9ième Colloque international
Le patrimoine culturel des sciences de la terre, archéologie, mines et métallurgie

9. International Symposium
Das kulturelle Erbe in der Archäologie, den Montan- und Geowissenschaften

9th International Symposium
Cultural Heritage in Geosciences, Archaeology, Mining and Metallurgy

2 - 7 septembre 2007
Université Laval
Québec, Canada

September 2 - 7 2007
Laval University
Quebec City, Canada

2. - 7. September, 2007
Universität Laval
Québec, Kanada

Ninth
Cultural
Heritage
Quebec City
2007

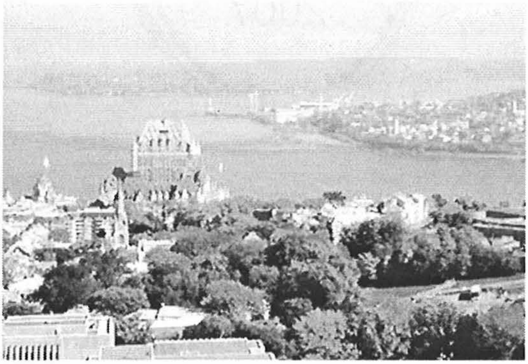
Cultural Heritage Symposium in Geosciences, Archaeology, Mining and Metallurgy

Libraries – Archives – Collections

September 2 - 7, 2007

Laval University
Quebec City, Canada

UNIVERSITÉ LAVAL



PROGRAMME
&
BOOK OF ABSTRACTS

9th Cultural Heritage Symposium

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Christoph Hauser, Austria
Lieselotte Jontes, Austria
Angela Kiessling, Germany
Joanne V. Lerud-Heck, USA
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Colorado School of Mines
Délégation Wallonie-Bruxelles au Québec

ALCOA

9th Cultural Heritage Symposium

CELAT, Université Laval,
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http://www.celat.ulaval.ca/heritage/index.html

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Historic of the Cultural Heritage Symposia

Schools of Mines were created, usually in a mining district, to educate technicians, miners, and metallurgists. Some schools were founded by private individuals; others were created by the State. Gradually, a need developed for qualified administrators for the mines and smelters, and for teachers at the schools. As a result, some schools were elevated to academies or became later technical universities, some were closed due to exhaustion of the mines or moved to more profitable regions. Some schools remained as vocational mining schools. Scientists and engineers who taught at these schools wrote numerous textbooks, monographs, and encyclopedias in these sectors for the benefit of students and engineers, thus, the fields of mining, metallurgy, and geology were established

The first attempts to provide an organized engineering education in Europe were in Germany. As early as 1702, there was a school of mining and metallurgy in Freiberg, which in 1765 acquired the name Bergakademie. Other such schools were established at Schemnitz in the Austrian Empire (now Banska Stiavnica in Slovak Republic) in 1763, Saint Petersburg (Russia) in 1773, Clausthal (Germany) in 1775, Madrid (Spain) in 1777, in Falun (Sweden) in 1819, and in Leoben (Austria) and Pribram (Bohemia) in 1840. Libraries in these schools possess impressive collections of books, manuscripts, maps, and other items related to geosciences, mining, and metallurgy. With the advancement of teaching in these schools it was realized that archaeology is also a part of the heritage and this discipline was introduced in many universities.

In the early 1990s, Dr. Peter Schmidt (1939-1999) then director of the library of the Mining Academy in Freiberg, sent a call for papers for a conference to be devoted to the Cultural Heritage in Geosciences, Mining, and Metallurgy and to be held in his home town. The response was favorable and the first meeting was held in September 1993. Proceedings of that conference represent an important collection of papers on the history of geology, mining, and metallurgy which would be otherwise very hard to locate in any technical or historical book.

The idea of organizing such a conference was certainly a fruitful idea as attested by the interest toward conferences that followed. In 1995, we met in Leoben, Austria the seat of the School of Mines founded by Emperor Ferdinand The proceedings volume have demonstrated that Archives are not a place to store unneeded papers but are a first class cultural source which conserves and retrieves human endeavor. The third Symposium was held in Saint Petersburg in 1997 the seat of the School of Mines founded by Catherine the Great The fourth Symposium was held in 1998 in Banska Stiavnica (the former Schemnitz of the Austrian Empire and seat of a School of Mines founded by Empress Maria Theresa. In 2000 we were in Colorado at the School of Mines for the fifth Symposium. Idrija in the Slovene Republic is famous for a 500-year production of mercury, its mines have been closed and one of them is kept as a museum where we met in 2002 to discuss the mining of mercury, health of miners and the amalgamation process in history. The Seventh Symposium took place in Leiden in the Netherlands May, 2003 and finally, the last Symposium took place in Schwaz in Tyrol mountains of Austria where we learned about its silver mining and minting during the Middle Ages.

Fathi Habashi
Université Laval

Previous Cultural Heritage Symposia

1. 1993 Freiberg/Sachsen, Germany
2. 1995 Leoben, Styria, Austria
3. 1997 St. Petersburg, Russia
4. 1998 Banska Stiavnica, Slovakia
5. 2000 Golden, Colorado, USA
6. 2002 Idrija, Slovenia
7. 2003 Leiden, Netherland
8. 2005 Schwaz, Tyrol, Austria
9. 2007 Quebec City, Canada

WELCOMING ADDRESS

Dear colleagues,

In the name of the organizing committee of the 9th International Symposium on cultural heritage in geosciences (archaeology, mines and metallurgy) we wish to welcome you to Quebec City and Laval University. We gathered around sixty specialists in geology, metallurgy and archaeology whose practice take into account the heritage dimension of geosciences in their archival and field research.

We would like to thank all the symposium attendees whom have agreed to come to share the results of their work in a program which we hope will please you. Conference and poster presentations as well as field trips will enable you to gain a maximum return on your stay and confirm your interests in the cultural heritage of geosciences. You will discover scientists who came to share their thoughts in a climate of generous exchange and we invite you to take that opportunity to establish durable bonds with new colleagues.

Several organisations have contributed to the 9th International Symposium on cultural heritage in geosciences (archaeology, mines and metallurgy). First, we would like to thank the international committee which supported us throughout the preparation and in particular Dr. Christoph Hauser, from the Austrian Geological Commission and chair of the last symposium. The generosity of Alcoa Canada as well as the Colorado School of Mines enables to entertain your palates during the receptions and, publication of the proceedings will be made possible through Alcoa Canada's support. The Wallonia-Brussels Delegation in Quebec helped in the presentation of the mining landscape exhibit of Wallonia and we very grateful for their help. We would also like to thank the Institut du Patrimoine de l'Université Laval as well as the CELAT for making a significant contribution to this symposium. Last but not least, many thanks to Dr. Pierre Poulin for sharing his knowledge on the mining landscape of the Beauce region and Dr. Tristan Landry for his assiduous work with the coordination of this symposium and finally we must recognise the unselfish contribution of all those volunteer students from the archaeology programme at Laval University.

We hope that you will appreciate the week you will spend among us and do not hesitate to take advantage of the many attractions Quebec City has to offer; a city where it is a pleasure to discover its geography, architecture and the history of its welcoming people.

Réginald Auger
Chair

MOT DE BIENVENUE

Chers (ères) collègues,

Au nom des membres du comité organisateur du 9e Colloque international sur le patrimoine culturel des sciences de la terre (archéologie, mines et métallurgie) nous vous souhaitons la bienvenue à Québec et à l'Université Laval. Nous avons regroupé une soixantaine de spécialistes de la géologie, de la métallurgie et de l'archéologie qui dans leur pratique, tiennent compte de la dimension patrimoniale des sciences de la terre à partir de leurs recherches en archives et sur le terrain.

Nous aimerions vous remercier chers conférenciers et conférencières d'avoir accepté de venir présenter les résultats de vos travaux dans un programme qui nous espérons saura vous plaire. Son déroulement vous permettra de profiter au maximum de la présence de chacun et nous souhaitons que vous en profitiez pour vérifier et confirmer vos intérêts à l'endroit du patrimoine culturel des sciences de la terre. Vous découvrirez des collègues venus partager leurs réflexions dans un climat d'échanges et nous vous invitons à prendre cette occasion qui vous est offerte pour établir des liens durables avec de nouveaux collègues.

Plusieurs organismes ont contribué de près ou de loin à la tenue de ce 9e symposium et nous aimerions tout d'abord remercier le comité international qui nous a appuyé tout au long de la préparation et notamment

Dr. Christoph Hauser, retraité de la Commission géologique de l'Autriche et organisateur du dernier symposium. La générosité d'Alcoa Canada ainsi que la Colorado School of Mines nous permet non seulement de vous sustenter lors des réceptions mais Alcoa Canada appuiera la publication des actes de ce symposium. La Délégation Wallonie-Bruxelles au Québec a facilité la venue de l'exposition sur le paysage minier de la Wallonie et nous lui en sommes très reconnaissant. Nous aimerions également remercier la Ville de Québec, l'Institut du Patrimoine de l'Université Laval ainsi que le CELAT pour avoir contribué de façon significative à la tenue de ce symposium. Un dernier remerciement s'adresse à Dr. Pierre Poulin pour nous instruire sur le paysage minier de sa région d'origine qu'est la Beauce et Dr. Tristan Landry pour son travail assidu à la coordination de ce symposium et enfin nos remerciements vont à tous ces étudiants bénévoles du programme d'archéologie de l'Université Laval pour leurs nombreux services tout au long de cette semaine.

Nous espérons que vous apprécierez cette semaine passée parmi nous et n'hésitez surtout pas à bénéficier des nombreux attraits qu'offre la Ville de Québec et ses environs. Une ville fantastique où il est agréable de marcher et découvrir sa géographie, son architecture et l'histoire de ses gens.

Réginald Auger
Président

PROGRAMME TIMETABLE

Sunday 2nd September

14:00 Registration (at 3 rue de l'Université)

18:00 Reception in honour of Dr. Lieselotte Jontes hosted by the Colorado School of Mines Library

Monday 3rd September

9:00 Opening Ceremony

Plenary session
Chair: Réginald Auger

Landscapes and the Cultural Heritage of Mining in the American West,
Donald Hardesty

Creating New-France and its capital: an archaeological perspective
William Moss and Marcel Moussette

Le patrimoine scientifique de l'Université Laval : un aperçu
James Lambert

10:30 Break

11:00 **Session 1 : Early Mining technology**
Chair: Christoph Hauser

Auf den Spuren des Bergbaus in Zschopau in Saxony
Peter Hammer

History of Mining and the Geological Survey in Russia
Gennady Kalabin and Yuri Solovyev

The Ancient Copper Mines of the South Urals
Elena Minina, Anatoly Yuminov, and Elena Shcherbakova

Hydrogen in Pressure Hydrometallurgy – An Analysis of early work
Tuhin K. Roy (presented by Sunil Kumar Dey)

12: 30 Lunch

14:00 **The Georgia Gold Rush and America's First Mining Scrip**
Fred N. Holabird

Industrial Architecture in Almaden. Repercussion of the Model in the American Mining
Rafael Sumozas García-Pardo

Session 2 : Ancient Metallurgy

Chair: Fathi Habashi

The Two Oldest Methods of Roasting Mercury Ores in Idrija
Martina Peljhanj (Jože Čar, Rafko Terpin)

Pavel Anosov (1799-1851) and Damascus Steel
Zoya A. Bessudnova

Gold im alten Tibet
Günther Jontes

Metallurgical Industry in the Urals in the Epoch of Peter the Great
Tatiana K. Ivanova

African-American Miners Create a Silver Ingot, 1869
Fred N. Holabird

Copper Tool Making Among Western Arctic Inuits
Geneviève Treyvaud

17:30 – 19:30 Walking tour of Quebec City with David Mendel
Les visites culturelles Baillairgé, inc.

Tuesday 4th September

8:30 **Session 3 : Slag composition studies**
Chair: Fathi Habashi

The Composition of Slags in Iron and Steel Production
J. Lamut, M. Knap, M. Debelak, B. Lamut

Characterization of Slag Findings from Felix Romuliana
D.Živković, J.Lamut, N.Štrbac

Session 4: Archaeology
Chair: Geneviève Treyvaud

The Russian Mineralogist Anatoly Bushmakin and His Contribution to the Development of Geo-Archeological Studies
Elena Shcherbakova and Elena Minina

New Information on the Mining Archeology in the Region of Banská Štiavnica
Jozef Labuda

10:15 Break

10:45 **De la découverte de minerais à la fin d'une tentative coloniale : le site Cartier-Roberval**
Richard Fiset et Gilles Samson

L'approvisionnement en cuivre en Valais (Suisse) vers 2000 av. J.-C. : le rôle de la mine de Saint-Véran (Hautes-Alpes, France)
Florence Cattin (Barbara Guénette-Beck, Hélène Barge et Marie Besse)

Mineralogy, Chemical and Isotope Composition of Lead Beads from Frobisher's Assay Site, Kodlunarn Island, Canada : A Parallel to the Bre-X Scandal
Georges Beaudoin and Réginald Auger

12:00 Lunch

14:00 **Session 5 : Mining education and culture**

Chair: Marc Vallières

Quebec Cultural Heritage - St. Lawrence Valley Bridges
Hugh J. McQueen

Mining in Europe. Movement of the Elites and Technological Transfer
Donata Brianta

James Douglas and the Origins of the Hunt and Douglas Process.
William Culver

Mining Academies as Centers of Geological Research and Education in Europe Between 18th and 19th Centuries
Ezio Vaccari

The Role of German Metallurgy and Mineralogy in the Introduction of Lavoisier's Chemistry in Mexico (1786-1798)
Francisco Omar Escamilla González

Canada's First Schools of Mines
Fathi Habashi

16:30 Vernissage of the exhibit *Évocation du Borinage d'aujourd'hui*

Room 419

Mines, art et education. Le Grand-Hornu : site désaffecté, acteur contemporain
Maryse Willems

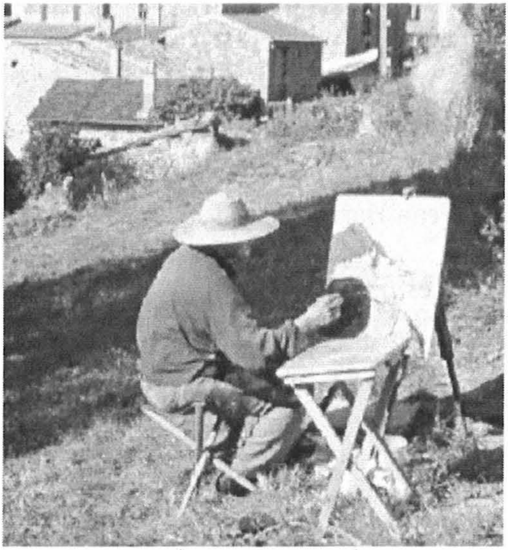
General Conference:

Les leçons du Grand-Hornu
Jean Barthélemy

Reception hosted by Alcoa Canada

Tuesday 4th September 17:30 – 19:00

Vernissage of the exhibit *Évocation du Borinage d'aujourd'hui*



Jean Barthélemy

Né à Jemeppe-sur-Meuse en 1932, Jean Barthélemy, ingénieur de formation et récipendaire de nombreuses distinctions académiques, est moins connu comme artiste peintre. Pourtant son talent de peintre paysagiste a été couronné par plusieurs prix. Issu de la tradition impressionniste de l'Ecole liégeoise, Jean Barthélemy s'en est progressivement détaché, en y introduisant plus de recherche et de maturation dans le choix des sujets et des atmosphères au détriment du caractère relativement spontané et instinctif de ses premiers tableaux.

Wednesday 5th September

8:30 **Session 6: Libraries, archives and collections**
Chair: James Lambert

Kalliope – eine Datenbank für geowissenschaftliche Nachlässe in der Universitätsbibliothek der TU Bergakademie Freiberg/Germany
Angela Kießling

The Goniometer – Rise and Fall of the Most Powerful Crystallographic Instrument of the 18th and 19th Centuries
Olaf Medenbach

Mining, Metallurgy, and Geology Collections in the Acervo Histórico del Palacio de Minería, Facultad de Ingeniería, Universidad Nacional Autónoma de México
Francisco Omar Escamilla-González

Travelling and Collecting: Two Interdependent Phenomena. Adolf Traugott von Gersdorf in Vienna, 1781
Marianne Klemun

Application of the cementation in Smolník – Schmolnitz
Gabriel Kunhalmi

10:30 Break

11:00 **The Iron Casting Museum in Budapest**
Katalin Lengyelné-Kiss

Illustrationen in Büchern des Montanwesens
Lieselotte Jontes

Les collections minéralogiques et géologiques de l'Université Laval, 1852-1920
Mélanie Desmeules

The Science Museum at Laval University 1986 – 1999
Fathi Habashi

12:30 Lunch

14:00 **7. Poster session**

Maria M. Ogilvie Gordon (1864- 1939) - some aspects of an extraordinary personality
Christoph Hauser

A Century of Laterite Ores Exploitation in Cuba
Jorge Miranda López

Die geologische Erforschung Albanies
Kujtim Onuzi

Friedrich Johann Karl Becke's Professorship at the K. K. Deutschen Carl-Ferdinands-Universität zu Prag from 1890 to 1898
Franz Pertlik

Gerhard Hamilton's (1917-1976): Contribution to the Exploration of Non-metallic Mineral Deposits in Austria
Margarete Hamilton

Mineral Raw Material for Ancient Industries of the Northeast of Europe (Russia)
Tatiana Mayorova

Ami Boué's Geological Map of South-Bavaria: a further addendum concerning the knowledge of Boué's estate at the Geological Survey of Austria
Tillfried Cernajsek (Daniela Angetter, Johannes Seidl, design: Christoph Hauser)

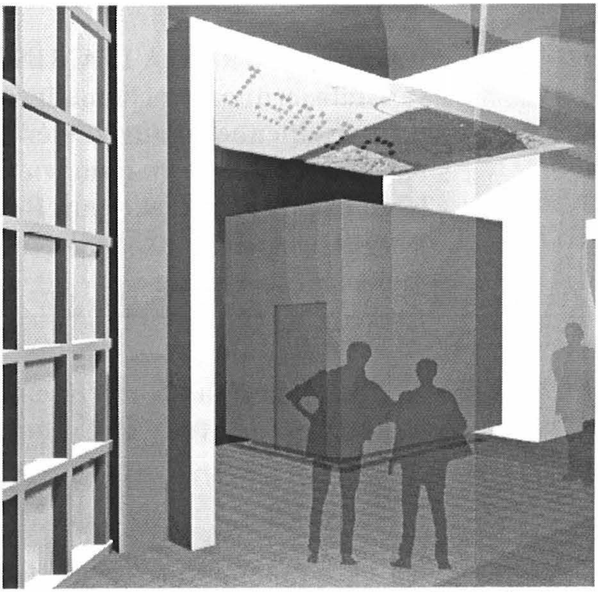
The Bloomery Furnace at the Stingamire's Smelting Site, UK
Catherine Emond

17:00 Reception

Thursday 6th September

8:00	One-day excursions* : Les Forges du Saint-Maurice or Musée Minéralogique et Minier de Thetford Mines * Included in registration fee: • Bus transportation • Entrance to the site • Lunch • Guide and commentator
17 :00	Visit of the LAMIC (transportation by coach)

Laboratoire de muséologie et d'ingénierie de la culture



Caroline Lajoie, architecte, **bisson** | associés

LAMIC

Friday 7th September

9:00 **Session 8: General papers on cultural heritage**
Chair: Martin Pâquet

The Activity of Urquhart – Hoover Group at the Urals from 1906 to 1917
Vera Nikolaevna Makarova

Das EU-Projekt REVITAMIN, Revitalisierung von ehemaligen Braunkohlenbergbaugebieten und Aufbau eines transnationalen Koperationsnetzwerkes am Beispiel der Bergbauregion Voitsberg - Köflach, Steiermark, Austria
Andrea Beyer

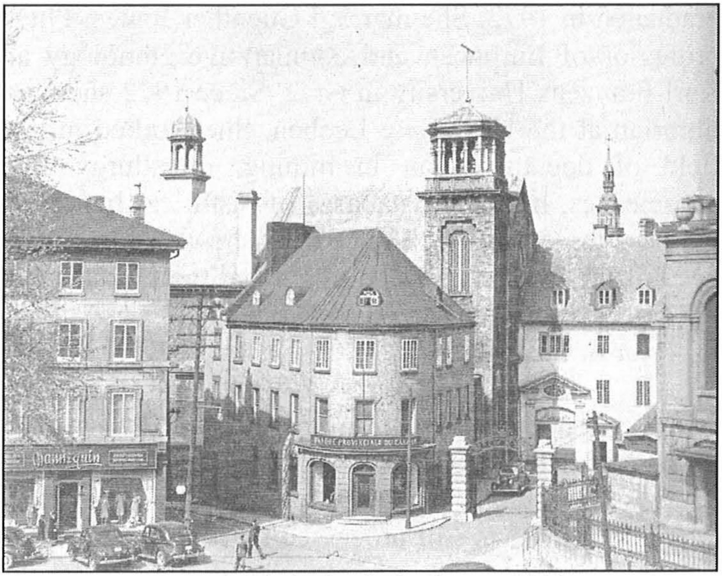
Application of the X-ray Spectral Method to the Study of Cultural Heritage Materials
A.G. Revenko

Reasons for the New Technological Development Cycle After 1823 in the Idrija Mercury Mine, Slovenia
Tatjana Dizdarevič, (Jože Čar, and Martina Peljhan)

Ancient Indian Metallurgy
K.S.Murty

12:00 Lunch

14:00– 16:00 Business Meeting



Le Petit Séminaire de Québec en 1945

Sunday September 2nd 17:00

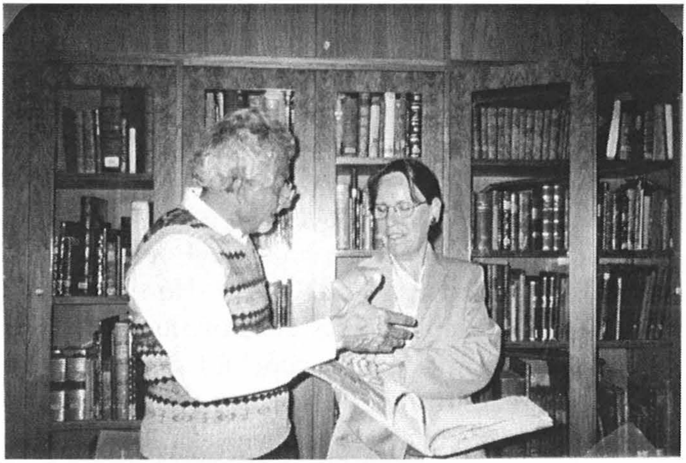
Reception in honour of Dr. Lieselotte Jontes

hosted by Colorado School of Mines Library

Born in Irdning Province of Styri in Austria January 19, 1942. Studied history at the University of Graz, graduated in 1972. She married Guenther Jontes, PhD, professor of European and comparative ethnology at Karl-Franzens-University in Graz. Since 1972 she was librarian at the University Leoben. She worked in the field of documentation in mining, metallurgy and geosciences, building databases of historical literature on these topics. From 1984 to 1992 she was nominated head of the Reference Department and the Department for Information Retrieval. From 1992 to present she is Director of the library.

The Leoben Library has a great stock of historical literature. This literature has been indexed and a database was built. This database "Montanhistorische Dokumentation" is still processed by her, she changed the conventional card catalogue to an electronic database. Now this catalogue is part of the Online Public Access Catalogue (OPAC). As Library Director she still tries to complete the stock of historical literature, as far as the modest budget makes these things possible. Besides the documentation in literature, the library has numerous pictures on the history of mining and metallurgy which are also indexed in a database.

As the University of Leoben does not have a special archivist, the Director is trying to get all the information needed for the history of the institution single-handed. The collection of mining maps and historical plans of industrial plants are also in a database, which is processed by her. As historian, who is very much interested in the field of mining history, Dr Jontes started together with Dr. Peter Schmidt (Freiberg /Saxony) the series of congresses on the cultural heritage in the fields of mining, metallurgy and geosciences in 1993 in Freiberg, followed 1995 by Leoben, 1997 St. Petersburg, 1998 Banska Stiavnica (Slovakia), 2000 Golden, Colorado, 2002 Idrija (Slovenia), 2003 Leiden (The Netherlands), 2005 Schwaz (Tyrol). For her support, enthusiasm and energy to the cultural heritage the newly founded "Peter-Schmidt-Award" was presented to her in Golden in 2000.



Dr. Jontes in her office discussing rare books with a visitor

ABSTRACTS

B

Barthélemy, Jean
Faculté polytechnique de Mons, Belgique

Les leçons du Grand-Hornu

Le domaine de l'architecture industrielle notamment a intérêt à se livrer à une telle réflexion rétrospective, attentive, sans complexe, sans dédain et sans nostalgie. C'est dans cet esprit que l'histoire du Grand-Hornu mérite qu'on s'y attarde aujourd'hui.

Le 19 janvier 1778, l'abbaye de Saint-Ghislain accordait à Charles Godonnesche, «fermier *général des octrois de la ville et banlieues de Valencienne »,* en association avec deux borains, le droit d'exploiter les veines à charbon d'une concession s'étendant de la seigneurie de Quaregnon à celle de Boussu. C'est l'origine du charbonnage du Grand -Hornu. Pour la conception d'ensemble de ses constructions, Henri de Gorge a le bon esprit de faire appel à l'architecte de la ville de Tournai, Bruno Renard. Celui-ci, formé à Paris, était acquis aux conceptions néoclassiques de ses maîtres Charles Percier et Pierre Fontaine, architectes associés des palais impériaux. Sur place, c'est cependant un autre architecte, un certain Cardona, qui a joué le rôle non négligeable d'architecte d'opération en contact permanent avec le maître de l'ouvrage.

1. Il est incontestable que l'esprit d'entreprise, la volonté d'innover dans tous les domaines et l'ambition personnelle d'Henri De Gorge doivent être considérés comme les facteurs déterminants de la réussite urbanistique et sociale du Grand Hornu. Il avoue lui-même qu'il a voulu attirer la main d'œuvre «par l'appât d'un bien-être inouï ».

C'est la première leçon que nous livre le Grand Hornu : la qualité d'une œuvre architecturale industrielle est le plus souvent le fruit d'une vision, d'une compréhension et d'une collaboration intime entre un maître de l'ouvrage et son architecte. D'expérience personnelle, je peux vous confirmer une telle affirmation. L'œuvre architecturale est le résultat du travail d'une équipe. Elle est à la mesure de sa cohésion et de sa volonté de mettre tout en œuvre pour en assurer la qualité, depuis l'implantation jusqu'à la mise au point du moindre détail. L'objectif est d'assurer à la fois la priorité aux aspects humains et sociaux de l'opération et l'insertion de celle-ci dans une vision globale et prospective de l'industrie. Cette réflexion fait écho à la réponse que fit Frank Lloyd Whrigt à un journaliste qui lui demandait quel était, selon lui, le facteur le plus important de la construction d'une usine. « Je pense, répondit-il, que ce sont les valeurs humaines qui y sont impliquées. »

2. Les bâtiments industriels du Grand Hornu ne peuvent être dissociés de l'impressionnante

composition urbanistique qui a présidé à leur implantation : les six rues principales de la cité, surprenantes de perspective et de cohérence, forment une zone de quelque 20 hectares entourant les bâtiments industriels, fleuron de la composition de Bruno Renard. Manifestement, cette ordonnance du plan général s'inscrit dans l'esprit classique. Néanmoins, l'architecte reste ici très sobre, tant au niveau des matériaux que des détails architectoniques. Grandeur certes, mais sans emphase ni sophistication, tel semble être le mot d'ordre qui a présidé à la conception du Grand Hornu.

La deuxième leçon qu'il faut tirer du Grand Hornu est d'ordre urbanistique : la réussite d'un grand projet industriel est liée à la qualité de l'implantation, à la réalisation d'espaces publics bien proportionnés et à la hiérarchisation des bâtiments en tenant compte de la noblesse de leur fonction symbolique.

3. Plus que jamais, après une longue période industrielle marquée par l'incohérence et le désordre, nous devons retrouver une nouvelle cohérence en aménagement du territoire. Chaque architecture doit y trouver sa place en harmonie avec le génie du lieu, suivant une hiérarchie symbolique précise. La société postindustrielle doit pouvoir y parvenir, répondant enfin au souhait déjà formulé en1851 par le comte de Laborde à son retour de l'exposition de Londres sur l'industrie naissante : « La destinée de l'homme s'est améliorée par la machine », écrivait-il dans son rapport au Gouvernement français, «je veux maintenant qu'elle s'embellisse ».

C'est évidemment au centre de la composition que se situe la partie architecturale la plus attractive du Grand-Hornu. Sous l'autorité de la Province du Hainaut, actuel propriétaire du bien, et avec l'aide de l'a.s.b.l. «Grand-Hornu Images», une nouvelle vocation, au carrefour du passé et du futur, mais aussi de l'art et de la technique, finit par se dessiner pour le Grand-Hornu. Un grand musée d'art contemporain vient de s'y installer. C'est une chance pour toute la région avoisinante.

C'est aussi la troisième leçon que le Grand-Hornu nous donne: grâce à la qualité constructive, au bon ordonnancement des structures et à la richesse architectonique de ses espaces intérieurs, un grand monument industriel peut transcender le temps et continuer à s'adapter avec brio aux nécessaires changements fonctionnels d'une société en perpétuel mouvement. Le Grand-Hornu, œuvre du début du XIX° siècle, deviendra ainsi une œuvre du troisième millénaire, associant à la fois l'art de l'industrie naissante et les techniques du monde postindustriel.

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Mineralogy, Chemical and Isotope Composition of Lead Beads from

Frobisher's Assay Site, Kodlunarn Island, Canada : A Parallel to the Bre-X Scandal

The first mining venture in the Arctic dates back to the late sixteenth century when Martin Frobisher left London in search of a passage to China by the Northwest of England. Lead beads recovered from a 16th century archaeological site on Kodlunarn Island, Frobisher Bay, Canada, are believed to be a by-product of assaying rocks mined from various locations by Martin Frobisher's 1577-1578 expeditions.. Microprobe analyses of galena grains in the lead indicate that they contain up to 0.4% silver but no gold. The chemical composition of the lead beads was determined *in situ* by electron microprobe and in bulk by ICP-MS and pyrolysis assay. The lead beads form two chemical composition groups, that were recovered from different sites: Shop 1) Cu-poor, Bi-free, Sb-rich, with 37 to 43 g/t Ag and no detectable gold; Shop 2) Cu-rich, Bi-rich, Sb-poor, with 78 to 96 g/t Ag and one sample that yielded 0.72 g/t Au. These two groups also have different lead isotope compositions: Shop 1 has low $^{206}Pb/^{204}Pb$ and $^{208}Pb/^{204}Pb$ compared to Shop 2. These compositions suggest that Shop 1 leads are derived from England whereas Shop 2 has a composition typical of Cyprus ores and of some England deposits. The composition of the lead beads indicates that the flux and collector used for the assays on Kodlunarn Island did not introduce a gold-rich contamination. Silver was likely added from the flux or collector used to assay the rocks, a contamination well-known to Renaissance assayers. It is, however, unlikely that the lead collector and the flux used in London assays were contaminated in gold, whereas those brought across the Atlantic were not. Therefore, the hypothesis of contamination of gold of assays performed in England must thus be rejected. There remains, then, only the hypothesis of fraudulent assays, wherein gold was deliberately added to the sample load or else, such as B. Kranich smelting coins in order to be able to show a gold bead as a result of a fake assay. The parallel between the Frobisher and the Bre-X scandals are striking as in both cases reported gold grades were suspicious.. Similarly, several aspects of the sampling and gold analysis procedure at the Busang deposit were questioned before the Bre-X scandal broke out but to no avail. Time has not changed the behaviour of investors such that power and greed were the ultimate reasons for not objectively assessing Frobisher's assay results.

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Pavel Anosov (1799-1851) and Damascus Steel Secret

Pavel Anosov graduated from the Saint-Petersburg Mining School in 1817. He worked in Zlatoust on the Southern Urals for three decades. The first geological study of the Southern Urals was done by Pavel Anosov in 1826. He was the first to describe a geological section from Zlatoust up to Miass, and discovered deposits of graphite and gold-bearing sand. For the first time in the world he used a microscope for steel structure study in section in 1831. Anosov postulated that characteristics of a metal depends on its crystalline structure. He was much successful in metallurgy. He suggested a new method of high-carbon cast steel production with direct cementation of iron in smelting crucible. This method was widely adopted in Russian and global industry and helped him to renew "know-how" (a secret lost in the Middle Ages) of the high-quality damascus steel production. In 1841 he published a classic work "About Damascus" that was a background for science on steels. Anosov was much followed and his discoveries and methods are recognized in metallurgy up to now.

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Das EU-Projekt REVITAMIN, Revitalisierung von ehemaligen Braunkohlenbergbaugebieten und Aufbau eines transnationalen Koperationsnetzwerkes am Beispiel der Bergbauregion Voitsberg - Köflach, Steiermark, Austria

Das Projekt „REVITAMIN“ beschäftigte sich mit der Revitalisierung von ehemaligen Bergbaugebieten und Bergbauflächen und der Entwicklung einer transnationalen multikriteriellen Entscheidungshilfe für Bergbauregionen. Dieses Projekt wurde von der EU über das Programm INTERREG III B ko-finanziert, wobei 5 europäische Bergbauregionen zusammenarbeiteten: Es waren dies die Regionen Südraum Leipzig und Zeitz - Weißenfels in Deutschland, die Region Most in Tschechischen Republik, die Regionen Veklý Krtis und Horná Nitra in der Slowakei, die Region Velenje in Slowenien und die Region Voitsberg – Köflach in Österreich.

In den mittel- und osteuropäischen Ländern haben die langjährigen Bergbautätigkeiten ihre Spuren in der Landschaft und in der Umwelt hinterlassen. Durch die Abbautätigkeiten wurden die ursprünglichen Landschaften verändert und partiell zerstört. So entstanden durch den Tagbau z.T. tiefe Löcher und an anderer Stelle wurde das Abraummaterial in Form von Halden abgelagert. Eine zentrale Aufgabe regionaler und überregionales Raumentwicklung ist die Wiederherstellung von Landschaften sowie deren nachhaltige Neubelebung nach Beendigung bergbaulicher Aktivitäten.

Mit dem Jahr 1805 begann die industrielle Nutzung der mineralischen Kohle. In diesem Jahr wurde die Glashütte Oberdorf bei Bärnbach als 1. Glashütte der damaligen Steiermark in unmittelbarer Nähe der Kohlenlager gegründet. Im Zuge des Kohleabbaues wurde auch eine Eisenbahnlinie errichtet, die von Köflach nach Graz führt und 1860 in Betrieb ging.

Durch die Kriege und Katastrophen gab es immer wieder Rückschläge für den Kohlenbergbau, von denen sich die Region immer wieder erholte. Allerdings kam es ab Mitte der 70-ger Jahre bis Ende der 80-ger Jahre des vorigen Jahrhunderts zur Schließung von Gruben- und Tagbauen, da sie ausgekohlt waren.

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Mining in Europe. Movement of the Elite and Technological Transfer

In recent years, the complexities of international economics and a certain crisis within the political system itself have led to a new acceptance of the legitimacy of "technical" governments, justified in the name of efficiency and professional competence. Various uses of the term 'technocracy' have emerged in the social and political sciences. From an historical-constitutional approach, the emergence of technical-scientific elites, characterized by a high-profile education, played an important role in the development of the bureaucratic and administrative apparatus of the modern State on the eve of the Industrial Revolution.

Using a comparative and interdisciplinary approach, the research goes through the cultural and institutional roots of a technocratic model, a milestone in the process of modernisation in certain crucial areas of Central Europe (including Italy, pre- and post-unification), whilst military considerations, socio-economic changes and scientific developments interacted for the emergence and growth of the modern State.

This study approaches the crucial aspects of what – after the Middle Ages and the Early Modern period – might be described, in the second half of the eighteenth century, as the third great period in European mining history. *La longue duréee* is a clear example of how the process of cross-cultural transfer in the field of mining sciences and metallurgy was facilitated by a network of exchanges, such as 'official' journeys and visits undertaken by the scientists and *savants* of the day and mining schools serving as research laboratories, pilot industrial establishments and communication centres.

In the end, this analysis makes it possible to define a Franco-German model in mining education, emerged in the German-speaking world, consolidated in the Franco-Piedmontese area (late eighteenth/early nineteenth century) and ultimately spread to other areas of Europe and to the Spanish-American colonies. Even mining, metallurgical, and railway sectors of second-comer countries could benefit from the know-how developed by human exchanges, as demonstrated by the Savoyard technical elite in the Italian case.
The 19th century, the herald age of new scenarios, terminates this research. On a global basis, the discovery of new ore veins in remote regions and the

emergence of new producing countries in the first half of the 19^{th} century moved the focal point of mining industry - with the exception of precious metals - to other continents, closing a seven hundred years-long historical cycle during which Europe was the undisputed leader.

C

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L'approvisionnement en cuivre en Valais (Suisse) vers 2000 av. J.-C. : le rôle de la mine de Saint-Véran (Hautes-Alpes, France)

Des objets métalliques en cuivre sont présents dans les Alpes dès la deuxième moitié du 5e millénaire. La question de la provenance du métal pour le Néolithique et le Bronze ancien fait l'objet de recherches depuis de nombreuses années. Elles ont commencé par l'identification de travaux miniers anciens (Zschocke et Preuschen 1932), puis par la tentative d'identifier les sources de métal sur la base de la détermination de la composition chimique d'objets archéologiques et de minerais (Otto et Witter 1952). Sur cette problématique, la méthode des isotopes du plomb a apporté jusqu'à présent peu de résultats novateurs (Höppner et al. 2005). La question de l'origine du cuivre au Néolithique et au Bronze ancien est toujours débattue.

L'étude récente de la mine de Saint-Véran (Hautes Alpes, France) a montré une exploitation de minerai de cuivre remontant à la fin du 3e millénaire av. J.-C. et au début du 2e millénaire av. J.-C. (Barge 2003). La signature isotopique de cette minéralisation a été définie et elle est très particulière. Elle a été comparée à un corpus d'objets datés du Bronze ancien et provenant du Valais central (Suisse), soit à une distance d'à peu près 200km à vol d'oiseau. Sur la base des 43 analyses menées jusqu'à présent sur le mobilier archéologique, il est possible de proposer l'hypothèse d'une production à partir du minerai de Saint-Véran pour deux torques en cuivre.

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Ami Boué's geological map of South-Bavaria: a further addendum concerning the knowledge of Boué's estate at the Geological Survey of Austria

Ami Boué (1794–1881) counts among the most illustrious scientists in the first half of the 19th century. He was born in Hamburg, where his family – Huguenots – settled after their banishment from France. On the basis of the family's great wealth, he was able to study in Scotland, where he did his doctor's degree after finishing a medical and a geological-botanical dissertation. He became popular because of his trip (1836–1838) to European Turkey, about which he published four volumes on *La Turquie d'Europe, ou observations sur la géographie, la géologie…*(1840). We also have his self-compiled atlas with maps from European Turkey, which contains, in addition to geological maps, an ethnographical map of the Balkan Peninsula (Cernajsek & Seidl, 2004). Boué bequeathed his estate to the Geological Reichsanstalt, later the Geological Survey of Vienna, among other institutions. Today it's impossible to reconstruct the whole estate, because of partial records within the archives of the Geological Survey.

The map presented in this poster follows from an accidental discovery by one of the employees at the Geological Survey-Library. Mrs. Martina Binder was engaged over a period of years with the inventory, indexing and realignment of the map collection kept in the Geological Survey-Library. Finding Boué's map ("Geognostical Map of Southern Bavaria [1: 8.000.000]") is among the luckiest of discoveries, as it was long believed to be missing.

On closer examination, the unicum emerged as an invaluable rediscovery. The geographical title "South-Bavaria" could be misleading for laypersons. Boué's geological manuscript-map described topography which "the then Russian captain and adjutant of the Russian czar" established for his publication, *Topographie: Versuch einer geognostisch-topographischen Karte von Süd-Baiern nebst den angrenzenden Laendern zwischen dem Inn und der Donau, gedruckt 1815*. This map was obviously produced during the Napoleonic era, when the Tyrol, Vorarlberg and Salzburg politically belonged to Bavaria. The term South-Bavaria, which in reality describes Austrian regions of today, was still used in the 19th century.

Boué's geological entries on J. F. Weiß's map accord to the geological knowledge of the Eastern Alps and of Bavaria as understood in the 1820s. The map only distinguishes 20 different strata, named in

English. It is especially remarkable how scantily the alpine Mesozoic is subdivided. The flysch-zone hides itself in the Viennese sandstone. Tertiary and Quaternary units are better classified. In the era, obvious volcanics were separately classified. The "Böhmische Masse" is described as old gneiss-alps with only some granitic deposits. As far as tectonics are concerned, the map doesn't make a clear statement.

Boué introduced his map at the Geological Society in London on May 7th, 1830. This indicates that Boué had already produced this map in 1829. In his report concerning the map, Boué rectified an error in the map itself: He had situated the Sonthofen deposit, together with the stone pit of Kressenberg, in the Tertiary, although Münster, Sedgwick, and Murchison referred the Sonthofen beds to the Mesozoic. Boué's map found its way to Vienna, where it was used by Haidinger and Hauer as background for the creation of the first general map of the Austrian Monarchy. Boué's contribution was explicitly mentioned on the map, together with that of Beudant and others.

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James Douglas and the Origins of the Hunt and Douglas Process.

Through examination of primary materials of the 1860s and 1870s in Quebec and Chile, and published mining reports of the period from all over North America, including Douglas' own writing, the paper looks at the development of the original Hunt and Douglas patented hydrometallurgical process. The original patent dates to January 14, 1869. The process was initially tried in Quebec's Eastern Townships, then in Chile and subsequently in North Carolina. The research is a case study of the conditions under which new technology is developed. *The Literary & Historical Society of Quebec* created a venue for sharing knowledge. This was at a time when "men of science" could know and understand the latest developments in many fields. It was also a time of belief in "progress." The *Society* is where Douglas and his partner in technology, T. Sterry Hunt, met and read papers. Douglas, whose own formal education was in theology and medicine, must have discussed the falling ore grade problems at the Douglas family's failing copper mine investment just south of Quebec City at today's St.-Jacques-de-Leeds. By 1867 T. Sterry Hunt had already led Douglas to the latest applications of chemistry to metallurgy as a way to recover copper from ores under five percent. Hunt taught chemistry at

Morrin College (subsequently Laval University) and became a major figure in academic chemistry over his long career. Hunt was himself a student of Benjamin Silliman, founder of Yale University's pioneering chemistry program.

D

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Les collections minéralogiques et géologiques de l'Université Laval, 1852-1920

Dès le début du XIX^{e} siècle, les musées de sciences naturelles de l'Université Laval au Séminaire de Québec se développent grâce aux efforts des professeurs de science. En 1835, Jérôme Demers, professeur de philosophie au Séminaire de Québec depuis quarante ans, sépare les sciences de la philosophie. À partir de ce moment, les mathématiques, la physique et la chimie sont chacune enseignées par un professeur différent. En ce qui concerne les sciences naturelles, elles acquérront un statut indépendant de la philosophie en 1843. On les subdivise alors en quatre disciplines : botanique, zoologie, minéralogie et géologie.

Les collections minéralogiques et géologiques de l'Université Laval ont une longue histoire. Dès 1816, on retrace le noyau de collection par un envoi de 431 minéraux arrangés sous la supervision de l'abbé René Just Haüy (1743-1822), célèbre minéralogiste français, créateur de la cristallographie. Ce début prometteur fut suivi d'une période au cours de laquelle des professeurs de sciences naturelles du Séminaire de Québec ont progressivement augmenté cette collection.

La période 1852 à 1920 marque toutefois l'âge d'or de son musée de minéralogie et de géologie. C'est en effet en 1852 que le Séminaire de Québec fonde la premières université francophone en Amérique du Nord : l'Université Laval. Tout au long de la période, les dons de spécimens, assortis de quelques achats et échanges, allaient augmenter considérablement les collections de minéraux, de roches et de fossiles en provenance du Québec, du reste du Canada et d'ailleurs dans le monde. L'intérêt de quelques professeurs de sciences naturelles et de minéralogie/géologie a également contribué à l'organisation, la mise en valeur et la conservation du musée minéralogique et géologique de l'institution. Plus qu'un musée dépositaire de collections d'échantillons, il servait de support pour l'enseignement et la recherche.

Une analyse préliminaire du rôle des collections dans l'enseignement de la minéralogie et de la géologie sera aussi tentée. Enfin, un rapide tour d'horizon de la situation du musée après 1920 sera présenté. C'est à partir de cette décennie que l'on observe, partout au Québec, un changement important dans l'enseignement supérieur et la recherche qui met fin à la période faste des collections de sciences naturelles dans les milieux académiques, dont celles de minéralogie et de géologie à l'Université Laval.

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Reasons for the New Technical Development Cycle after 1823 in the Idrija Mercury Mine, Slovenia

In 1508, soft and shaley Skonca layers richly mineralized with mercury were discovered in Idrija (Ladinian, Middle Triassic). This strata was comprised of extremely rich syngenetic ore (up to 78% HgS). In the centuries that followed up to the departure of the French from Idrija in 1813, mining was conducted almost exclusively in the Skonca beds. Owing to the increased production of mercury after 1736, the signing of contracts for the supply of enormous quantities of mercury to Spain in the period from 1785 to 1797, the fire of 1803, which destroyed the central part of the mine pit, and the accelerated, "plunderous" excavation of the richest ores in the periods of the French occupation (1797, 1805, 1809-1813), the known stocks of synsedimentary ores in the Skonca layers were largely depleted.

In 1813, Idrija repeatedly fell under Austrian rule. Although some doubts emerged around 1820 as to the further prospects of the mine, the situation nevertheless gradually stabilized. In 1823 the Higher Mine Office in Idrija was degraded to an ordinary mine office and subordinated to the Higher Mine Office in Klagenfurt. In the same year, the mine and the entire pit was inspected by a committee of experts from Vienna, whose useful guidelines eliminated any doubts about the prospects of the Idrija. After 1824, more intensive digging was carried out. In the 1930's, miners begun with numerous tracing and prospective galleries, which yielded unsatisfactory results. It was therefore the opinion of some that Idrija's mining days were numbered. Because the concentration of metal in ore had fallen to 2% by the middle of the century, it was necessary to increase excavation several times in order to maintain the average production of 156 tons of mercury and 50 tons of cinnabar achieved in the period from 1821-1846 but absolute record in the five-hundred-year history of the Mine's operation was set in 1913 with 820 tons of mercury and 60 tons of cinnabar.

Due to increased excavation, the mine had to be continuously modernized. In the period from 1850-1918, the mine underwent extensive organizational and technological changes. Of the numerous technical novelties, let us mention the introduction of machine drilling in 1874, more effective explosives, and the installation of new lifting devices in all shafts. Pit pumps were strengthened by the first steam machines, and after 1900 part of the mine was electrified. Austrian plans for the further expansion and modernization of the mine were prevented by the First World War.

E

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The Bloomery Furnace at the Stingamire's Smelting Site

Situated in the Bilsdale valley, the Stingamire`s smelting site comprises of a bloomery furnace, surrounded by a pile of slag and diverse debris of roasted ore, clay of the furnace walls and slag with high metal content (known as "gromps"). The study of these types of samples enables us to reconstruct the intrinsic chemistry of the furnace in order to discover how the Cistercian monks of Rievaulx abbey produced their iron blooms in the 12th century.

The premise of the research was to identify if the accepted limitations of the bloomery model are present within the case study site. The roasted ore, the clay lining, the slag and the gromps were analysed under the SEM for elemental composition in order to observe the efficiency of the furnace, from the weight recovery of iron and the melting point of the slag and bloom. The research also places emphasis upon discerning the working temperature of the furnace, theoretically and empirically. The analyses contribute in the construction of a model of the reduction process in the Stingamire`s furnaces. The study enabled the observation of how much the Cistercians mastered the bloomery process with great efficiency and it could be concluded that the technology as used was at its peak before being superseded by the new processes.

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The Role of German Metallurgy and Mineralogy in the Introduction of Lavoisier's Chemistry in Mexico (1786-1798)

The first director of the Royal Seminary of Mines in Mexico was the Spaniard Fausto de Elhuyar (1755-1833) who graduated from the Mining Academy in Freiberg in Germany in 1781. Prior to a trip through the mines in Hungary, he met the Austrian mining councilor, Ignaz von Born (1742-1791), who helped him know a number of European metallurgists. The government in Vienna showed interest in the possibility that Spain would buy quicksilver from the Idria mines to amalgamate silver in America. Born's contacts took Juan José de Elhuyar, Fausto's brother, to a six-month research journey with Torbern Bergman in Sweden, which later on would lead them to the isolation of tungsten in 1784.

When Elhuyar came to America in 1788, he tried to introduce Born's barrel silver amalgamation process. He also formed a circle for studying chemistry in Mexico. The main participants were Juan Eugenio Santelizes, Fiscal for the Royal Mining Tribunal; Francisco Xavier de Sarría, Director of the Royal Lottery; Vicente Cervantes, Director of the Royal Botanical Garden; Luis Lindner, who later on would take on the chemistry chair in the Royal School of Mines; and the apothecary Sebastián López Morones.

Sarría had published in 1784 a book called *Metallurgical Essay* in which, he cited for the first time in Mexico, French chemical knowledge to explain the properties of minerals. Elhuyar's arrival was perfect for Sarría. In 1791, he published a *Supplement* to his text, that would become the first Mexican printed source to include the new nomenclature. He presented there a summary of Lavoisier's theories and a comparison between the amalgamation processes of Born and the Spaniard Álvaro Alonso Barba and included a copper smelting process from the *Voyages métallurgiques* written by Gabriel Jars.

Another result for Elhuyar's chemistry circle was the contents of the classes offered at the Royal Botanical Garden, where Vicente Cervantes also used the new chemistry. His interest in this science was so strong, that Elhuyar charged him to do the translation of Lavoisier's *Traité élémentaire de chimie*, whose first volume appeared in 1797. This text was used to teach chemistry on the Royal School of Mines. The first professor was Elhuyar himself. On the other hand, German mineralogy came to America through the already mentioned French translation of Werner's text, because Elhuyar wanted to create a Spanish orictologycal terminology. This was finally crafted by Andrés Manuel del Río, another Spaniard who studied in Freiberg and who later on would take the mineralogy chair in the Mexican school of mines. Del Río published in 1795 the first volume of his *Elements of Orictognosy*, the first mineralogy book printed in America, following the mineral description with external characters proposed by Werner.

(Der Einfluss der deutschen Bergakademien in der Herstellung der Königlichen Bergakademie in Mexiko (1792) ist gut bekannt. Ihre Studienplan wurde nach die, der deutschen Schulen hergestellt. Ihre erste Direktor, der spanische Fausto de Elhuyar (1755-1833), studierte an der Bergakademie Freiberg zwischen 1778 und 1781. Vor einer Reise durch ungarischen Bergreviere, er hat der Österreicher Bergrat Ignaz von Born (1742-1791), der ihm geholfen hat, um seine große Kreis von europäischen Metallurgen einzutreten. Die wiener Kröne wollt große Menge von Quecksilber aus Idria an Spanien verkaufen, weil sie es brauchte für die Silbergewinnung in Amerika. Durch Borns Kontakte, Juan José de Elhuyar (Faustos Brüder) ist nach Schweden gefahren, wo er sechs Monate lang an Torbern Bergmans Labor arbeitete. Dieser Arbeit hat ihm und Fausto, um die Isolierung des Tungsten 1784 geholfen.

Als Student in Freiberg, Elhuyar bildete eine große Beziehung mit Abraham Gottlob Werner (1749-1817), der Spanier wollte Werners Mineralienklassifikationssystem durch äußerliche Kennzeichen verbreiten. Darum, entscheidet er sich, eine französische Übersetzung des *Von der äußerlichen Kennzeichen der Fossilien* machen. Er vertraute sie an Claudine Poulet de Morveau und gab ihr 1786 eine französische Version der äußerlichen Kennzeichen Tabellen in Dijon. Auf dieser Zeit, Bernard Guyton de Morveau entwickelte die neue Nomenklatur und es ist sehr möglich das Elhuyar davon lernte. Der Spanier reiste nach Glasshütte, wo er die Gründungsversammlung der *Societät der Bergbaukunden* teilnahm. Kurz danach, Ignaz von Born war der erste Wissenschaftler aus einem deutschen Land, der die neue Nomenklatur in einem Druck benutzte, der Katalog der minerallogischen Sammlung der Elleonore von Raab, die Schwiegerin Elhuyars

Als Elhuyar 1788 nach Amerika kam, versuchte er die Bornschen Amalgamationsmethode einzuführen, die er anhand ihrer chemischen Kenntnissen erklärte in seinem Bericht *Metallurgische Dissertationen.* Er sandte ihr an Born, so dass sie auf Deutsch unter dem Titel „Theorie der Amalgamation" in der Zeitschrift *Bergbaukunde* veröffentlicht würden. Elhuyar leitete ein kleines Kreis in Mexiko, um die neue Chemie zu studieren. Die Teilnehmer waren Juan Eugenio Santelizes Pablo, Fiskal des Königlichen Bergwerkstribunal; Vicente Cervantes, Direktor des Königlichen Botanischen Garten; Francisco Xavier Sarría, Direktor der Königlichen Lotterie, Luis Lindner, der später zu Chemielehrer an der mexikanischen Bergschule ernannt würde und der Apotheker Sebastián López Morones.

Sarría hatte 1784 das Buch *Metallurgisches Versuch* veröffentlicht. Dort, er benutzte zum ersten Mal in Mexiko französische chemische Quellen, um die Mineralieneigenschaften zu erklären. Die Kennzeichen der Metallen wurden aus dem Texte von Antoine Baumé, Pierre Macquer und der französischen Version des „Gründlicher Unterricht von Hütten-Werken" von Christoph Schlütter ausgenommen. Sarría glaubte, dass die mexikanische Bergbautechnik, die sich auf zwei Jahrhunderte von praktischen Kenntnisse gegründet war, anhand der Nutzung der europäischen Theorien verbessert werden könnte. Der Ankunft Elhuyars war perfekt für Sarría, weil er Anklang in ihm fand. 1791 veröffentlichte Sarría ein „Supplement" für seinem Text, dass das erste mexikanische Buch, wo die neue Nomenklatur benutzt wurde, ist. Dort er präsentierte eine kurze Zusammenfassung der lavoisierischen Theorien und eine Vergleichung zwischen die Amalgamationsmethode von Born und der spanische Álvaro Alonso Barba. Man muss sagen, dass die Erklärung der Ersten, wurden mit der neuen Chemie geschrieben. Zuletzt, er fügte eine Kupferschmelzmethode aus dem *Voyage métallurgique* des Gabriel Jars ein.

Elhuyars chemisches Kreis fand ein großes Erfolg in der Chemiekurs des Königlichen Botanischen Garten, wo Vicente Cervantes benutzte auch die neue Chemie. Seine Interesse an diese Fach war so groß, dass Elhuyar vertraute ihn die spanische Übersetzung des *Traité élémentaire de chimie* von Lavosier an.

Der erste Band erschien 1797, ein Jahr vor die Madrid Ausgabe. Der Text wurde für die Chemiekurs der mexikanischen Bergakademie benutzt, der Professor war erstens Elhuyar, aber später wurde von der Schemnitzer, Luis Lindner (ca.1763-1805), ein Arzt, der an die Wiener Medizinische Schule studierte, angenommen. Er war ein Teilnehmer der Expedition, die zusammen mit Elhuyar, nach Amerika kam, um die lokale Bergbautechnik zu verbessern. Der Kurs war so wichtig, dass Sarría und Cervantes haben auch Chemielehrbücher für die Schule verkauft.

Deutsche Mineralogie kam nach Mexiko über die französische Übersetzung von Werners Buch. Elhuyar wollte eine spanische oryktognostische Terminologie entwickeln. Schließlich, es wurde geschafft von Andrés Manuel del Río, ein andere Spanier, der in Freiberg studierte und die Mineralogie Stuhl an der mexikanischen Bergschule nahm. Del Río veröffentlichte 1795 der erste Band seiner *Anfangsgründe der Oryktognosie*, dass das erste mineralogisches Buch Amerikas ist. Er folgte Werners äußerlichen Kennzeichen der Fossilien. Dieser Text, zusammen mit seiner Übersetzung der *Minerallogischen Tabellen* von Dietrich Ludwig Gustav Karsten (veröffentlicht 1804), stellte die Übersetzung der wernerischen Terminologie fest. Del Río, der auch ein chemisches Element – das Vanadium – isolierte, schrieb seine Mineralien chemische Analyse mit der neuen Nomenklatur.

So waren die deutsche Metallurgie und Mineralogie der Einführungsmittel der lavoisierischen Chemie in Mexiko. Die mexikanische Wissenschaftshistoriker schreiben fast immer über der Widerstand der mexikanischen Wissenschaftler gegen diesen Kenntnissen. Dann sie vergessen ihre Ankunftsweg und die Leute, die sie antrieb. Das ist ein sehr interessante Teil der wissenschaftliche Entwicklung des Landes.)

Mining, Metallurgy, and Geology Collections in the Acervo Histórico del Palacio de Minería, Facultad de Ingeniería, Universidad Nacional Autónoma de México

The Royal Seminary of Mines was founded in 1792 following the model of the German mining academies, especially Freiberg and Schemnitz [Banska Stiavnica]. In 1867, it became the National School for Engineers, an institution where civil engineering ruled as the most important career and whose plans were inspired by the *École des Ponts et Chaussées* in Paris. Nonetheless, mining engineering and geological studies were never forgotten. The academic activities of these schools generated an important amount of manuscripts, books, and periodicals most of them were donated or sold by teachers and students.

The most important collections in the library (books and periodicals) from the 18th century are those of Joaquín Velázquez de León (1732-1783), founder of the Royal Tribunal of Mines in New Spain; Fausto de Elhuyar (1755-1833), first director of the Royal Seminary of Mines; and Juan Eugenio Santelizes (1733-1793), a miner from west Mexico and Tribunal's attorney. Other Mexican miners like Manuel de la Vega Huici donated his books during 19th century, and also the American engineer Curtis Alexander in the 20th. The archive has an important collection from the academic life of the schools of mines and engineering for every aspect: thesis, study plans, reports of visits to mines and metallurgical plants, etc; from 18th to 20th centuries.

With over 200,000 volumes in the library and 80,000 documents in the archive, the *Acervo Histórico del Palacio de Minería* is therefore the most important repository for the study of earth science history in Mexico. A description of the collections and a selection of the most important pieces from the first edition of Georgius Agricolas *De re metallica libri XII* from 1556 to descriptions of different descriptions of metallurgical plants in the 1920s will be given.

F

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De la découverte de minerais à la fin d'une tentative coloniale : le site Cartier-Roberval

Alors même qu'il construit ses forts à la fin du mois d'août 1541, Cartier pense découvrir les richesses qui vont garnir les coffres royaux et faire sa renommée : des diamants sur la falaise, du fer au pied de la montagne et près du fort, ainsi que des feuilles d'un or fin sur la berge de la rivière. À peine arrivé, il croyait déjà avoir accompli un de ses mandats mais son objectif premier était toujours de découvrir le passage vers la Chine et ses richesses (or, épices, etc.). Aussi, certains indigènes de Stadaconné et de Hochelaga tels que Donnacona et ses deux fils, Taignoagny et Domagaya par leurs discours ont fait miroiter les richesses du royaume du Saguenay et le passage vers l'Asie. François 1[er] lui-même s'enflammait dans ses révélations à ceux qui s'intéressaient aux découvertes des « terres de Canada et Ochelaga» qu'il croyait être un bout de l'Asie du côté de l'Occident. Ses confidences à Lagarto nous apprennent qu'il croit à un «Royaume du Saguenay» renfermant des mines d'or et d'argent, de même qu'une abondance d'épices et de fruits tels que girofle, muscade, poivre, oranges et grenades. On y mentionne même la présence d'hommes blancs, comme en France, vêtus de draps de laine.

Cartier n'était pas le seul à convoiter les richesses espérées du pays car Roberval, noble et endetté, plus que quiconque avait misé une grande partie de ses avoirs sur des promesses de fortune. Cartier, harcelé par les Stadaconiens, quitte son établissement avec ses trésors miniers pour retourner en France. Lorsque Cartier arrive à Terre-Neuve le sept juin, il trouve Roberval et refuse de revenir à Cap Rouge, malgré les ordres. Avant que Cartier ne quitte Roberval, à la faveur de la nuit, on expérimenta la qualité de l'or qui fut jugé de bonne qualité. En France, ces richesses se révélèrent être de la pyrite et du quartz. Comment ces gens ont-ils pu se tromper sur les résultats comme l'ont fait d'autres expéditions du 16e siècle ? Que révèleront les analyses à venir ?

La découverte et la fouille de l'établissement de Cartier et de Roberval ont permis de retrouver des petits creusets qui ont probablement servis pour des tests de minerai ainsi que d'autres éléments qui pourraient être reliés au processus de traitement minier (plomb, scories, mercure et souffre ?) La présente communication veut présenter les résultats préliminaires sur l'une des avenues prometteuses de la recherche sur le site.

G

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Industrial Architecture in Almaden

During the 18th century, the city of Almadén constituted an industrial and mining model not only for Spain but also for America. The Almaden School of mines was created there to educate the engineers who would participate in the exploitation of the American resources. The mine from Arabic al-madin is an example of mineral deposits with an antiquity of exploitation. Its riches attracted people from many places and the value of the mercury increased with the discovery of the amalgamation process of the precious metals in America. This made mercury essential in the process to obtain gold and silver. The Spanish crown controlled the mercury exploitation obtaining great benefits. They were interested in improving the techniques and increasing their economy, so this caused many research workers to come here in order to make better the mining and the metallurgical treatment, this in the 16th century.

The technological exchange between Almaden and American mining was studied by many historians. The miner and engineer working in mines contributed to forge the urban physiognomy of town's configuration with outstanding buildings with a greater presence providing the technical education of the professionals and the use of materials, spaces and ways to use them. The mining development is a way to conform all the mining things. This includes the way to work and also the lives of the inhabitants. This investigation shows the importance of the knowledge which the Industrial Heritage proposes like a reflection of a global and collective work and not exclusive of one group.

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Canada's First Schools of Mines

Few years after the provinces of United Canada (Ontario and Quebec), Nova Scotia, and New Brunswick joined on July 1, 1867 to form a federal state under the British Crown, the Dominion of Canada important discoveries of mineral deposits were made and a number of universities were created: McGill in Montreal in 1821, Queen's in Kingston in 1841, and Laval in Quebec City in 1852. It was during this epoch that schools of mines were founded to graduate engineers and technicians to exploit the natural resources of the country. The first schools were founded in Kingston (1893) and Haileybury (1912) in Ontario and in Quebec City (1938). The creators of these schools had British education. These schools were either independent or affiliated with the local university. They prospered with time and contributed greatly to the welfare of Canada.

Most engineers in Canada were, however, educated through apprenticeships in workshops and drafting rooms. It was only after 1870 that educational institutions formed new schools or colleges for educating future engineers as a result of growing industrial and technological economy. The first teaching of mining engineering in Canada began at McGill University in 1871 when Bernard James Harrington was appointed as lecturer in mining and assaying. The university principal at that time was the geologist John William Dawson who had been campaigning since 1857 for the creation of a School of Mines. In 1873, the Province of Ontario authorized the creation of an independent School of Practical Science to teach courses in engineering, mining, geology, and analytical and applied chemistry. The degree offered was called Bachelor of Applied Science in Practical Chemistry and Assaying. The first professor of metallurgy was Alfred Stansfield, who came from the Royal School of Mines in London in 1901.

The construction of the Canadian Pacific Railway main line in 1883 included a station at a location that became known as Sudbury. The discovery of nickel and copper during the digging for the railway provided the impetus for growth. The Canadian Copper Company was formed in 1886 and smelting operations were started in 1888. In 1902, Canadian Copper merged with Orford Refining Company of New Jersey to form International Nickel Company and in 1928 Falconbridge Nickel Mines was formed in Sudbury.

The Kingston School of Mining and Agriculture was founded in Kingston in 1893 under a royal Charter of the Province of Ontario signed by Queen Victoria and affiliated with Queen's University, which was already in existence since 1841. One of its graduates was James Douglas (1837–1918), who obtained in 1858 a degree in theology but turned out to be one of the most distinguished Canadian metallurgists.

The Science Museum at Laval University 1986 – 1999

Since its foundation in Quebec City in 1852, the professors at Laval University have accumulated large collections of scientific specimens and works of art. On May 13 1980, the university authorized the construction of the Center Muséographique to be composed of four sectors: The Universe, The Earth, Life, and The Human. On May 25 1986, the Center was inaugurated with the four sectors of the Museum composed as follows:

- Sciences of the Universe: The discovery of the cosmos, the discovery of the telescope, the Solar System, stars and galaxies, and the immensity of the cosmos
- Sciences of the Earth: The movement of the Earth's crust, the structure of the interior of the Earth, the age of the Earth, the fossils of Quebec, rocks and minerals, volcanoes, and meteorites
- Sciences of Life: The environment, the habitats, evolution, the dinosaurs, insects, the vertebrates
- Sciences of Man: The pre-humans, Homo habilis, Homo erectus, Homo sapiens, *the*

Neolithic, the beginning of writing, the ancient Greece.

At the moment of inauguration, the sectors of the Sciences of the Universe and Sciences of the Earth were opened to the public, while the other sectors of the Sciences of Life and Sciences of The Man were in the course of realization. More than 1 500 objects and specimens were exposed. The Museum functioned satisfactorily receiving tens of thousands of students, laymen, and scientists for thirteen years.

Hoever, the Center Muséographique was closed on July 1, 1999 by Dr. François Tavenas, then rector. At that time the section on the Inuits was not yet realized. The Museum remained intact up to 2003. It was the successor of Rector Tavenas, Dr. Michel Pigeon, who decided to dismantle it in the summer 2003. All the objects and exposed specimens reintegrated their original collection where they continued to support the mission of the university, that is, the teaching and the research. Most of the geology samples were retrieved by Mr. André Lévesque at Geological Museum in Pouliot Building while some were preserved in storage in room 0743 of Louis Jacques Casault Building. All the elements of expositions (panels and modulate) are preserved on the 5th floor of the Louis Jacques Casault Building. Parts of the collection were deposited in the following institutions:

- Centre d'Interprétation du Cap Tourmente (diorama on the white geese)
- Musée Maritime de Charlevoix (météorites)
- Musée Géologique at Thetford Mines (some explanatory panels on the geology and the dinosaurs).

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Gerhard Hamilton (1917-1976) and His Contribution to the Exploration of Non-metallic Mineral Deposits in Austria

Gerhard Hamilton was born on July 29, 1917 in Mistelbach, Lower Austria. His father Alfred Hamilton was a Scottish citizen living in Austria. His ancestors were born in Ramsgate, Scotland. During the first part of the First World War Gerhard Hamilton's father was a teacher at the famous Berlitz school at Innsbruck. In the early twenties the family moved to Vienna and Gerhard went to high school (Gymnasium) there.

In 1935 he was enrolled to the Vienna Technical University. He specialised in technical chemistry. Following his studies, he was offered an assistant professor position at the institute for Mineralogy and Petrography of the Technical University in 1941. In 1943 he finished his doctor's thesis and was promoted being the personal assistant of Professor Roman Grengg (1884-1972), the dean of the institute. Gerhard Hamilton's doctor thesis about clay suspensions already was the basis for his later specialisation in clay minerals and their behaviour in different concentrations, temperatures, and suspensions. He also pointed out the commercial and economic aspects of

Austrian's mineral resources after the Second World War and the problem, how the Austrian mining industry could be made more competitive and successful.

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Auf den Spuren des Bergbaus in Zschopau

Im Vertrag vom13. Juni 1377 zwischen den Herren von Wolkenstein und dem Markgrafen von Meißen wurde für Ehrenfriedersdorf und Wolkenstein die Bergfreiheit ausgesprochen und im erneuerten Vertrag vom 16. Oktober 1407 die Bergfreiheit auf Thum, Geyer und Zschopau ausgedehnt. Danach begeht Zschopau im Jahre 2007 den 600sten Jahrestag als Bergstadt. Von Georgius Agricola wird Zschopau bei einer Aufzählung der Erzlagerstätten in seiner im Jahre 1546 publizierten Schrift *De veteribus et novis metallis libri II* in der deutschen Übersetzung erwähnt: " .....das Schneeberger (Revier),.......das ist von allen Bergwerken Deutschlands dasjenige, das den reichsten Ertrag von gediegenem Silber aufzuweisen hat. An diesen Stellen befinden sich Städte, doch größer sowohl als Schneeberg, wie als Marienberg und Geyer ist Annaberg, die größte Freiberg; und rings um jede Stadt befinden sich zahllose Gruben. Weniger bekannte Bergwerke gibt es in demselben Meißnischen viele: eins bei der Stadt Wolkenstein, ein zweites bei dem Dorfe Drebach, ein drittes bei der Stadt Zschopau ....“

Der für den Bergbau außerhalb Freibergs eingesetzte Bergmeister Hans Kluge verlieh 1478 an Zschopauer Bürger die Grube Birkenberg, wo 1555 die Grube Heilige Dreifaltigkeit bestand. Westlich der Zschopau wurden die Gruben Freudiger Bergmann Stolln und Göpelzeche betrieben. Der Zschopauer Bergbau unterstand seit 1556 dem Bergamt Marienberg. Nach dem 30-jährigen Krieg waren um 1680 vier Gruben in Betrieb, davon die Grube "Heilige Dreifaltigkeit". Im Jahre 1884 endete der Bergbau auf Silber.

Der Marienberger Bergmeister von Trebra, der für das Zschopauer Grubenrevier mit verantwortlich war, schreibt in seinem Buch „Bergmeisterleben und Wirken in Marienberg 1767 - 1779“ Seite 529:“Auf einem der mächtigsten ,......, sehr hoffnungsvollen Gange, Heilige Dreyfaltigkeit benannt, zu Zschopau, unternahm ich ebenfalls den Bau eines Kunstgezeuges. Von schönen grünen (Grünbleierz, Pyromorphit $Pb_5Cl(PO_4)_3$)) , weißen (Weißbleierz veraltet, Cerussit $PbCO_3$) und schwarzen Bleyerze (Schwarzbleierz veraltet, dunkler Cerussit) und derben reinen, wenngleich silberarmen Bleyglanze, war hier vorlängst schon, zu weiterer Untersuchung der Tiefe, überredend eingeladen worden.“ Die Förderung des Bleiglanzes erfolgte, auch in Zschopau, um das darin enthaltene Silber zu gewinnen. Leider konnten bisher in der Literatur keine Angaben zu dem Silbergehalt des Zschopauer Bleiglanzes gefunden werden. Neuere Untersuchungen zu den alten Vorkommen dürften daher von Interesse sein.

Mit der metallurgischen Seite und dem Silbergehalt im Zschopauer Bleiglanz beschäftigte sich die Numismatische Gesellschaft Zschopau. Auf den alten Halden der Fundgrube "Heilige Dreifaltigkeit" und im Bachgrund am Fuß der Halde ist auch heute noch reichlich mit Schwerspat vergesellschafteter Bleiglanz zu finden. Nachdem wir eine geeignete Menge davon gefunden, ausgewaschen, gepocht und aussortiert hatten, konnten wir mit der metallurgischen Verarbeitung beginnen. Die wichtigsten Daten wurden auf die Medaillen eingeprägt, die ein wertvolles Dokument der Zschopauer Montangeschichte darstellen.

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Landscapes and the Cultural Heritage of Mining in the American West

Mining and miners left an enduring cultural heritage in the landscapes of the American West. The landscapes are the result of mining for salt and turquoise by indigenous peoples; early mineral and metal mining by Spanish explorers and settlers in the American Southwest; global mining rushes such as the California Gold Rush, Nevada's Comstock silver strike, and Alaska's Klondike Gold Rush; and twentieth century mining for copper, iron, borates, and other base metals and minerals. Mining landscapes and their cultural heritage can be viewed as the cumulative material expression of the history of mining-related human-environmental relations. They encompass a wide variety of components such as buildings, structures, and landforms that reflect historical and evolutionary processes of landscape formation. The formation processes include land use practices and technologies such as the evolution of mercury processing at the site of the Mariscal Quicksilver Works on the Rio Grande in Texas. They also include patterns of spatial organization such as the central place hierarchies associated with placer mining settlements in the interior boreal forests of Alaska; patterns of ecological interactions; and cultural traditions and ideologies such as the ancient Chinese concept of *fengshui* and the role of changing geological beliefs in structuring mining settlement patterns in Nevada and the Great Basin. The evolution of mining landscapes in the American West can be interpreted through the concept of "historical structures" of the *annales* school of social history. Mining landscapes range from long term structures such as geological formations and global political economies to short term structures such as temporary mining camps, households, and life histories, with a cultural heritage often expressed as networks of microenvironments.

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Maria M. Ogilvie Gordon (1864- 1939) - some aspects of an extraordinary personality

Maria Mathilda OGILVIE GORDON, was born 30th april 1864 at Monymusk, Aberdeenshire, Scotland, as a daughter of Reverend Ogilvie and Maria Mathilda Nicol. Maria (nickname May) started her school education at a guild-boarding-school - the Merchant Company Schools' Ladies College - at Edinburgh. - where she finished after nine years with excellent success and grading. In the age of 18 she started to attend the Royal Academy of music, but soon she alternated to Heriot-Watt College in Edinburgh later to University College in London, from where she graduated in 1890 as a Bachelor of Science in geology, botany and zoology.

The University of Berlin refused Maria to continue the studies there, but Prof Karl Alfred VON ZITTEL, Professor of Geology and Paleontology at Munich (Ludwig-Maximilians-University), attended to her. The mapping of the area Schluderbach and Cortina d'Ampezzo were the beginning of her field work, she had to become acquainted with rough unexploited landscape and climbing. Freiherr VON RICHTHOFEN introduced her to the geology of the South Tyrolean Dolomites. Geological maps, structure-analyses and various palaeontological observations led to fundamental publications. Most of them written in German language, published at the Geological survey of Austria in Vienna, only a few in English at Edinburgh and London. The Doctor of Science degree (D.Sc.) from London University 1893 was the first in geology given to a woman. In 1900 the Ludwig-Maximilians-University, Munich, awarded her the Doctor of Philosophy (Dr. phil.).

Between receiving her academic degrees she became married in 1895 with John Gordon, physician (from Aberdeen). Three children originated from this marriage. 1901 she translated for K.A. ZITTEL his *History of Geology and Palaeontology to the end of the Nineteenth Century* from German to English. In the next time, besides K.A. VON ZITTEL, Sir Archibald GEIKIE and some others, Otto AMPFERER had intensive contacts with her and they influenced each other in developing new cognitions. The zone around St. Cassian-Falzarego, the structures of Monzoni and Fassa, the overthrust of Langkofel in Groeden-valley, Schlern and Sella were the main interest of her field work during the next years.

In 1919 Maria Mathilda's husband passed away, at this time she had already published about 25 geoscientific works and projected already further voluminous scientific writings. The Royal Society at London refused in 1925 to print the geological results of the research in the Groeden- Fassa- and Enneberg-area; therefore she translated the text to German and with the help of director W. HAMMER and Otto AMPFERER as redacteur (and AMPFERER was really interested in that subject and realized the importance of Maria's work) of the Geological Survey of Austria the famous large-sized monographie (Abhandlungen der Geologischen Bundesanstalt, vol. **24**, split to 3 parts, was published in 1927. Only 1 year later Gordon published a next valuable book – the *"Geologische Wanderbuch" of the western Dolomites* (1928). The Geological Society of London recognised Maria M. OGILVIE GORDON's outstanding work by awarding her its *Lyell medal* in 1932.

"After her husband's death in 1919 that Maria moved to London and became active in the Liberal Party. She was the first woman to chair a London borough court and was heavily involved in several leading women's action groups. She served as honorary president of both the Associated Women's Friendly Society and the National Women's Citizens' Association and became president of the National Council of Women of Great Britain and Ireland in 1916 (later vice-chair of the International Council of Women), and chair of the Mothercraft and Child Welfare Exhibitions Committee in 1919. She played a strong part in the negotiations following the First World War at the Council for the Representation of Women in the League of Nations. For all this work she was awarded her D.B.E. from King George V."

The Scotsman (Saturday, june 29, page 22, 1935) reports from the University Graduation Ceremonies and three honorary graduates – among them Maria M. OGILVIE GORDON, as vice-president of the International Council of Woman. .... *"Dame Maria died at her home in Regent's Park, London, on 24 June 1939. Her ashes were placed in Allenvale cemetery in*

Aberdeen." (Prof. Cynthia BUREK, University of Chester). After OGILVIE GORDON's death Julius PIA finished and published her last work: Geology of the Langkofel-group (1940). Maria Mathilda OGILVIE GORDON was an extraordinary personality – an early female scientist, outstanding busy, successful and public spirited and an early representative for woman's rights.

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The Georgia Gold Rush and America's First Mining Scrip

The Georgia Gold Rush was a natural offshoot of the gold discoveries in North Carolina in the late 1790's. The concept of mining any metals was relatively new to America, even though early explorers sought precious metals. Prospecting in the Appalachian mountain range was slow to develop over three decades because the science of geologic mapping and mining geology had not yet been invented. People of the Appalachian mountains were slow to believe that there was gold in the hills. None of them knew how to look for it.

The science of geology had made a major breakthrough around 1815-1823 when William Smith completed and published the first geologic map, which was an entirely new concept. By the time gold was discovered in Georgia in 1828, most American geoscientists had never heard of a geologic map, let alone the modern process of geologic mapping. The American scientific community centered around Yale, where a young American geoscientist named Benjamin Silliman edited one of the few scientific publications of the period, *The American Journal of Science*, which began reporting on North Carolina gold deposits as early as 1825 and Georgia gold deposits in about 1833.

The development of gold deposits in Appalachia was slow, cumbersome, and expensive. With a severely depressed economy in the 1830's, Georgia and North Carolina gold camps never developed like their later California cousins. Whiskey didn't flow, gold wasn't so abundant that it traded widely, and the wild west concept so prevalent on the western frontier decades later was non-existent. The gold mining took place in complete poverty.

A few mining camps developed near the source of the greatest gold production, an area today known as Dahlonega. The principal town in the late 1820's and early 1830's was Auraria, located along a flat ridge top adjacent to the main gold workings. Here Georgia miners, with no experience and no one from whom to gain experience, mined and developed placer deposits, then known as "deposit" or "branch" mines. By the early 1830's the miners had located some of the richest ground along stretches of the Chestatee River and tributaries. On one of the tributaries miners found an elevated fossil river bed rich with gold. They named it the Pigeon Roost, though they didn't understand that it was an old river channel at the time. It was the most important channel discovered in the region, which led to subsequent lode discoveries in and around Dahlonega after the Civil War.

The isolated mining camps of the Appalachian range needed a financial infrastructure. Gold dust was traded, but the purity was always an issue, particularly because of unscrupulous operators. Gold was new to Americans, and people didn't recognize it as easily as it is today. Banks in the major towns studied the issues surrounding gold trading, and several competed to become the principal banks and gold trading businesses in the Georgia gold region. Without a source of ready cash, the miners started something that they would become known for over the next hundred years – they made their own money. The Pigeon Roost Mining Company issued paper currency bearing their name in 1835. It appears that it was widely circulated. The first legitimate bank to act was the Bank of Darien, who started a branch in Auraria shortly after, and built another branch in Dahlonega later still.

The Pigeon Roost Scrip is notable because it is the first mining scrip issued in America. It was the very first in a long line of private money made by mining companies that evolved from paper currency to private gold coins. Others followed suit in Michigan, and then in California during the gold rush of the 1850's. Miners in California didn't accept paper currency, so they soon began making their own coins – gold at first, then other metals for minor coinage.

African-American Miners Create a Silver Ingot, 1869

The discovery of massive amounts of gold and silver in North America created mining rushes not seen before in the world – first in California for its gold(1850's), then in Nevada for its gold and silver(1860's). As thousands of people from around the world came to the western mining regions, the need for money easily surpassed demand. Miners were creative. They traded in gold dust. They made their own pioneer gold coins. They poured ingots from the metals extracted from mines. All of these forms of money regularly traded at banks and the branch mints. Nevada discoveries resulted in silver and gold production at unprecedented rates. The Comstock proved to be the largest single mining district yet discovered in the world. With that success, the rush was on to find another region that would be as productive. One of the first subsequent discoveries was at Treasure Hill in 1868, known as the "Rush to White Pine" because of its location in remote White Pine County on Nevada's eastern frontier.

Robert H. Small and William Saunders were free-born African-Americans born in Maryland in 1833 and 1836. Small, a relative political activist, took part in the later stages of the California gold rush and mined silver at Treasure Hill in 1869. Later Saunders was an important lawyer in Baltimore. Small was a regular reader of San Francisco's Elevator newspaper, one of two western newspapers published by African-Americans in the 1860's. The Elevator, which promoted activism, was one of the most important forms of communication to the African-American community. It was overlooked by the regular newspapers, and rarely quoted, unlike newspapers from the interior mining regions. The late 1860's were a time of rebuilding, for all Americans and African-Americans in particular. It was a time of the passage of three important Constitutional Amendments, the 13th, 14th and 15th Amendments which were freedom, the right of citizenship and the right to vote for all African-Americans.

Small played a great part in all of these matters. His interest in mining at Treasure Hill was aroused by story after story in the Elevator about rich silver discoveries at White Pine. Many of his fellow African-American men had run off to White Pine to seek fortunes, and even began forming their own mining companies, such as the Elevator Mining Company, formed in 1869. While in Treasure Hill, he became heavily involved with the politics of the Fifteenth Amendment and the politics of the African-American political movement nationwide. He was elected as Nevada's sole representative to the Colored National Labor Convention in Washington, D.C. held in December, 1869, along with only one other western representative from California, the only two western representatives among hundreds from eastern states. Small sent in his stead his friend of long standing William Saunders, and later commemorated the event with a small silver ingot, which Small had engraved to Saunders with their names and "Nevada" on one side and "Maryland" on the other side.

Small went on to make a powerful speech in support of the Fifteenth Amendment in Virginia City, reported on the front page of the Virginia City Territorial Enterprise, the newspaper born of Sam Clemens, also the second largest newspaper published on the West coast. The details of the speech, and of Small and Saunders' life are tremendously important, adding a new chapter to a book yet unwritten about African-Americans on the western mining frontier, a secret unlocked by the discovery of a simple silver ingot.

I

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Metallurgical Industry in the Urals in the Epoch of Peter the Great

Emperor Piotr the 1st (1672- 1725) is well-known as the reformer of Russia. In 18^{th} century, Russia needed iron and copper. The existence of iron and cupper ores in eastern and western slopes of Urals mountain range has been known from 1630. At the beginning of the century the organizer of metallurgical industry Nikita Demidov (1656 – 1725) arrived in this region. In 1700, the Nev'yancky factory was built near the river Neivi. The factory was trnsformed into the most important factory in Russia. In the period 1700-1704 other factories – Kamensky, Alapaevsky and Yctussky were built. These blast-furnace and simultaneously hammer factories, belonging to State have been perspective for that time. The famous scientist and statesman Vasiliy N. Tatisthev (1686 – 1750) made great contribution to the development Urals metallurgy. In 1720, Piotr the Great assigned Tatisthev on the Mining Board. He leaded construction of the new factories, took place in creation of the first mine school in Urals, also he drew up plans for the instructions for managers of metallurgy factories, and organized mine investigations. After opening new factories (1716-1725) Urals became the most important regions for the production of cast-iron, iron, steel, and copper.

Smelting of copper took place in seven factories and third small smelting undertaking. Three factories located in centre of Urals, two on North, two on river Kama. Creation metallurgy centre in Urals has been conditioned by following: economical politics of the State, outstanding organizers of metallurgy industry, the rich deposits of metals, considerable of forest territory, the wide of river network, cheap working force.

J

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Gold im alten Tibet

Tibet is not a large gold-mining country but gold may be observed often there. Golden roofs of temples and palaces, jewellery, precious ornaments and objects of art in the mysterious halls or antique buildings dedicated to the worship of Buddha and the innumerable gods praise the divine with the splendour of an unchangeable metal of great rarity. In ancient Tibet, that means until 1949, when the Red Chinese troops occupied the country, gold was only extracted from the sand of rivers and brooks. Mining was banned, because public opinion peculiarly nourished by conservative Buddhist monks, believed that removing gold from the rocks in the hills by digging would make the chthonic spirits very angry. As Tibet is a region of geologic unrest, earthquakes and landslides were feared. Gold from the rivers was collected by many people, especially by nomads and herdsmen. As people thought, that gold grain was growing from bigger nuggets, they spared these more seldom pieces. Experienced people were panning gold, others collected it by hand.

At about 1900 one Tibetan, who was educated in England, tried to open a gold mine in his country but he had no success because monks from the monastery nearby prevented him. For the nomads, money was almost without value, because they were used to barter their products such as wool, skins, fur or butter for tea, flour, etc. But merchants needed it, and also the monasteries, who imported such valuable things like silk, brocade, objects of bronze or brass, tea, amber, incense or paper. So the Tibetan mint at Lhasa produced coinage. There was one golden coin called *sertang* or *gold-tranka* and goldsmiths made a variety of golden ornaments, often combined to the Himalayan "trinity" of gold, amber and coral. As a symbol of godly eternity statues, ceremonial devices, containers of sacred relics, tombs of high ranking incarnations, were gilded.

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Illustrationen in Büchern des Montanwesens

Für das Verständnis technischer Werke waren Illustrationen immer von großer Bedeutung. Neben den fachbezogenen Bildern gab es oft kleine, unbedeutende Ausschmückungen des Textes, die ein Buch liebenswert machten. Vignetten bei den Kapitelüberschriften oder Verzierungen in Initialen nehmen die Thematik des Bergbaues auf oder beleuchten ein Thema in emblematischer Weise.

In der Zeit des Georgius Agricola im 16. Jahrhundert war die bevorzugte Illustrationstechnik der Holzschnitt, der dann vom Kupferstich abgelöst wurde. Agricolas „De re metallica libri XII“ enthält 292 Holzschnitte, die mit dem Text zusammen eine gelungene Synthese bilden. Dieses klassische Werk der alten Technik stellt einen Höhepunkt in der Ausgestaltung dieser Literaturgattung dar. Oft sind es schon die Titelblätter, die den Inhalt illustrieren, wie etwa in Lazarus Erckers „Großem Probierbuch“, auf dem eine ganze Probierstube mit vielen Retorten abgebildet ist, die Abbildungen selbst sind Kompendien der Maschinentechnik der Zeit. Daneben sind für den Kulturhistoriker die Trachten und die Arbeitsdarstellungen von Interesse.

Die Handschrift des Schwazer Bergbuches aus dem 16. Jahrhundert zeigt in eindrucksvollen Aquarellen die Arbeit im Silberbergbau des 16. Jahrhunderts, daneben kann man aus den Bildern etwa die Tracht der Bergleute und ihr Gezähe studieren. Die Literatur des 17. und 18.Jahrhunderts illustriert die Fachbücher mit Kupferstichen, die ebenfalls ganz im Geiste Agricolas die Arbeiten im Berg und in der Hütte beschreiben, wobei besonderes Augenmerk auf die Maschinen gelegt wird. Die Ausschmückung der Grubenkarten früherer Zeiten ist äußerst kunstvoll, die Veduten sind aufwendig verziert, die Kartenränder zeigen oft Bergleute und Markscheider bei der Arbeit.

Ein besonderes Werk ist das Trachtenbuch aus dem Jahre 1721, das bei Christoph Weigel in Nürnberg erschienen ist. Es gehört mit seinen 50 Kupferstichen zu den wichtigsten Quellenwerken für die

Entwicklungsgeschichte der bergmännischen Kleidung. Mit dem Leben des Bergmannes befasst sich schließlich Eduard Heuchlers Buch „Des Bergmanns Lebenslauf“, das in naiver Weise das alltägliche Leben von der Geburt bis zum Tode zeigt.

(Pour la compréhension d'œuvres techniques les illustrations ont toujours été d'une grande importance. À côté des images se rapportant à la discipline étaient souvent jointes au texte de ces ornementations qui rendent un livre digne de lecture. Les vignettes dans lesquelles s'insérait la numérotation des chapitres ou encore les lettrines éclairaient la thématique des mines et de la métallurgie ou un de ses thèmes en particulier d'une façon emblématique.

Au temps de Georges Agricola au 16e siècle la technique de l'illustration préférée était l'estampe en bois, qui fut par la suite remplacée par la gravure sur cuivre. Le *De re metallica libri XII* d'Agricola contient 292 estampes en bois, qui ensemble avec le texte constituent une synthèse réussie. Cet ouvrage classique de la technique ancienne représente un sommet dans le développement de ce type de littérature. Ce sont souvent les feuilles de titre qui illustrent le contenu, comme par exemple dans le *Grand livre des expériences* de Lazare Ercker, sur la feuille de titre de laquelle est reproduite une salle d'expériences avec ses nombreuses éprouvettes. Les illustrations sont en soi des abrégés de la technique mécanique de leur temps. En outre, les représentations du travail et des vêtements des mineurs présentent aussi un intérêt pour les historiens de la culture.
Le manuscrit du livre minier de la ville de Schwaz en Autriche datant du 16e siècle recèle des aquarelles impressionnantes qui montrent le travail dans la mine d'argent à cette époque, en plus on peut étudier à partir de ces illustrations les vêtements et les outils des mineurs.

Dans la littérature des 17 e et 18 e siècles, les manuels sont illustrés par des gravures en cuivre qui — tout comme chez Agricola — décrivent les travaux dans la mine et les aciéries et où un regard particulier est accordé aux machines. Les ornementations des cartes minières des temps anciens sont particulièrement artistiques, les paysages sont luxueusement parés, les bords des cartes montrent souvent les mineurs et les arpenteurs au travail. Un ouvrage particulier est le livre des vêtements paru en 1721 chez Christoph Weigel à Nurenberg. Avec ses 50 gravures sur cuivre, cet ouvrage fait partie des sources les plus importantes pour l'histoire du développement du vêtement du mineur. En ce qui touche la vie du mineur, mentionnons enfin le livre d'Eduard Heuchler *Le* curriculum vitae *du mineur* qui montre de façon naïve sa vie quotidienne de la naissance à la mort.)

K

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History of Mining and the Geological Survey in Russia

Exploration and use of mineral resources all over Russia required its organization. That's why the long and didactic history of mining and geology is rousing interest up to now. The first period (since the 12th century to Peter the Great) was the time of uncertain but realized activities. Rock salt, iron, marsh ores, mineral colours and whetstones mining in Komi and the Urals is known since the 12th century. At the beginning of the 18th Peter the Great took significant steps for industrial exploitation of minerals in the Russian State. The Geological Survey was founded in Russia in 1882 ut its prosperity falls on the 20-30s of the 20th – the time of the rapid industrial growth, and after the II World War (1941-1945) when destroyed national economy was reconstructed.

Approach to study and exploitation of mineral wealth has changed in the 90s after the USSR disintegration and transition to market. The Geological Survey that was made of many big scientific and research institutions felt disintegration too. Since 1993 its privatization with further incorporation has begun.

None the less Russia has kept its potential in mineral resources and is now one of the world leaders in reserves and production of such minerals as oil, gas, iron, gold, diamonds, nickel and chemical fertilizers. The Ministry of Natural Resources of the Russian Federation was established in 1999. The Federal Subsoil Use Agency (under the Ministry authority) is responsible for mineral resources with due regard to the Russian natural features and the world experience and innovations.

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Kalliope – eine Datenbank für geowissenschaftliche Nachlässe in der Universitätsbibliothek der TU Bergakademie Freiberg/Germany

Im Zeitalter großer internationaler Datenbanksysteme kommt den wissenschaftlichen Nachlässen eine wachsende Bedeutung zu. Die Bibliothek der TU Bergakademie beherbergt etwa 180 wissenschaftliche Nachlässe aus vier Jahrhunderten. Sie spiegeln die Entwicklung der Montanwissenschaften und der Geowissenschaften vom 18. Jahrhundert bis heute wider. Gleichzeitig zeichnen sie aber auch ein Bild der

Kulturgeschichte und politischen Entwicklung einer Region oder eines Landes nach. Das macht sie zu einer unentbehrlichen Quelle unikalen Informationsmaterials für unterschiedlichste historische Forschungsarbeiten.

Neben den bekannten Gründen ergibt sich aus heutiger Sicht ein weiterer wichtiger Punkt zum Sammeln, Erschließen und Bereitstellen wissenschaftlicher Nachlässe. Wenn man bereits 1963 feststellte, dass sich das Gewichtsverhältnis zwischen dem Quellenwert staatlicher Akten und privater Papiere seit dem 19. Jahrhundert zugunsten der privaten Papiere verschoben hat, so gewinnt dieser Aspekt durch Internet-Kommunikation und Mailboxen immer mehr an Bedeutung. Für zahlreiche biographische Informationen werden künftig nur noch wissenschaftliche Nachlässe zur Verfügung stehen. Die Erwerbung von persönlichem Schriftgut bedeutender Persönlichkeiten des gesellschaftlichen, wissenschaftlichen und kulturellen Lebens entspricht daher einem dringenden Erfordernis, um künftige Untersuchungen zur Hochschul- und Wissenschaftsgeschichte sowie in zunehmendem Maße auch biographischen Forschungen auf eine möglichst breite Quellenbasis gründen zu können.
Eine wesentliche Grundvoraussetzung für eine zentrale Datenerfassung mehrerer Bibliotheken und Archive ist die Normierung von Daten. 1997 wurden die Regeln zur Erschließung von Nachlässen (RNA) geschaffen. Als Portal bot sich das offene Verbundinformationssystem Kalliope an, da hier bereits das Geologenarchiv integriert war.

Kalliope ist ein Verbund zur Katalogisierung von Autographen und Nachlässen mit dem Ziel der Präsentation der Erschließungsergebnisse über ein gemeinsames Portal im Internet. Die Datenbank enthält insgesamt 1.185.000 Autographen, 17.500 Bestände und ist ein biographischer Nachweis für 412.200 Personen.

2004 hat die Universitätsbibliothek der Bergakademie Freiberg mit Unterstützung der Deutschen Forschungsgemeinschaft ein Projekt gestartet, bei dem Nachlass-Daten in das Verbundsystem eingespeichert werden und dann weltweit zur Verfügung stehen sollen.
Nach einer on-line-Katalogisierung aller Nachlässe wurden drei regional bedeutende Nachlässe detailliert erschlossen. Einer der tiefer erschlossenen Nachlässe ist der von Abraham Gottlob Werner (1749-1817).

Bei der einheitlichen Erschließung der Bestände soll einerseits dem unikalen Charakter der Materialien und andererseits dem heterogenen Kontext ihrer Aufbewahrung in den verschiedenen Bereichen der Bibliothek Rechnung getragen werden. Mit einer inzwischen nutzbaren Konkordanz von RNA und Dublin-Core-Code wird eine Weiterentwicklung der Metadaten und deren konsequente Anpassung an international gebräuchliche Daten berücksichtigt und damit die Nutzung bereits erfasster Nachlassinformationen über Suchmaschinen verbessert. Das Verbundinformationssystem Kalliope wird künftig auch über die virtuelle Fachbibliothek Geowissenschaften, Bergbau, Geographie und thematische Karten recherchierbar sein.

(In the age of big international data bank systems a growing meaning comes up to the scientific reductions. The library of the University of Technology mining academy accommodates about 180 scientific reductions from four centuries. They reflect the development(creation) of the Montanwissenschaften and the geosciences of the 18-th century till this day(so far). However, at the same time they also go over a picture of the cultural history and political development of a region or a land. This does them an indispensable spring of unikalen information for the most different historical research projects. Beside the known reasons another important point arises from today's view to the collecting, opening and providing scientific reductions. If one found out already in 1963 that the weight relation has moved between the spring value of state acts and private papers since the 19-th century in favour of the private papers, this aspect wins by Internet communication and mail boxing more and more in meaning. Only scientific reductions will be available from now on for numerous biographic information. Hence, the acquisition of personal written property of significant personalities of the social, scientific and cultural life corresponds to an urgent requirement to be able to found future investigations to the university history and science history as well as in increasing measure also to biographic researches on a possibly wide spring base. An essential basic condition for a central data capture of several libraries and archives is the standardisation of data. In 1997 the rules were created for the development by reductions (RNA). As a main entrance the open group information system Kalliope offered, because here already the geologist's archive was integrated. Kalliope is a group to the cataloguing of autographs and reductions with the purpose of the presentation of the development results above a common main entrance on the Internet. The data bank contains a total of 1,185,000 autographs, 17,500 supplies and is a biographic proof of 412,200 persons.

In 2004 the university library of the mining academy has begun Freiberg with support of the German research council a project with which reduction data are stored in the compound system and should be available then worldwide. After an on-line-cataloguing of all reductions three on the regional level signifying reductions were opened in detail. One of the deeper opened reductions is that of Abraham Gottlob Werner (1749-1817). By the uniform development of the supplies should be taken into account on the one hand to the unikalen character of the materials and, on the other hand, to the heterogeneous context of her safekeeping in the different areas of the library.

With a concordance usable in the meantime of RNA and Dublin Core code an advancement of the Metadaten and their logical adaptation to internationally common data is taken into consideration and with it the use is already improved of grasped reduction information about searching machines. The group information system Kalliope will be investigateable from now on also about the virtual technical library geosciences, mining, geography and thematic maps.)

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Travelling and Collecting: two Interdependent Phenomena. Adolf Traugott von Gersdorf in Vienna, 1781

Adolf Traugott von Gersdorf (1744-1807), a nobleman and landowner from Oberlausitz (now Germany), was a passionate traveller and collector who kept records during his travels. After his studies in Leipzig, he occupied himself with mineralogy, geology, meteorology and the study of electricity, and came into contact with many scholars of his day. In 1779 Gersdorf's travels included the Netherlands, 1781 saw him in Vienna and 1786 in Switzerland. His manuscripts of more than 10,000 folio pages, were never published and were not intended for public scrutiny. At the centre of my analysis are these previously unpublished records of Gersdorf's concerning his journey and his stay in Vienna in 1781. I shall publish this manuscript in a monograph. The brief analysis here will serve to put forward some first thoughts on his mode of writing. Gersdorf concentrated on the museum locations in the city. Although Gersdorf visited a number of significant people, such as the mineralogist Ignaz von Born, the composer Joseph Haydn or the prelate Johann Ignaz Felbiger, we learn literally nothing about these personalities but an infinite amount of detail about the centres of learning, the treasure-chambers, the gallery, the park at Schönbrunn, the Hofburg, the Court Library and the natural history collections and their objects.

Travelling and collecting: these are phenomena that influence one another reciprocally. The objects collected travel from their original contexts into new contexts created by the collector. And the collector travels in order to be able to collect. This reciprocal relationship between the event of travelling and that of collecting is articulated in Gersdorf's system of recording in such a way that this becomes more than the example of a single individual. It can, rather, be understood as symptomatic of the collecting and museum-displaying attitude of a prominent representative of that mode of perception who embodied the rapid growth in collecting and investigation in the second half of the 18^{th} century.

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Application of the cementation in Smolník – Schmolnitz

At first we must to situate the location of the process. Smolník (in german Schmolnitz) is situated in the mountains of the ores (Slovenské rudohorie) about 50 km to the west of Košice – one area of the present Slovakia. Schmolnitz was one of the mining centre long ago in latén period, so 500 years b.J.C.. The first indications about the gold in Schmolnitz is from year 1243, but it fall short the details about this activity. From this papers it is possible conclude in the valley of the creek Smolník the iron was. At this time Schmolnitz was one part of the town of Gelnica (Golnitz). Schmolnitz received the town rights in 1326. One of the more long established memory about Schmolnitz is from 1255 in the document of king Belo IV. in which the monastery border of the Jasov,s monastery and of the bishop was described. The privileges of Schmolnitz were in contacts of the financial reforms and with the duty system and with foundation of the mint of the Upper Hungary, also in Schmolnitz. The mint was here a long time ago, it was the second mint after the first in Kremnica – Kremnitz. One of the task of the mint was to determine the silver content and the price of silver in one denar. In 1339 the king Charles Robert did give the higher laws.

The first indications about excraction of copper in Schmolnitz are from year 1410 – it was 1231 quintals.

Schmolnitz was known by a lot of mining and metallurgical activities, but it is sure the most important was the cementation, the copper production by this process. The cementation generally is the reduction of one metal more noble from the solution by one metal few noble. In Schmolnitz it is possible to describe the proces by the next reaction:

$$Fe + CuSO_4 = Cu + FeSO_4$$

In the reality the mining water with copper content did forme one origin specific of this district in the region Spiš – Gemer mountains. The cementation water was one natural or artificial solution of sulphure acid and t'he copper salts in majority the vitriol. The copper was precipited as solid by iron in the underground and after in cementation apparatus over the terrain. In the past this water was named as copper water or cementation water.

The cementation water as produced in the mine area in the specific conditions favourables of the oxidation of the sulphides (chalcopyrite, bornit and the next) in the pyrite presence and the transformation of the sulphate whioh after as facile solubles passed to the mining solutions, which percolated through the parts of the ores „attacked".

The cementation water was formed in Schmolnitz mines by natural and artificial way. The cementation water in Schmolnitz mines is known and used from the end of 13th century. The poor water was lead down to the reserved mining stratums of the ores and over terrain in the years 1725 – 1878.

For the conduction of the water to the superficies the wood tubes more than 3000 m totally was used for example in the year 1860. For this aim they used in the majority the water sources from this area or the precipitation waters. The superficies water after percolation through the material underground was pumped to the superficies and on this was flowed by the conduits and canals to the cementation apparatus.

The first memory on the copper production by cementation is from year 1346. In 1497 M. Thurzo from Lotschau and the mayor of the chamber J.Donel did conclude the contract for the cementation and for the production of pumps. (kunst). By the sourcre from year 1528 was produced abut 400 quintal of copper and benefit was 400 – 500 golds.

In the first two centuries the copper was produced in the channels in the mines where the water was lead down by wood tubes and by old or new iron. In 1634 6 apparatuss was in function. In 18th century the amount of the cementation apparatuss increased considerablement. The greater increasing production of the copper was in 19th century when 10 apparatusses were in function.

As the equipment of the cementation the wood tubes were constructed of the dimension: 80 cm long, 1,5 cm wide and 26 cm deep.

From the beggining of the production of the copper the raw iron, cuted and foundred iron was used, but also the waste in bars. The copper content in the cementation water natural was 3,5 – 14 g/0,0315 m^3. In the 19th century the waters after cementation was used in one sedimentation tank, where the basic salts was produced which after dehydratation was packed and selled as yellow and green ocre, after calcination as english red. In 19th century and during the first world war here also the blue and green vitriol was produced. The copper production from mine waters in the first

third of the 19th century has the decreasing development.
During the past century the cementation was used in the more modern equipements. The copper production was definitivement abandoned in the end of 70th years of the past century.

The mint in Schmolnitz.

The coin production in Schmolnitz has the long tradition. It was joined with the development of the town and its mines and metallurgy. The beggining of the mint is in the time of Charles Robert Anjou (108 – 142). The mint chamber was founded here in the end of the 20th years of 14th century. At the top of the mint was the count (comes camerae) who received from the king un allocation of the fix price. Here the silver coins were produced marked by „S“ and the initials of the counts of the chamber. Also the denars, oboloss and parvus was made here. The groschs were made in the years 1330 and 1543. The production of the coins in Schmolnitz was interrupted the most probably in 1543. During the rule of Marie Therese (1740 – 1780) in 1759 the copper coins beggined to produce. It is assumed it was in 1761. But the mint here was not in production regular. In the time of the largest production 14 stamp machines was in function, 500 employees and the production was 0,5 million of the coins. The grajciars and its multiples (3, 6, 15, 30) were here produced but also the mipoltours, schilings and grosches. The more known specialist of Schmolnitz was France Xaver Drevenyak, who was evaluated by Chambre of Cour of Vienna by golden medal. The mint in Schmolnitz was closed and finished the production in 1871.

L

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New Information of Mining Archaeology in the Region of Banská Štiavnica

The Banská Štiavnica region belongs to the most significant mining regions in Slovakia, which was also predetermined by the rich sources of silver, gold, lead or iron ore. Archaelogical research situated either directly in the town itself or its broader surroundings and conducted during the last three decades has proved the beginning of ore extraction by Celts since the 3rd century BC till 1st century AD, permanent settlement and extraction in the mining region from the 12th to 20th centuries. The research on extraction was conducted in the following territories: the old town Glanzenberg- Celts, a mining settlement, a medieval castle, technical objects – "pinga" fields, depression of soil due to mining activities, a furnace, an ore testing laboratory and the object of the metal shroff, 12th – 16th centuries; Banská Štiavnica – Kammerhof, the settle of the mining management, residential and fortification objects, an ore testing laboratory, 12th – 19th centuries,; Vyhne – gold washing, Sklené Teplice – mettalurgical objects, 15th – 18th centuries; Beluj – "pinga" fields, Celts ; hill Sitno – a fortified castle, a medieval castle, primeval – new age; other localities.

The latest research of the locality "The Old Town" conducted from 2000 to 2006 has brought remarkable facts from the territory Kostolík. It includes the places where ore lode Bieber is situated with visible soil depression after extraction activities in the 13^{th} but in the 16^{th} or 17^{th} centuries as well. In the neighbourhood of Bieber lode housing objects added to the encircling fortification have been explored just like the underground rooms /probably a warehouse of deposited iron ore/ situated directly under the technical object, which was previously considered to be a church on the base of archaelogical findings in 1902, although it has never been confirmed. The research from 2005 to 2006 made on the territory brought a clear evidence of ore extraction from the 16^{th} to 17^{th} centuries when medieval objects had already been abandoned, destroyed and covered with slag heap material. It is necessary to mention a Byzantine coin from the 11^{th} century, imported ceramics from Saxon territories in Saxony, findings of glass, ceramics, an ore mill for ore graining dating to the 13^{th} – 14^{th} centuries.

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Le patrimoine scientifique de l'Université Laval : un aperçu

Cette présentation fournira un aperçu de la constitution et de la composition du patrimoine archivistique, livresque, muséologique et architectural généré par l'enseignement et la recherche en sciences à l'Université Laval depuis sa fondation en 1852, portant une attention particulière aux domaines des sciences de la terre, des mines et de la métallurgie. Elle mettra la constitution de ce patrimoine dans le contexte de l'évolution de l'idée d'université à Québec, surtout depuis l'introduction de la modernité dans la société québécoise au tournant du 20e siècle. La fondation des écoles de Chimie et des Mines à l'Université Laval marque une étape majeure dans cette évolution et a un effet important sur la constitution du patrimoine archivistique en sciences. Outre les archives, cette présentation fera connaître les collections scientifiques de livres rares de la Bibliothèque de l'Université Laval, la collection du Département de géologie et de génie géologique, les objets des Collections de l'Université Laval ainsi que l'urbanisme du campus et des édifices construits durant les années 1940, 1950 et 1960 en grande partie afin de satisfaire l'expansion des sciences.

Du 13e au 20e siècle, l'université est conçue essentiellement comme une institution d'enseignement et de formation d'une élite humaniste dans une société traditionnelle (le *gentleman*, ou l'honnête homme). La formation ne visait pas à l'utilité sociale, bien que celle-ci était sous jacente. L'Université Laval, dès sa fondation en1852, est l'héritière de cette conception. Au tournant du 20e siècle, dans le contexte de la transformation de la société québécoise traditionnelle en société industrielle moderne, mais plus spécifiquement sous la pression de chefs d'entreprises à Québec, l'Université Laval porte une attention accrue à un enseignement scientifique, technique et professionnel. Elle offre de moins en moins une formation professionnelle nécessaire à une société traditionnelle, et de plus en plus celle d'une main d'œuvre qualifiée et économiquement utile dans un monde moderne. Au même moment elle introduit et cultive la recherche comme une deuxième mission, mettant l'accent sur la recherche appliquée par rapport à la recherche fondamentale. Les glissements d'un enseignement humaniste vers un enseignement professionnel, de l'enseignement vers la recherche et de la recherche fondamentale vers la recherche appliquée traduisent une évolution de l'idée de l'université comme une institution autonome (la tour d'ivoire) vers l'idée de l'université comme une institution au service de la société (enracinée). L'enseignement et la recherche resteront des missions de l'Université Laval, mais deviendront des moyens, privilégiés mais pas exclusifs, par lesquels l'Université exerce sa mission première de service à la société.

Jusqu'au début du vingtième siècle, les sciences constituaient un élément dans la formation de « têtes bien faites ». À l'Université Laval, elles étaient enseignées dans le cadre de la formation générale à la Faculté des arts. Au tournant du siècle, et surtout après la première guerre mondiale, l'Université se mit à traiter les sciences et la technologie comme des domaines de spécialisation comportant une fonction de recherche. La fondation des écoles de Chimie et des Mines joua un rôle crucial dans ce changement d'optique. La spécialisation et l'augmentation du nombre d'étudiants qu'entraînait le développement de la recherche en sciences coûtaient cher et obligèrent l'Université à déménager en banlieue de Québec. Le déménagement en banlieue constitue une caractéristique du modernisme nord américain, et ce sont des concepts modernistes qui inspirèrent l'aménagement du campus et le style architectural des pavillons qui y sont construits de la fin des années 1940 jusqu'à la fin des années 1960. Afin de financer le nouveau campus et, entre autres, soutenir le développement des sciences, l'Université mit à contribution le gouvernement, le milieu économique ainsi que la population. Se justifiant de plus en plus comme un service à la société, l'Université se voit contrainte de se soumettre à certaines exigences de cette société envers les organismes publics, dont la législation touchant les archives, y compris les archives scientifiques. De plus, en réaction aux discontinuités générées par le changement rapide dans une institution moderne et complexe, l'Université Laval, réfléchissant en cela une société québécoise en pleine Révolution tranquille, créa des « lieux de mémoire », selon l'expression de l'historien français Pierre Nora, notamment un service d'archives, une collection de livres rares et un musée, ayant pour mandat de préserver et de faire valoir la mémoire institutionnelle considérée menacée d'oubli.

De tous les patrimoines universitaires, celui des sciences est parmi les moins bien préservés, entre autres parce que les sciences contrairement à d'autres disciplines semblent attribuer moins de valeur à ce qui s'est fait dans le passé, et parce que ceux et celles qui se préoccupent du patrimoine ont moins de sensibilité envers les sciences qu'envers d'autres domaines. La conséquence en est la pauvreté du patrimoine livresque et archivistique au moins en science ; aussi l'idée de l'université comme une institution au service de la société peut –il avoir un impact positif sur cette situation.

(This paper will provide an overview of the constitution and composition of the heritage resources - archival, librarian, museological, and architectural - generated by teaching and research in the sciences at Université Laval since its foundation in 1852, particularly as regards the geosciences, archaeology, mining, and metallurgy. It will place the constitution of these heritage resources in the context of the evolution of the idea of the university in Québec, particularly from the introduction of modernism in Québec society at the turn of the 20th century. The founding of the schools of chemistry and mines at Université Laval mark an important stage in this evolution and have a significant impact on the constitution of the archival heritage in the sciences. In addition to the archives, however, this paper will present the rare book collection in the sciences in the University library as well as the geological collection in the Département de Géologie et de Génie géologique, artefacts in the Collections de l'Université Laval, and the campus and buildings constructed from the 1940s through the 1960s in large part to house expansion of the sciences.

From the 13th to the 20th centuries, the university was conceived essentially as an institution for the formation of a humanist elite in a traditional society (the gentleman or the *honnête homme*). The education dispensed was not intended to be useful to society, although it was so incidentally. This concept of the university inspired teaching at Université Laval from its beginnings in 1852. At the beginning of the 20th century, within the broader context of the transformation of Québec from a traditional to a modern industrial society, but more specifically under pressure from leaders of business and industry, Université Laval began to pay increasing attention to scientific, technical and professional teaching. Less and less it educated the professional class for a traditional society and more and more it formed a qualified and economically useful work force for the modern world. At the same time it introduced and developed research as a second mission. The slide from a humanist education to professional formation, from teaching to research, and from fundamental to applied research reveals an evolution of the underlying idea of the university as an autonomous institution (the ivory tower) to that of the university as a service institution, rooted in the society it serves. Teaching and research remained missions of Université Laval, but, more significantly, they become means, special but not exclusive, by which the University exercises its primary mission of service to society.

Until the beginning of the 20th century, the sciences constituted one element in the education of the gentleman. At Université Laval they were taught within the framework of the general programme of teaching in the Faculté des arts. At the turn of the century, but particularly after the First World War, the University began to treat the sciences and technology as fields of specialization that included a research function. The founding of the schools of chemistry and of mines played a crucial role in this changing perception. The specialization and the increase in the number of students generated by the development of research and teaching in the sciences proved to be expensive and forced the University to move to a suburb of Quebec. The move to the suburbs is one aspect of modernism in North America, and the lay-out of the new campus and the buildings constructed on it from the end of the 1940s through the 1960s were inspired by modernist concepts in architecture. To pay for the new campus and, among other objectives, to enable the development of the sciences, the University was obliged to seek significant financial support from the public. Justifying itself more and more as a service institution, the University was increasingly obliged to submit to constraints imposed by society on public institutions, including archival legislation that affects archives touching on the sciences. In addition, as a reaction to the discontinuities generated by rapid change in a complex, modern institution, Université Laval, reflecting in this Québec society generally, established "places of memory," to use an expression popularized by French historian Pierre Nora, notably an archival service, a collection of rare books, and a museum, with a mandate to preserve and promote an institutional memory felt to be under threat of oblivion.

Of all the aspects of university heritage, that of the sciences is among the less well preserved, in part because the sciences seem to attribute less value than do other fields of knowledge to what has been done in the past and in part because those involved in heritage resources are less attuned to sciences than to other fields. The result is that at least rare books and archival resources in the sciences are poor in comparison to heritage resources in other fields, but the idea of the university as a service to society may have a positive impact on this situation.)

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The Composition of Slags in Iron and Steel Production

The numerous places of the slag residues exist in Slovenia, where the iron was recovered by the reduction of the iron ore in the ancient times. The simple reduction furnaces dug into the ground or into the slope of the hill were used respectively. The production of the malleable iron of the loup shape (Slovenien "volk" means wolf) in the smaller blast furnaces named as the Slovenian furnaces were the next stage. Pig iron was manufactured using the charcoal in the blast furnaces, but in the 19th century the coke was already used.
In the blast furnace the ferro-manganese of about 40 % of Mn was manufactured. For that success the Medal in the World exhibition was won in Vienna.

In that article the compositions of the slags will be presented, which were used by the metallurgists of that time at the reduction of the iron ores and at the various refining processes respectively. The slags have the different compositions, which could be represented by the three-component system of FeO-CaO-SiO_2. In the vitreous phase between the fayalit and olivine phases the various contents of the potassium oxide are in the solidified slags. The slags of the melting points between 1000 and 1150°C have the composition between the potassium alumosilicates and anorthite with the FeO content of 8 to 15 %. Their phase composition is presented by the micrographs.

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Characterization of Slag Findings from Locality Felix Romuliana

Felix Romuliana (near Zaječar, Eastern Serbia), well known as imperial fortress and palace of the Roman emperor Galerius, is dated to the end of 3rd and the first two decades of the 4th century AD. Recently, after 50 years of systematic archaeological exploration, this famous locality showed one more aspect – as a potential archaeometallurgical locality, dated to early Byzantine period – the end of the fifth and first half of sixth century. Namely, large metallurgical object - a kind of smelting furnace, has been discovered in 2004 during the archaeological investigations, together with a lot of slag occurrences and different metal findings. The slag samples, taken from this locality, have been investigated using different characterization methods – chemical analysis, SEM-EDX, thermal analysis and XRD, in order to clarify the Early Byzantine metallurgical activities at Felix Romuliana.

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Die berühmte Schalenhartgusswerk von Abraham Ganz in Budapest funktioniert derzeit als Museum

Das Budapester Gießereimuseum wurde in der ältesten, bis heute bestehenden, als Holzkonstruktion errichteten Gießereihalle im Jahr 1969 eröffnet. Das Gebäude wurde ursprünglich in den Jahren 1858-62 nach den Plänen von *Egon Pfannl* gebaut, es war die Eisengießerei zur Erzeugung von Eisenbahnrädern von Abraham Ganz. Es war bis zu seiner 1964 erfolgten Stilllegung als Schalenhartgusswerk in Betrieb.

Die Einführung der von den Hochöfen unabhängigen Eisengießereiindustrie fällt mit den Bestrebungen zur Erlangung der gesellschaftlichen und wirtschaftlichen Umgestaltung des Landes und gleichzeitig zur Einführung der nationalen ungarischen Autarkie zusammen. Diese Epoche der ungarischen Geschichte – die von 1830 bis zum Freiheitskampf 1848-49 dauerte – wird als Reformzeitalter bezeichnet. Sie kann auch als Vorabend der ungarischen Industrierevolution betrachtet werden.

In diesen turbulenten Zeiten kam der gebürtige Schweizer, Abraham Ganz (1814-1867) nach seiner Wanderschaft im Westen im Jahr 1841 nach Pest, um seinen seit seiner Jugend gepflegten Wunsch zu verwirklichen. Er gründete eine florierende Gießerei, die in Kürze der Stolz der Industrie des Landes wurde.

Ganz startete 1845 sein selbstständiges Unternehmen. 1853 begann er, die Anforderungen des in Entwicklung befindlichen ungarischen Eisenbahnnetzes erkennend, mit der Herstellung von Eisenbahnrädern aus Schalenhartguss, und schützte sein Verfahren auch patentrechtlich. Der Sinn des Patentes war, dass auf der Oberfläche der Eisengussstücke mittels Schnellkühlung eine harte Kruste hergestellt werden kann, und dies ist durch Innenbeschichtung der sog. Kokille mittels eines, metallisches Antimon enthaltenden Beschichtungsmaterials erreichbar. Obwohl Ganz das Sb wahrscheinlich aufgrund seiner Erfahrung für die Glasur als geeignet gefunden hat, haben Jahrzehnte später durchgeführte metallurgische Forschungen bestätigt, dass dieses Element die Entstehung der Hartschicht ähnlich, wie Mn und Mo wahrhaftig fördert.

Der Name und die Gießerei Ganz wurde mit der Einführung des Schalenhartgusses auf dem ganzen Kontinent berühmt. In der zwischen 1858-62 erbauten neuen Gießereihalle wurde bereits 1867 das hunderttausendste Eisenbahnrad hergestellt. Dank seiner unermüdlichen Aktivität hat seine Fabrik während 23 Jahren 69 Bahngesellschaften in sieben Staaten beliefert, bis 1867 stieg die Zahl der Arbeiter auf das Zehnfache, die Gussproduktion auf das Fünfzehnfache und der Reinertrag auf das nahezu Hundertfache. Das Vermögen von Ganz belief sich auf 2,5 Millionen Forint.

Ganz behielt seine schweizerische Staatsbürgerschaft, aber war auch gleichzeitig treuer Bürger seiner Wahlheimat. Während der gegen die Unterdrückung der Habsburger im Jahr 1848 aufgeflammte Revolution und Freiheitskampf hat seine Gießerei auch Geschützrohre und Kanonkugeln gegossen, darum wurde er nach der Niederschlagung des Freiheitskampfes vom Kriegsgericht zu sechswöchigem Gefängnis verurteilt. Die Strafe wurde aber aufgrund eines Gnadenaktes erlassen. Ganz unterstützte die sozialen und kirchlichen Einrichtungen in Buda mit Spenden. Er wurde zum Ehrenbürger der Stadt gewählt. Für seine besonderen Erfolge in der Entwicklung der Industrie wurde er mit dem Großkreuz des Franz Joseph Ordens ausgezeichnet.

Die mit der Entwicklung der Fabrik verbundene überdimensionierte Arbeit und Sorgen haben seine Gesundheit stark geschädigt, dazu trug auch seine geerbte Nervenkrankheit bei. 1867 ist er unter tragischen Umständen gestorben.

Nach dem Tod von Ganz wurde die Fabrik unter der Leitung von Andreas Mechwart zu einer Aktiengesellschaft umgestaltet. Man begann mit der

Produktion von Walzstühlen für die Mühlenindustrie, dann wurde auch eine elektrische Division gegründet. Mit dem Ankauf mehrerer Fabriken hat man die Produktionspalette mit Eisenbahnfahrzeugen und Schiffen erweitert. Schließlich wurde das Unternehmen zu einer der größten Unternehmensgruppen in der Maschinenindustrie. Nach dem Zweiten Weltkrieg zerfiel das Unternehmen auf kleinere Teileinheiten. Derzeit benützen 25 Unternehmen den Namen Ganz.

Mechwart entwickelte die Technik des Schalenhartgusses 1896 durch Ankauf des Griffin Patents weiter. Diese Technik wurde bis zur im Jahr 1964 erfolgten Schließung der Gießerei angewandt. Das Stammwerk, wo Ganz seine Gießerei gegründet hat, wurde 1984 aus Gründen des Städtebaus zum Abbruch verurteilt. Unter der Leitung des Technikhistorikers Gyula Kiszely wurde das Gebäude zur Herstellung des Schalenhartgusses 1969 als Gießereimuseum der Öffentlichkeit übergeben. In der Errichtung nahmen die damaligen Gießereien, Hüttenwerke, das Ministerium für Industrie, der Ungarische Verein für Berg- und Hüttenleute gleichermaßen teil.

Das Museum hat die Stürme der Privatisierung der 1980-er Jahre überlebt und wurde zur Tochterinstitution des Technischen Landesmuseums, deren Träger ist das Ministerium für Kultur. Etwa die Hälfte der 1125 m^2 großen Fläche des Museums dient zur Vorstellung des ursprünglichen Einrichtungen des Ganzschen Stammwerkes (die Kupolofen zum Schmelzen des Eisens, die zum Abstich benützten

Pfannen, die unter den Drehkränen befindlichen Form- und Gießkreise). Auf der restlichen Fläche werden die Reliquien und die Geschichte der ungarischen Eisen-, Stahl- und Metallgießerei präsentiert. Auf der Freilichtaustellung sind große Gussstücke, im Pantheon der Metallurgie die Büsten namhafter Persönlichkeiten des ungarischen Hütten- und Gießereiwesens zu sehen.

In der Bücherei kann in 5200 Büchern und nahezu 1000 Zeitschriftenbänden, zum Großteil aus dem Gebiet des Hütten- und Gießereiwesens geforscht werden, darunter in dem kompletten Bestand der im Jahr 1868 gegründeten Zeitschrift der Ungarischen Berg- und Hüttenleute. Im Archiv stehen Dokumente der Metallurgie und des Gießereiwesens, Manuskriptsammlungen, Photos, Zeichnungen den Forschern zur Verfügung. Im EDV Datenregister befinden sich 17.000 Datenblätter der Geschichte des ungarischen Glockenbestandes für die Forschung.

Das Museum diente während der 37 Jahre seines Bestehens mit zahlreichen Tagungen, Referaten der Bildung. Bedeutendste Ereignisse des letzten Jahrzehntes: Im Jahr 1998 wurde für die Gäste des 63-sten Internationalen Weltkongresses eine Ausstellung ungarischer Kunstgussstücke veranstaltet. 1999 feierten wir zusammen mit einer Delegation aus dem schweizerischen Heimatdorf von Abraham Ganz den 30-sten Geburtstag des Museums. 2000 wurde eine schöne Wendeltreppe aus dem XIX Jahrhundert und eine Galerie im Ausstellungsraum installiert. 2001 hat die Sammlung „Kunstguss im Badeleben Anno…" viele Zivilbesucher angezogen. 2002 wurden die

Gebläse der Kupolofen renoviert. Mit dem Titel „Lob des Gußeisens" wurde in der Slowakei (Selmecbánya) eine Sonderausstellung eröffnet, die seither an weiteren elf Plätzen vorgestellt wurde. 2003 bearbeitete die Ausstellung „Zauber früherer Feuer" die Geschichte der Bügeleisen. Diese wurde auch zur Wanderausstellung und konnte bisher in weiteren fünf Ausstellungsräumen gezeigt werden. 2004 begannen im Museum die Renovierungsarbeiten. Das Dach wurde erneuert und das Musuemsgrundstück mit einem, schönen Zaun umgeben. Gemeinsam mit dem Amt zum Schutz des Kulturerbes wurde in der Burg Buda eine Ausstellung der Glockengeschichte eröffnet. 2006 begann die Erneuerung der Stammausstellung. Als Erstes eröffneten wir die Ausstellung über das Leben und die Tätigkeit von Abraham Ganz, und im Juni dieses Jahres kam es zur Renovierung der unter Denkmalschutz stehenden Einrichtungen des Ganzschen Stammwerkes. Als Nächstes werden wir im Herbst des Jahres die Gedenkausstellung zur Ehrung des vor 100 Jahren verstorbenen Andreas Mechwart eröffnen.

Seit 1997 veranstalten wir alle zwei Jahre Tagungen der Glockengeschichte, an welcher heimische und ausländische Referenten über ihre Forschungstätigkeit berichten. Für Kinder gibt es Vorführungen über Formen und Gießen. Mit der Bezeichnung „Museumshefte des Gießereimuseums" veröffentlichen wir ein Periodikum, in dem unsere ehrenamtlichen Forscher Artikel der Geschichte des Gießereiwesens präsentieren. Wir unterrichten Studenten der Museologie und Museumspädagogik, außerdem geben wir Möglichkeit für Sitzungen der

Fachleute des Gießereiwesens und der Geschichte der Technik.

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Urquhart – Hoover's group at the Urals from 1906 to 1917

The eighties of the 19th century in Russia are characterised by an active process of establishing joint-stock companies. Beginning the nineties the Government stimulates the penetration of the foreign capital into a gold mining industry. It is exactly a copper ore industry being developed in minning and metallurgical districts such as Kyshtim, Sisert and Tanalik-Baimak (the Urals) which is in the sphere of interest of British Capital. 1906, the Anglo Siberian company was organised in London in 1908, it is transformed into the Kyshtim corporation. In 1909 some London banks together with the Asov-Don Bank have founded the Russian Mining and Industrial Society. To sum it up, one can observe an appearence of Urquharta – Hoover's group, the most poweful private-capitalist association, having effect the copper industry of Russia.

The largest industrial of the Great Brittan, the USA and Russia its owness have been. Among them- Lesli Andre Urquhart (1874-1933) - a representative of the British business companies, has worked in Russia more then twenty seven years. At first he started as an engineer at the petroleum industrial works of Baku and the Caucasus, since 1906 he has been interested in the problems of nonferrous metallurgy as an executive director of the administration of the Anglo-Siberian and Russia-Asian corporations he has arranged the co-production of refined copper at Kyshtim's factories; the extractions and development of polymetallic ores in a mining Tanalik-Baimak district; and he has arranged the explotation of coal mines in Ekibastus and at Altai. Urquhart has been interested in the exploitation of some mines in France and Australia. After the Great October Socialist Revolution he became chairman of the Society of Creditors of Russia. 1921, he kept up the negotiations with the Soviet Government about the restitution of his previous ownership into concession. In 1927, the Russian-Asian corporation started exploiting the deposit of polymetallic ores in Australia.

Herbert Clark Hoover (1874-1964), one of the presidents of the USA, a geologist and a mining engineer, has taken part in the exploitation of Maico's oil inqustry and a mining inqustry of the Urals and Siberia. At the same time he was director of many companies, including the Russia - Asian, Irtish and Kysctim Corporations and the Society of Kysctim Mining Works. In 1908, he established a private consulting office in San Francisco. In 1921 he became Minister of Finances of the USA, signed the agreement aimed to help the people of the Volga region and the Urals in their struggle with the famine.

Due to the activety of Urchart – Hoover's group from 1906 to 1917 there have been established nine large companies on the extraction, processing and selling coloured and precious metals. Their interest included the wood industry. Minerals investigations have had a paramount significance. Much has been done by foreign specialists. Spacious prospecting has been fulfilled by G.M. Kinbury, L.D. Meiris, Brodricame, Stikney at South Urals. In Desember, 1917 all jont-stock companies credit Institution have been nationalised by the Decree of the All – Russia Central Executive Committee. 1920, The Council of National Commissioners has again begun considering the idea of cooperation with foreign firms on iteme of mineral extraction and processing. As a whole, one can consider the experience of foreign capitals investment into mining industry of the Urals, their experience can be investigated in other mining regions today.

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Mineral Raw Material for Ancient Industries of the North-East of Europe (Russia)

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Quebec Cultural Heritage. St. Lawrence Valley Bridges

Despite problems of travel and goods transport especially during freeze-up or spring thaw, there was no bridge across the St. Lawrence until 1859, when railroad development reached a stage that ensured it would be economically successful. A long bridge across the non-navigable Lachine rapids provided easy pier construction and employed a wrought iron box girder design developed shortly before in England. Wrought iron had to be imported from Britain because of very low production in Canada, although there was sufficient pig iron capacity. The bridge proved a technical success for 50 years, carrying up to 100 trains per day, providing passenger traverse and product delivery that enhanced industrial production in Montreal. The Grand Trunk constructed a bridge with a tubular main span across the Ottawa at the west tip of Montreal island that was also replaced with a steel truss. It has been paralleled by road bridges. As part of the initial stages of the transcontinental Canadian Pacific RR, a bridge was built at Lasalle in 1886.This through-truss, wrought-iron bridge was replaced by a steel truss bridge in 1910. In these narrows near the Upper Lachine Rapids, the Mercier tied arch bridge was built in 1934 and as the major link from the western south shore; the south end was raised for the

Seaway in 1958 and was paralleled by an almost identical span in 1963.

On the notable route going north from Montreal island, the Cartierville cantilever bridge (262 m with 127 m center span) that was constructed in 1930 by Dominion Bridge to replace earlier ones. There are some dozen multi-span road and rail bridges crossing the two northern channels; this includes the Papineau cable stayed bridge (1969) that has two towers supporting a center span of 240 m and side spans of 120 m.

Far north, up the Saguenay Fiord, an extraordinary aluminum bridge (1950) at Arvida (Jonquiere) has an arch with 90 m span of (center 14 m above foundations) with symmetrical approaches of 30m each. The roadway is supported on vertical pillars at equal interval of 6 m. Also spanning the Grands Decharges from Lac St-Jean, the Grenon cantilever bridge (span 82 m, anchor arms 57 m), built in 1920 for the Quebec-Chibougamau RR (never completed), was converted in 1946 to a road bridge with the old timber approach trestles being replaced by reinforced concrete. Just east of Quebec City, a suspension bridge was constructed in 1935 by Dominion Bridge, over the north channel of the St. Lawrence to Isle d'Orleans, from which ferry service was cut in winter and spring because of ice floes moving with the tide. The north connection is near the Montmorency Falls, where the earliest suspension bridge (50 m clear span to shore towers) collapsed shortly after completion in the spring of 1856 killing 3 persons. A temporary three-span wooden truss was built in 1857 near the site of a similar 1839 bridge. A new 2-span steel truss bridge was completed several hundred meters upstream in 1926. Further east on the South Shore, the Inter Colonial RR, entering from the St. John River Valley, N.B., built wrought iron truss bridges across wide tributary valleys, such as at Trois Pistoles; this rail link enhanced development compared to the North Shore.

The Canadian-designed and built bridge near Quebec City stands as the longest cantilever span (550m); it was designed for twin rail tracks and a road way that was later expanded by removing one track. An earlier attempt in 1907 collapsed during construction due to under-design and not to any metallurgical failure. The final successful bridge, opened in 1917. In 1936 was the Jacques Cartier Bridge high over Montreal harbor to the south shore; it also provided access to a major park, Isle Ste-Hélène. In critical members, the Quebec structure included high-strength heavy plates that could not be rolled by the fledgling Canadian steel industry. The completion, originally planned for 1916 was interrupted by the dropping of the suspended mid-span through failure of a cast hoisting saddle. When an expressway was constructed parallel to the Quebec Bridge in 1970, the solution was the Pierre-Laporte suspension span, the longest in Canada.

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The Goniometer. Rise and Fall of the Most Powerful Crystallographic Instrument of the 18th and 19th Centuries

During a period of more than one century, the measurement of the angle between crystal faces – goniometry – was the most important scientific tool of mineralogists. It led to epoch making discoveries between 1669 and about 1900. In 1669 Nicolaus Steno found that angles between equivalent faces in a mineral species are always equal. This "law of constancy of interfacial angles" is still the fundamental law in crystallography and the classification of solids in 7 crystal systems is based on this observation. René Just Haüy formulated his "dekreszenz-theory" in 1781 after morphological studies, as well as Eilhardt Mitscherlich the nature of "polymorphism" and "isomorphism" after combined morphological and chemical studies in the years between 1818 and 1823. All these observations finally culminated in our modern concept of crystal structures.

The angles between crystal faces are determined with special protractors – goniometers – which have been developed to perfection over the centuries. The first such instrument was designed by Arnould Carangeot (1783). It was a simple contact goniometer which allowed only a precision of about 1 degree. In 1809, William Hyde Wollaston described the first optical goniometer. In such instruments the reflection of light from crystal faces is monitored while the crystal is rotated about an axis. This increased the precision considerably though only faces of a zone with the zone axis oriented parallel to the axis of rotation could be measured, and the crystal had to be remounted for each new data set. At the end of the 19^{th} century, two-circle goniometers (theodolite-goniometers) were finally designed which allowed the evaluation of complete data sets on a single crystal without remounting it (e.g. Goldschmidt, 1893). At the beginning of the 20^{th} century goniometers had evolved to perfect and elegant crystallographic instruments of extraordinary precision.

The decline of goniometry started in 1912 with the discovery by Max von Laue, who, with a single ingenious experiment using x-rays, proved the structure of crystals to be three-dimensional networks of atoms, and, with the same experiment, showed the nature of x-rays as being electromagnetic radiation. Thus the theories about the structure of crystals, which resulted from goniometer measurements, were totally verified. X-ray crystallography soon became the ultimate method of structure determinations, and morphological studies were carried out for descriptive reasons only. The once pioneering and indispensable goniometer was relegated to obsolescence and has now practically disappeared in modern geosciences.

(Über einen Zeitraum von mehr als hundert Jahren war die Messung der Winkel zwischen Kristallflächen - die Goniometrie - das wichtigste Messverfahren der Mineralogen. Es führte zu den epochalen Erkenntnissen in der Zeit von 1669 und etwa 1900. Im Jahre 1669 entdeckte Nicolaus Steno, dass die Winkel zwischen gleichwertigen Flächen bei einer Mineralart immer gleich sind.

Sein Gesetz von der „Konstanz der Flächenwinkel" ist noch heute das fundamentale Grundgesetz der Kristallographie und führte zur Einteilung der kristallinen Materie in 7 Kristallsysteme. René Just Haüy formulierte seine „Dekreszenz-Theorie" im Jahre 1781 als Erkenntnis aus morphologischen Studien. Die wichtigen Phänomene des „Polymorphismus" und „Isomorphismus" entdeckte Eilhardt Mitscherlich durch kombinierte morphologische und chemische Studien. All diese mit Hilfe von Goniometern gewonnenen Entdeckungen führten letztlich zu unserem modernen Konzept des inneren Aufbaus der Kristalle aus dreidimensional periodischen Raumgittern von Atomen.

Winkel zwischen Kristallflächen werden mit speziellen Winkelmessern bestimmt, den so genannten Goniometern, die im Laufe ihrer Entwicklung perfektioniert wurden. Das erste solche Gerät konstruierte Arnould Carangeot (1783). Es war ein einfaches Kontaktgoniometer, das nur Genauigkeiten von ca. 1° zuließ. Im Jahre 1809 entwickelte William Hyde Wollaston ein erstes optisches Goniometer, bei dem die Reflexe der Kristallflächen beim Drehen um eine Achse als Einstellkriterium benutzt wurden. Die Messgenauigkeit wurde dadurch erheblich gesteigert, allerdings waren immer nur die Flächen der Zone, deren Zonenachse parallel zur Drehachse des Goniometers verlief, messbar. Für die Messung weiterer Zonen musste der Kristall jeweils neu aufgekittet werden. Ende des 19. Jahrhunderts wurden schließlich die ersten Zweikreis-Goniometer (Theodolit-Goniometer) entwickelt, die die Messung vollständiger Datensätze ohne Umsetzen des Kristalls ermöglichten (z.B. Goldschmidt, 1893). Zu Beginn des 20. Jahrhunderts waren Goniometer zu perfekten und attraktiven kristallographischen Messgeräten höchster Genauigkeit gereift.

Der Niedergang der Goniometrie begann im Jahre 1912 mit einer genialen Entdeckung Max von Laues. Mit einem einzigen Experiment löste er das Rätsel um die Natur der kurz zuvor entdeckten Röntgenstrahlung und bewies gleichzeitig, dass Kristalle einen periodischen dreidimensionalen Aufbau aus Atomen besitzen. Damit waren die aus den Goniometer-Messungen abgeleiteten Theorien vollständig bestätigt. Die Röntgenkristallographie wurde schnell zur ultimativen Methode zur Kristallstruktur-Bestimmung und morphologische Studien wurden lediglich noch aus deskriptiven Gründen durchgeführt. Die einst so unentbehrlichen Goniometer degenerierten zu überflüssigen Instrumenten und verschwanden schließlich völlig aus den modernen Geowissenschaften.)

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The Ancient Copper Mines of the South Urals, Russia

The first academic expeditions to the Urals of the end of 18th century have found the specific relief forms, which origin could not be explained by natural reasons. They were rounded and oblong depressions surrounded by grown-over dumps containing fragments of rocks with bright copper minerals. These were so-called "Chud' Pits" - forgotten mines of ancient times. In the middle of 19th century, isolated data about these mines have been systematized for the first time and by the second half of 20th century the basic ideas about ancient metallurgy of the Urals and its raw-material base were finally generated. At present, the geo/archaeological studies directed on searches of ancient mines and reconstruction of extraction and processing of copper ores are carried out in the Urals.
Manufacture of copper in the Urals appeared between 3rd and 2nd millennia BC. The most ancient sources of copper were Cu-bearing sandstones of Kargalinsky mines located near the modern city of Orenburg. Since

the middle of the Bronze Age, copper has been mined from carbonate (malachite-azurite) ores, which were extracted from numerous small localities connected with oxidation zones of impregnated and massive sulfide ores in sedimentary, volcanogenic and magmatic rocks. The remains of ancient mining have been found at various deposits of the zone of the Main Ural Fault.

One of such deposits – Ishkinino – is located in the South Ural, near the town of Guy. The ore bodies as extended lenses of copper-bearing sulfides locate here among basalts and serpentinites. The oxidation zone, which was basically mined by quarrying, is developed in the top part of the bodies. One of largest ancient quarry now is more than 100 m long and up to 40 m wide. Three dumps up to 5 m high, which have become swollen by time, occur on the quarry's bottom. The detailed study of the main dump allowed to distinguish three different horizons, and to correlate each of them to the certain stage of the deposit exploitation.

In the each stage, the ores of one and the same type have been mined. The Cu-content in the ores was decreased from the initial to final stage of exploitation. The "fire face" method of ore extraction, which consisted in destruction of rocks by repeated heating and subsequent sharp cooling by water has been applied from the second stage of exploitation. Later, a similar method was widely applied at extraction of copper and silver ores in the antique and medieval Europe. In addition, and it is especially important, the ancient Ural miners conducted the remediation procedures, filling the abandoned mines with rocks taken from the next working horizon. It is supposed that certain religious-philosophical sights of ancient miners were reflected in this, according to which a person should return to the Earth that has been taken from it.

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The Russian Mineralogist Anatoly Bushmakin and His Contribution to Development of Geo/archeological Studies

Russian mineralogist Anatoly Filippovich Bushmakin (1947 - 1999) was born and all his life lived in Urals Mountains. Having graduated from the Sverdlovsk Mining Institute (now - the Urals State Mining and Geological Academy), he for a long time worked at this Institute and in 1988 has moved to Miass, to just organized Mineralogical Institute of the Urals Branch of the Academy of Sciences of the USSR. Here he started working in a new direction of the mineralogical science - mineralogy of technogenesis.

Technogenesis, according to outstanding Russian scientist A.E. Fersman, is a set of geological, geochemical and mineralogical consequences of human technical activities. Accordingly, the mineralogy of technogenesis studies minerals formed in nature due to technical activities of the man, first of all, in dumps of diverse wastes of mining and metallurgical activities. It is considered that the overwhelming number of objects of the mineralogy of technogenesis has formed in present period and their age does not exceed dozens or hundreds of years. However, it is not absolutely true. The age of the oldest technogenous objects is some millennia, these are metallurgical slags traditionally studied by archeologists.

At the end of 1980th, accumulations settlements of 20th – 15th centuries B.C. have been discovered in Southern Urals. This region was called the Country of Cities. The religious-administrative and economic center of the Country of Cities was the fortified settlement of Arkaim. One of economic activities of Arkaim inhabitants and in other centers of the Country of Cities was melting of copper ore.

In the beginning of 1990th, the Institute of Mineralogy and a number of other scientific organizations have organized joint geoarchaeological expedition, in which A.F. Bushmakin took part. The purpose of expedition was comprehensive study of historical monuments of Southern Urals and, first of all, of the Countries of Cities and Arkaim. By the end of 1990th A.F.Bushmakin has formulated the purposes and tasks of the archaeological mineralogy as: "...study of mineral substance related to human life and economic activities in ancient times." Mineralogical studies in archeology, according to A.F.Bushmakinu, should solve a number of particular tasks, namely: definition of used minerals, revealing of their functions and roles; establishment of sources of mineral materials; study of mineral raw material, its transformation while processing, as well as some resulting products; study of newly formed minerals and processes of their formation caused by activity of the ancient man, including compounds formed at alteration of metal goods.

Application of modern mineralogical methods to archaeological objects enables to determine assignment of subjects, to restore conditions of deposition and orientation in space of things before their extraction at excavation, to restore technology of melting of ore and manufacturing of ceramics, to estimate safety of archaeological exhibits at museum storage, to reconstruct shape of the products damaged by corrosion and so on.

Proper studies of Bushmakin touched all circle of the above tasks. He studied copper, bronze and lead goods, gold things, products of corrosion of ancient copper things, ornaments from jewels and mineral paints. His works on ancient slags and ores are important. For determination of the most authentic sources of raw material for metallurgy of the Country of Cities, he was first to use the doctrine on typomorphism of minerals to the decision of particular archaeological tasks. For this purpose he selected minerals of variable composition accompanying the mineralization, for example, tourmaline $AB_3[Si_6O_{18}](BO_3)(OH,F,O)_4$, where A= Na, Ca; B= Mg, Fe^{2+}, Fe^{3+}, Li, Mn, Al; C= Al, Fe^{3+}. Fragments of tourmaline-containing ore have been found near copper-melting furnaces of Arkaim.

By appearance and features of mineral and chemical composition they are were close to ores of one deposits located 200 km to the southeast from Arkaim. The tourmaline in both cases has practically identical composition and corresponds to dravite (A= Na, B= Mg, Fe^{2+}). In addition, it was revealed that slags of Arkaim contain boron in quantities corresponding to concentration of tourmaline in initial charge. The conclusion was made that this deposit was the most probable source of ore for Arkaim masters.

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A Century of the Laterities Ores Exploitation in Cuba

The following work is a summary of the historical main documents from the beginning of the exploitation of the Laterities ores in the year 1906 and later on that have contributed to the development of the technical and scientific knowledge, of the personnel that works in the Mineral-Metallurgical industries, for the ammonia-carbonate technology (Caron Process) and high pressure acid leach. Information is also shown, of the personalities of the technological and social environment that have participated actively in its development.

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Creating New-France and its capital: an archaeological perspective

France began colonizing the Americas as early as the 16th Century. The Saint Lawrence River valley was the most successful attempt and the city of Quebec -- port of entry for half of the North American continent and capital of New France -- was the heart of these efforts. Recent archaeological research has contributed to a new understanding of the emerging Atlantic world between 1500 and 1700.

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Ancient Indian Metallurgy

In "Rudra Nmakam", Sanskrit text recited in religious functions, names of some metals figure. they are:hiranya (gold), seesam (gold), trapu (tin) and ayas (iron), copper (tamra) loha (all metals) . This text is part of "Veda". Sanskrit names for some other metals are: rajata for silver, riti for brass, parata for mercury and souveeram for antimony. Copper and bronze artifacts in the India date from the early centuries of the third millennium BC. They were recovered from the pre-Harappan peasant settlements in Bacluchistan, Indus valley and Rajasthan. Copper and bronze continued as the dominant material for tool production in India till iron emerged in the early centuries of the first millennium BC. Copper-Bronze age in India dominated and spanned over two thousand years.

The Chalcolithic sites have been found extending from the foothills of the Himalayan mountains in the north to the Deccan plateau in the south and from the Arabian seacoast in the west to the plains of Ganga-Yamuna rivers in the east. The Chalcolithic communities laid the foundations of distinctive Indian civilization. The Harappan communities made use of copper and bronze. A study of the Aravalli range in Rajasthan revealed that ore-bearing rock pieces were carried down to the valley floor where they were roasted, crushed, concentrated and smelted. The finely crushed ore was concentrated by gravity separation at the smelting sites which were located near the banks of hill streams. Most of the slag pieces showed clear cylindrical flow structure. Their main component was fayalite. Nearly all of the Chalcolithic copper objects were found to be made of either more than 98 % pure copper or low tin bronze. It showed that an advanced stage in copper smelting was reached in India in the third millennium BC and it was consistently maintained. Some of the metal objects were made of bronze.

Archaeological records indicate that from 2000 BC to 1200 BC, iron objects in west Asian sites gradually increased and a similar development in the production of iron objects took place in India, as evidenced by excavations at Atranjikhera and Hallur. They were dated by radiocarbon to the eleventh and ninth centuries BC respectively. By the fourth century BC the knowledge of iron technology had spread all over the country and the industry had reached its mature stage. Indian iron quality was very much appreciated by Alexander the Great, Herodotus and Kautilya (Chanakya, the preceptor of Chandragupta Maurya). The Wootz steel produced then came to be known Damascus steel as it was being exported from that city. The massive iron pillar of 4th century AD in Meharauli near Delhi, the iron beams used in the Konarak temple (tenth century AD) and the iron pillar at Dhar (twelfth century AD) are examples. Wood-charcoal was used as fuel for smelting which was careried out at a temperatuiere that was sufficient enough to tap slag (fayalite).

The Agaria community used a furnace that was a low-shaft. slag-tapping furnace with a provision for continuous feeding of fuel and ore at the top. The reaction temperature of this furnace was of the order of 1250 degrees centigrade. Because of the golden glitter, good quality brass has been a popular alloy in India for more than 2000 years, preferred for casting images of Hindu, Buddhstt and Jain gods and goddesses. Zinc was produced from mines at Zawar in Rajasthan and the zinc distillation process was in use at Zawar. Smelting was done in small retorts, cylindrical and approximately 30 cm long, 10cm in diameter near the centre, with a 1 cm thick wall. The ore is sphalerite. Zinc vapour was distilled from the charged retorts by placing them in the furnace chamber in a a vertically inverted position. To keep the charge in position, a reed was inserted into the charged retort after the tunnel part was luted on it. Ratnasamucchaya, a 14th century Sanskrit text of Indian medeaval technology mentions that1.5% of common salt was included to reduce carbon monoxide and to reduce the zinc oxide to zinc vapour and also to provide the necessary reducing atmosphere in which the zinc vapour condensed to metal. Many carbonaceous ingredients, like turmeric powder, soot, lac treacle, mustard and clarified butter were also used. The temperature reached was estimated to be 1150 to 1200°C and maintained for over six hours. The Indian metal workers at Zawar produced high quality brass alloy containing 10-12% zinc by direct fusion of copper and zinc, free from non-metallic inclusions.

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Die geologische Erforschung Albanies

Das Gebiet der heutigen Republik Albanien war bis zum Weltkriege der geologisch wie auch topographisch unbekannteste Teil der Balkanhalbinsel und überhaupt Europas. Die moderner geologischer Karte beginnt in Albanien am 1905. Sie Knüpft sich vor allem an den Namen Franc Baron Nopsca der Nordalbanien viele Jahre (bis 1913 Jahr) kartographiert hat. Er hat verschiedene Publikatione "Zur Geologie von Nord Albanien". "Zur Geschichte der Kartographie Nordalbanies", " Begleitworte zur geologische Karte von Nordalbanien", , "Geologie und Geographie Nordalbanien mit geologische Karte 1:200.000" "Zur Tektonik Mittelalbaniens". So nur der Norden des Landes,das Gebiet von Skutari,war durch die langjärigen von Franc Baron Nopsca geologisch in ausgezeichneter Weise erschlossen worden. Am wichtige Studium war *Geographie und Geologie Nordalbaniens* als auch Geologische Karte von Nordalbanien 1:200 000.

Österreichische Geologer Herman Wetters hat im Nord und Mittelalbanien um 1905-1917 geologische Beobachtung gemacht und publiziert eine Buch "Geologie von Nord Albanien" begleitet mit "

Geologische Karte in Maßtab 1:75 000" als auch eine Fotoalbum und Zeichnen von diese region.

Der Krieg erschloss, wie einen grossen Teil der übringen Balkanhalbinsel, so auch Albanien der Forschung. Im Kriege waren z.T.in Militärischem in wissenschaftlichen Auftrag auf österreichisch-deutscher Seite Ampferer, Göbel, Hammer, Kerner, Nowack, Roth, Telegd und Wetters tätig.Ampferer und Hammer untersuchten das Erzgebiet der Munella (N-Albanien)Kerner das untere Valbonatal(N-Albanien), Roth das Gebiet von Plava (Albanische-Montenegrische Grenze)Göbel obere Shkumbini-Gebiet (die Gebirge am Ohrisee) während Wetters eine Reise im zentralen Mittel-Albanien unternahm.(Tirana-Elbasan, E.Nowack kartierte 3 grössere Gebiete:die Landschaft Mallakastra, in S-Albanien,das mittlere Shkumbini-Gebiete (Ungebung Elbasani) und die Gegend Tirana-Durres.Die Veröffentlichung der geologischen Karten erfolgte in reduzierten Masstabe 1:50 000 , 1:75 000, 1:100 000.Bourcat von französischer Seite erforschte den Süd-Osten Albaniens(die Gegend von Korça) und publizierte eine geologische Karte 1:200 000.

Seinem früheren technisch wie wissenschaftlich gleich wertvollen Geologenwirken in Albanien hatte es E. Nowack zu danken, wenn ihn die Albanische Regierung in Frühling
1922 als "Landesgeologen" berief und Forscherarbeit fortzuführen.Er war über fast das ganze Land erstreckenden wanderungen zumeist von seinem Dolmetscher und Freude Ago Agaj und dem jungen Berliner Geographen H. Louis und dem Berliner Botaniker F.Markgraf begleitet.Mit dem Jahre 1922

beganen von Seiten des albanischen Staaten ins Werk gesetzte geologische Aufnahmen, mit denen E. Nowack bekant wurde.

Das Ziel der geologischen Forschung von staatlicher albanischen Seite war die Aufnahme der praktisch-nutzbaren Vorkommen des Landes in erster Linie die Untersuchung des Erdölgebietes, und im zweiten Jahre wurde die Aufgabe auf Antrag E. Nowack's zu einer allgemeinen geologischen Landesdurchforschung ausgestaltet, die das Ziel zunächst die Herstellung einer geologischen Übersichtkarte von Albanien setzte.Dr. Ernest Nowack war die erste Geologe dass die albanische geologischen Karte in Massstab 1:200 000 gemacht und publiziert im 1929 in Insbruck und zur Zeit hat und die Erleuterung für die geologische Karte publiziert im Salzburg.Fig.4,4.4 Die Geologische Karte und die Erleuterung war lange Zeit für albanische Studenten die Grundbuch Geologie zu lernen. Die erste geologiscche Karte von Albanien 1:200 000 als auch begleiter geologische Buch war viele Zeit als Grund im geologische Fakultät im Tirana.Italienische Geologer Giovanni Ineichen realisiert die geologische Karte von Albanien in Massstab 1:400.000.

P

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The Two Oldest Methods of Roasting Mercury Ores in Idrija

The oldest method of burning cinnabar ore in the Idrija mine was very simple and resembled the procedure used to burn coal. A burning pile was made of alternating layers of firewood and cinnabar ore, which was covered with a 10-15 cm thick layer of soil and furnished with openings. After three weeks, when the burning procedure was finished, the pile was cooled and mercury was collected in the basin below it (Kavčič, 2006).

Although it is not precisely known in which year the method of 'burning in piles" was abandoned, there is no doubt that an improved method was introduced at the beginning of the 16 century, i.e. 'burning in earthen vessels', known as the German or Bavarian method. Burning in earthen vessels was described by Agricola in his famous book De re metallica (1556). A set of two earthen vessels was used in this method. The top vessel, shaped like an oblong pumpkin, was larger, and the bottom supporting vessel (recipient), which was shaped to fit the mouth of the top vessel, was considerably smaller. Ore containing native mercury was first crushed into very fine silt and the mercury drops were isolated by washing. After washing, a very fine mine gravel was obtained and mixed with crushed ore which did not contain native mercury. The earthen vessels filled with ore were turned around and inserted in the supporting vessel, and the contact was carefully clogged. As many as several hundred vessels were stacked in an adequately prepared burning site, covered with firewood and set on fire. After approximately twelve to fourteen hours, the burning process was stopped and the earthen vessels were cooled. Being made of poor-quality clay, the vessels disintegrated quickly, leaving extensive piles of earthenware pieces at the burning sites.

At the Idrija Mine, ore was burnt in clay vessels until 1652, when a permanent smelting plant was built at Prejnuta, i.e. for approximately 150 years. The reason why burning in earthen vessels was practised for so long, despite the fact that the Almaden Mine in Spain was already using permanent furnaces of higher quality, can only be explained by the large quantities of rich ore contained in the Skonca layers, which were discovered on 22 June 1508. It is highly probable that the excavated ores contained on average more than 20% Hg and were, in the first half of the 16^{th} century, 5-7 times richer in Hg than the ores of the Almaden Mine.

The process of burning ore in earthen vessels was considerably shorter, with efficiency rates increasing to 60-70 %. The use of firewood was five times smaller, decreasing from the previous ten to two wagons for one Viennese cent of Hg. Since transporting large quantities of wood down steep slopes and through hardly accessible gorges was extremely difficult, it seemed more reasonable to carry the rich ores into the forests around Idrija and burn them there. So far, we have found 21 old burning sites with waste piles of earthenware pieces coated with cinnabar. Undoubtedly a great many more burning sites had existed, but several of them have completely disappeared as the result of erosion and various human interventions.

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Friedrich Johann Karl Becke's professorship at the „Kais. Kön. Deutschen Carl - Ferdinands-Universität zu Prag“ from 1890 to 1898

Friedrich Johann Karl Becke was born in Prague on December 31, 1855. His father was a publisher and bookseller, but later became a railroad official. In preparation for admission to the university, Becke studied at the gymnasiums in Prague, Pilsen (Plzeň, Czech Republic), Budweis (České Budějovice, Czech Republic), and Vienna. Here he took the school leaving examination at the renowned grammar-school, the "Schottengymnsium". In October 1874 he matriculated at the University of Vienna where he spent six years studying mineralogy and petrography under the guidance of Professor Gustav Tschermak

(1836-1927), and in 1880 the doctor degree was conferred to him. In 1881 he qualified as a university lecturer in petrography at Vienna. The following year he was appointed associate professor of mineralogy at the University of Czernowitz (Chernovtsy, Ukraine). He held this position for four years before he was advanced to a full professorship. In 1890 he accepted a call to the University at Prague. From 1890 to 1898 he worked as a full professor of mineralogy and director of the "K. k. Mineralogisches Institut" at the „Kais. Kön. Deutschen Carl-Ferdinands-Universität zu Prag". In 1898, after the death of Albrecht Schrauf (1837-1897), Becke got a call to Vienna. So he returned to his alma mater, the University of Vienna, where he continued in active service until his retirement in 1927.

In Prague Becke found an inspiring atmosphere, and a field of cooperation with the directors of the "K. k. Chemisches Institut" Guido Goldschmiedt (1850-1915) and the "K. k. Geologisches Institut" Gustav C. Laube (1839-1923). As an academic teacher he educated students who asserted themselves as secondary school teacher as well as in geological practice. He belonged to the best teachers, not only of the faculty of science but of the whole university. His lectures were logically and methodologically sophisticated, characterized by their precision. Under the instruction of Becke three doctor theses were elaborated in Prague.

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Application of the X-Ray Spectral Method to the Study of Cultural Heritage Materials

The particular features of the application of X-ray spectral analysis are discussed in this report to solve various problems related to the study of materials and objects which are of archaeological, historical and cultural heritage. The following objects were analyzed such as glass- and ceramic products, different plates and dishes, jewellery, iron-, copper-, silver-, gold-based metal alloys, instruments of labour, and various constructional materials of different origin. The study of a chemical composition of particular materials, for example, several metal ores, obsidian and others is necessary very often in order to determine raw material sites: pre-historical mines, quarries and others. Essential attention was given to the works related to the study of pigments, glass, ceramic and metal products. When studying the above-mentioned materials the work of an analyst is similar to the work of a criminalist. In both cases it is necessary to reconstruct the picture of the past using the smallest fragments of a material retained. It is desirable to keep the material obtained. The X-ray fluorescence analysis is widely used for the control of chemical compositions of the materials considered owing to its compliance with these requirements and the availability of commercial instrumentation for the determination of most elements. The increasing number of publications on this problematics is noted.

The analysis of the examples of X-ray method applications for the study of the objects considered showed that in a number of cases the earlier-developed XRF techniques, concentrated on the solution of other problems, can be used in the field considered without substantial changes. This refers to the ceramic and glass products, alloys and metallurgical slags. The similar problems were solved in geological laboratories and factory laboratories in glass and metallurgical industries. The problem of non-destructive investigation of some materials is presented somewhat different when using micro-XRF spectrometers. To solve such problems it is necessary to use the modern theoretical and experimental developments. In some cases only the combination of several methods allows to find satisfactory solutions.

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Hydrogen in Pressure Hydrometallurgy – An Analysis of early work

The feasibility of using hydrogen as an energy carrier is now being examined the world over. Steadily declining new oil discovery and rising consumption of crude oil(at twice the rate of discovery), emission of pollutants and greenhouse gases from internal combustion engines and power plants have convinced many national governments to support introduction of hydrogen and fuel cells in vehicles and stationary power generators. In petroleum refineries, hydro-processing to desulphurise diesel and gasoline and hydro-cracking to recover additional liquid fuels from residues have become common features. Hydrogenation of coal to convert it to liquid fuels are now attracting large investment, particularly in China.

Years before Hydrogen became prominent as a possible energy carrier and in hydro-processing of petroleum fractions, compressed hydrogen became a versatile reactant in concentration and recovery of metals. At the beginning of the Twentieth Century, V.N. Ipatieff of Russia carried out pioneering research in Saint Petersburg on precipitation of metals by hydrogen under pressure.

A number of metals like uranium, nickel, copper and cobalt are currently extracted commercially by leaching the ores or concentrates by alkaline, ammoniacal or acidic water. Such leach solutions, often dilute, always contain a number of unwanted metal ions and need economical purification steps before the metals of the required specifications can be recovered by hydrogen reduction. The paper recounts the early work on the hydrogen sulphide technique, an elegant way to purify acidic leach solutions. It also deals with early developments in selective hydrogen reduction technology, by which pure copper, nickel and cobalt powders were produced.

The metals research group of Chemical Construction Corporation (Chemical) soon found a solution. They found that although nickel and cobalt are not precipitated by hydrogen sulphide from an acidic leach solution, at higher temperature and pressure, they react rapidly to form a mixed sulphide. When subjected to hydrogen sulphide gas at 6-8 atmosphere pressure and 110-130^{0}C, 98-99% of cobalt and nickel are precipitated. Hydrogen sulphide is generated separately by reaction of hydrogen gas with molten sulphur. One can thus get a very high-grade sulphide concentrate containing 60% nickel plus cobalt and about 35% sulphur. It was further found that when this sulphide concentrate is oxidized with compressed air at about 175^{0}C, the metallic values are dissolved as sulphates. The solution now contains about 55 gpl of nickel plus cobalt, and only small concentrations of the impurities originally present in the acidic leach solution.

It was shown by the Chemico group that the purified nickel-cobalt sulphate solution could be selectively reduced with hydrogen at about 200^{0}C and 50 atmospheres total pressure to produce pure nickel as a powder. Equilibrium data obtained revealed that most of the nickel can be reduced to metal without affecting cobalt ions, provided the pH of the solution is maintained at 1.5 to 2 by pumping in ammonia continuously. It was, however, found that the rate of hydrogen reduction of nickel ions is much faster than that of cobalt reduction. So, dosing of ammonia for pH control during reduction is not essential, when cobalt to nickel ratio is low (say,less that 1/20) and the reduction is stopped before too much of cobalt starts coprecipitating. In such cases, ammonia required to neutralize the sulphuric acid generated during hydrogen reduction is added with the feed solution. Ammonia is ultimately recovered as fertilizer grade ammonium sulphate.

A trace quantity of a mild reducing agent (e.g. $FeSO_4$ hydroquinone, sodium hydrosulphite) is added to the first reduction batch in a series to promote the formation of nickel seed powder. Subsequent reductions were carried out in presence of these seed particles. After a series of such reductions, the nickel powder as well as the spent liquor are blown into a flash tank. The nickel product produced by this preferential reduction technique contained about 99.8% nickel, about 0.1% cobalt, 0.01% sulphur and 0.02% carbon.

It was found in early nineteen fifties that when a typical weathered nickeliferous laterite ore (limonite) containing 1.15%-1.44% nickel, 0.1%-0.14% cobalt is treated with hot sulfuric acid at 230-260^{0}C, only minor amounts of iron and aluminium dissolve, while 95 to

96% nickel and cobalt in the ore is leached within one to two hours of reaction time. The leach liquor obtained by pressure leach of such a nickeliferous ironoxide with hot dilute sulphuric acid usually contains about 4 to 6 gpl of nickel plus cobalt, 1.5 to 1.75 gpl aluminium, 0.5 to 0.75 gpl of iron and similar concentrations of magnesium and manganese. Recovery of nickel and cobalt values from such dilute and impure acidic solutions became a subject of considerable attention.

A number of metals like uranium, nickel, copper and cobalt are currently extracted commercially by leaching the ores or concentrates by alkaline, ammoniacal or acidic water. Such leach solutions, often dilute, always contain a number of unwanted metal ions and need economical purification steps before the metals of the required specifications can be recovered by hydrogen reduction. The paper recounts the early work on the hydrogen sulphide technique, an elegant way to purify acidic leach solutions. It also deals with early developments in selective hydrogen reduction technology, by which pure copper, nickel and cobalt powders were produced.

A method was developed for recovery of pure cobalt from mixture of cobalt and unreduced nickel in the reduction end liquor. This was done by oxidizing and complexing cobalt as either cobaltic aquopentammine or cobatic hexammine and separating out nickel still in the divalent state. The nickel-free cobalt ammine was reduced to pure cobalt powder with compressed hydrogen. The aquopentemmine route is still being used commercially.

The author was the inventor or a coinventor of a number of process steps in pressure hydrometallurgy that are still being used in commercial scale at the nickel-cobalt plants in Canada, Cuba and Australia. He participated in both pilot plant and design-engineering phases of the nickel plant in Moa Bay, Cuba as a consultant to Freeport Sulpur Company. In nineteen sixties, after the plant was nationalized and Amercan engineers left Cuba, the author and his Indian colleagues helped the Cuban Technologists to bring back the Moa Bay plant to commercial production. High pressure acid leaching and production of a high grade concentrate by hydrogen sulphide treatment is still continuing there. In fact, the plant is expanding its production as a Cuban-Canadian Joint venture. The paper recounts some of the engineering difficulties faced during scaling up of laboratory research to the commercial-scale plant at Moa Bay and also the solutions found.

S

T

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Technological characteristics of worked copper artifacts and other metals in the Western Arctic, Abitibi and Lac St-Jean in the North of Quebec

Throughout the last two millennia, several technological innovations have occured in the Arctic and in the North of Quebec. During late prehistoric period, along with the development of Thule culture in the Arctic and the Archaic and Woodland period in Quebec, we observed the first uses of native copper in the creation of tools for the native people. The copper originating from different rivers (such as the Yukon River, or from other rivers in the Northwest Territories for the Thule culture or the region of the Superior Lake), was intensively used and exchanged. We can also observe a definite continuity with the late prehistoric archaeological artifact assemblages representing a link between the late prehistoric period and the period of European influence. Many of the tools created during that time continued to be produced and used after contact. Many camp sites created by the native people more than a thousand years ago were still used by them when the Europeans stepped foot for the first time in the Arctic and in the North of Quebec.

The advent of metal technology has had many implications throughout the years on the industrial and artistic development of all human societies. From the beginning of their discovery and until contemporary times, the diversity and propagation of metals and all their by-products are remarkable and show the different varieties of those metals and technologies. But it also proves the capacity of metals to be used for many different kinds of activities. In North America, native copper and alloy products created by the Europeans, became the primary material to create tools such as knives, hunting weapons, fishing tools, burins, chisels and other tools like wires and rivets. Shiny metals were also used to create jewelry, ornaments, pendants and ritual pieces. These objects were used by North American native people to show their prestige and their rank in the society.

A first hypothesis suggested is that during the late prehistoric period, all of the objects composed of different kinds of metals were made from native metal; they were made from meteoric iron or native copper which was extracted and worked. The craftsmen were very flexible and created a great majority of their products composed of metals tailored to their needs. The second hypothesis is that metal technology is more economical because of the lifespan of the metal tools versus the energy used to extract the raw material directly from the deposit and its transformation into tools. The third and last hypothesis follows the first two primary hypothesis and suggests that, following European contact, the rapid diffusion of manufactured alloys which came from Europe entitled the Inuit or the native groups in the North of Quebec to upgrade and perfect their technological processes and to make more uniform their tool productions, and to create a new form of exchange for the European merchandises.

> We can say that during that period of tremendous cultural changes, there was a process of "métissage". The "métissage" took place in a 'space of contact' (Turgeon 2003), an area where a continual interaction between two or more cultures take place. We can hope to discover this process of "métissage" within the archaeological assemblages and the metal artifacts of the contact period.

The study of metallurgy includes the processes and techniques of extraction and transformation of different metals. Although the heating process used during the prehistoric and contact periods allows to reach a temperature of up to 800 degrees, it seems that the native groups from the Subarctic and the Arctic during these periods never had recourse to the European smelting, molding, and alloying techniques. The technology of native copper and alloy objects remains simple in comparison, but also demands a profound understanding of the materials and craftsmanship.

In this project, I will use my technical knowledge of metals and different alloys as well as some manufacturing practices used in contemporary metallurgy and archaeometallurgy:

- Visual observations will provide information on the material and the way the object was made.
- Metallography will provide information on the state of the alloy and metal, and also the processes used to form the object.

- Physico-chemical analyses (primarily non destructive) will allow us to study the metals and alloys used in the creation of objects.
- The linear distension factor and the specific indices of surface offer an understanding of the mechanic metallurgic characteristics of the raw material.
- The geological setting of metal and ore deposits will allow me to study the conditions and the formation of metals.
- Experimentation will be used to recreate the procedures used in transforming the metal into finished objects.

This study will explore primarily the technological characteristics used in the workmanship of metals during the late prehistoric period by native people. Furthermore, I will add to my observations by means of chemical and macroscopic analyses of native copper and European copper alloys. Finally, with the help of geological databases like GeoRef and bedrock geology maps, I will locate in the regions of Nunavut, the Northwest Territories and in the North of Quebec the potential sources of native copper, meteoric iron and their eventual distribution on the studied sites.

V

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Mining Academies as Centers of Geological Research and Education in Europe Between 18th and 19th Centuries

The aim of the 18th century mining academies was to create a new type of higher education at the same level of the classical universities. Most of the historians agree in stating that toward the end of the 18th century the development of new techniques, together with the increasing demand for metals and the problems of exploitation, required the formation of a new trained class of mining officers and experts. In the cases of Freiberg and Schemnitz the foundation of the mining academies was mainly the regulation and reinforcement of a local mining tradition which had already been in existence for a long time, but for example in the case of Paris, the establishment of the École des Mines was an attempt to create a new category of French mining experts independent of external influences.

Moreover, in the German-speaking world, the mining academies compensated for the lack of teaching of mineralogy and mining within the universities.

Through the teaching programs of the new Academies, the students were not simply instructed in the techniques and in the disciplines traditionally connected to mining, like metallurgy, but were also introduced to the scientific study of mineralogy and geology. Some of the professors were distinguished scientists, who played a significant role in the development of mineralogy and in the birth of geology as a science, particularly during the last decades of the 18th century.

To date the mining academies have been studied only individually within local contexts and a historical general syntesis concerning their role in geological research and education does not yet exist especially for the late 18th and the early 19th centuries, which was the crucial time of their formation. The importance of the mining academies for the scientific development of the earth sciences is certainly accepted by historiography, but it definitively needs more support from new researches in depth on primary sources. The aim of this paper is to offer an overview of this historiographical question within the European context.

W

Mines, art et education. Le Grand-Hornu : site désaffecté, acteur contemporain

Maryse Willems

No abstract submitted

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Invitation 2009

Cultural Heritage Symposium
in Geosciences, Archaeology, Mining and Metallurgy

Libraries – Archives – Collections

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The University Library "Georgius Agricola" in collaboration with the Staatsarchiv/Bergarchiv in Freiberg/Saxony invite to Freiberg. Subject of the Symposium should be the contact with manuscripts and scientific reductions.

- Scientific reductions as an unused resource
- Collection and indexing of manuscripts of Mining, Metallurgy and Geosciences
- Collection and indexing of unpublished works in scientific reductions

- Role of libraries, archivs and museums in diffusion of information concerning reductions in the electronic age

Welcome to Freiberg,

Freiberg offers the tourist the special charm of a medieval city in lovely surroundings, all steeped in the history of civilisation and technology. Not to be forgotten are Freiberg's friendly residents who, even today, often use the miners' old greeting "Glück Auf" which means "good luck". The traditions and customs are self-evident and are fostered with pride. Year after year the miners' parades in Freiberg draw thousands of spectators into that city of the former silver wealth of Saxony.

You too are welcome and we bid you a hearty *GLÜCK AUF!*

Contact address: Angela.Kiessling@ub.tu-freiberg.de
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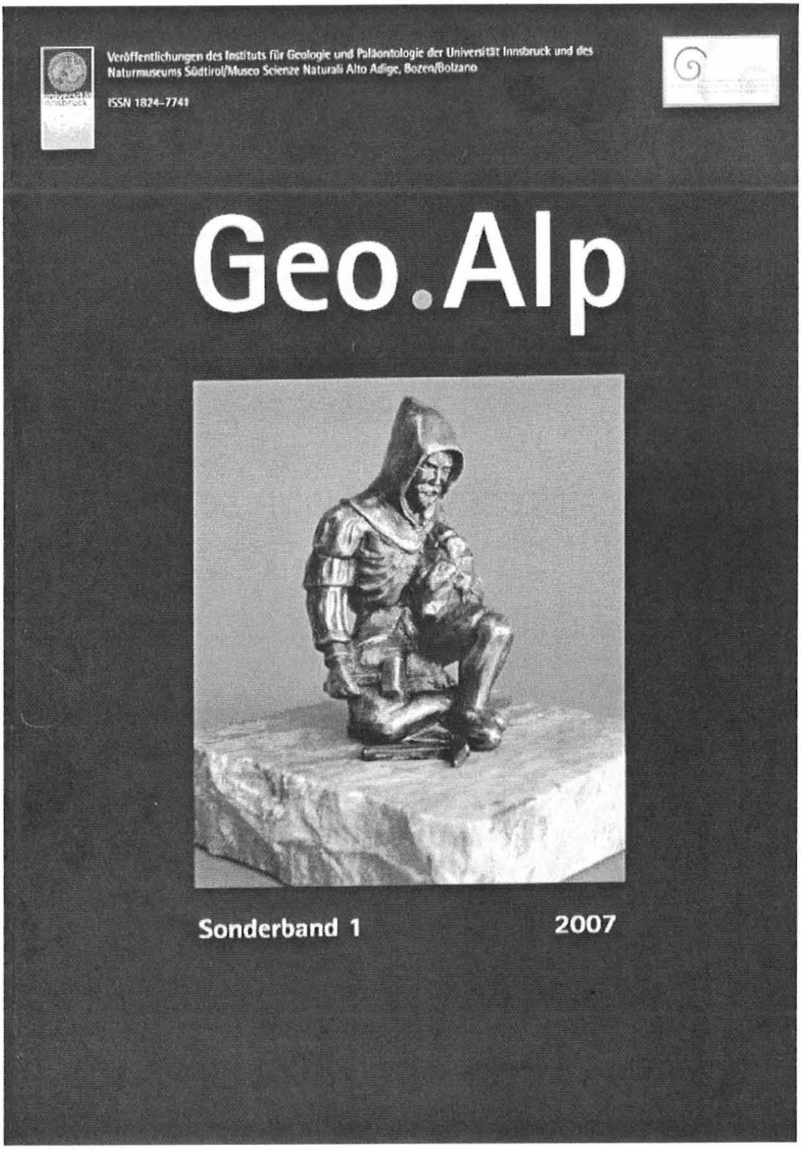
Veröffentlichungen des Instituts für Geologie und Paläontologie der Universität Innsbruck und des Naturmuseums Südtirol/Museo Scienze Naturali Alto Adige, Bozen/Bolzano
ISSN 1824-7741
Geo.Alp
Sonderband 1
2007

PROCEEDINGS OF THE
8TH INTERNATIONAL SYMPOSIUM

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HISTORY OF EARTH SCIENCES IN
AUSTRIA

SCHWAZ/TYROL/AUSTRIA
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= PROCEEDINGS OF THE 5TH SYMPOSIUM HISTORY OF EARTH SCIENCES IN AUSTRIA

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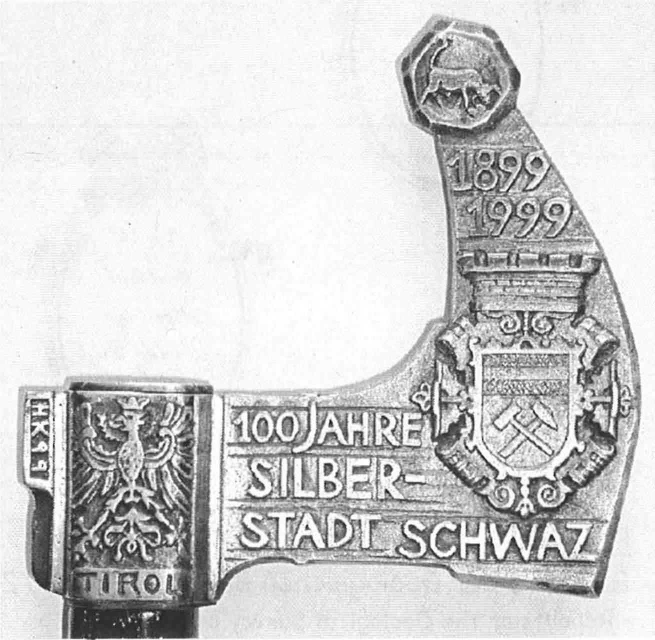

Berichte der Geologischen Bundesanstalt, 72
Wien 2007 <ISSN 1017-8880> Christoph Hauser (Red.)

8.
Erbe-
Symposium
Schwaz/Tirol

Ninth
Cultural
Heritage
Quebec City
2007

PART 2:

Berichte der Geologischen Bundesanstalt, 72

< Reports of the Geological Survey of Austria, 72 >

Wien/Vienna, 2007

9th International Symposium
Cultural Heritage Symposium in Geosciences, Archaeology, Mining and Metallurgy

Libraries – Archives – Collections

Publication of proceedings

Deadline for submitting contributions is 1st February 2008.

CELAT and Institut du Patrimoine de l'Université Laval (IPAC) will publish all oral and poster presentations as five-page papers. The publication format will be a black and white book in the IPAC's series of publications on cultural heritage. The authors should take into account the following notes while preparing their papers.

Format
Submission should comprise a written text in font Times, size 12, single spaced, with a maximum of 5 printed pages A4-format. The 5 printed pages space includes the text as well as all the illustrations and references.

Text should be saved in Word.doc and stand alone in one file. Illustrations such as tables, photographs or maps should be in separate files, not in text. Figures must be in jpeg-format high definition (300 dpi or higher) while tables must be submitted as EXCEL files, only one table per file. All the illustrations (figure, table etc.) should be submitted in black and white version. Again each figure and/or table must be submitted as a separate file.

- Formatting

  Please use Bold Sentence Case for the top level headings and italicsto signify 2nd level headings, with a limit of two levels of headings.
- Abstract

  Abstracts are not needed with your five-page papers. Make sure your title represents well your content.
- Authors

  Names and full addresses (including e-mails) of all authors should be included.
- Page numbers

  Pages should be numbered.

References

All works cited in the text should be listed in the references and all the works listed in the references should be cited in the text. Please use the Harvard system, giving the author's surname and the year of publication in the text and a full reference in an alphabetical list.

Examples:

- Finnegan JE, RE Hummel & ED Verink 1981 : Optical studies of dezincification in alpha-brass, Corrosion 37, 256-261.
- Fitzgerald WR 1995 : A Late Sixteenth-Century European Trade Assemblage From North-Eastern North America, in RH Duncan, R Hook & DRM Gaimster (eds), Trade and

Discovery: The Scientific Study of Artifacts from Post-Medieval Europe and Beyond, British Museum, Occasional Paper n° 109 : 29-44, London

- Pollard AM & C Heron C 1996 : Archaeological Chemistry, Royal Society of Chemistry, London.

Reviewing

Please note that all papers are refereed on the following aspects:

- Are the interpretations and conclusions sound and justified by the data?
- Are the figures and tables necessary and self-informative?
- Is the quality of the language used satisfactory?
- Are the references complete, necessary and up to date?

Deadline

Please supply all submissions as soon as possible but no later than 1st February 2008 as e-mail attachments to: reginald.auger@celat.ulaval.ca

In addition, you are requested to send a hard copy of the manuscript, including figures and tables to:

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ALCOA

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