
Water wheel 79
Wenceslas Square 11
Wood alter at Saint James Church 81
World War I 1, 85, 98, 126
World War II 1, 61, 98