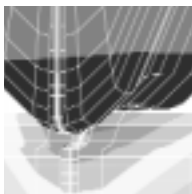


MONTAN **UNIVERSITÄT** LEOBEN

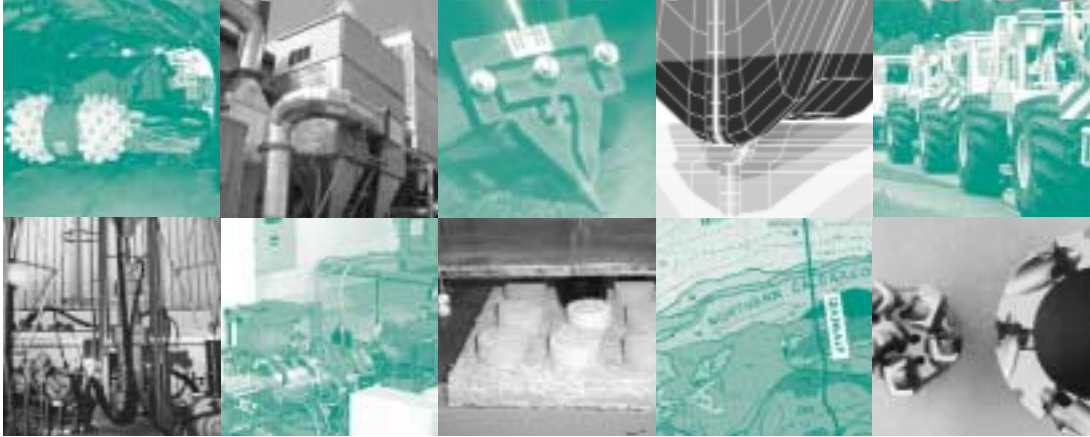


ANNUAL REPORT 1999

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MONTANUNIVERSITÄT
LEOBEN



Universities on the

PROLOGUE



Foto Freisinger

Universities must open up - not only to industry and commerce, but also to other universities. Educational goals have to be evaluated together with the labour market so that education meets the demands and offers all chances to graduates. Internationalization is also crucial. An international standardization of education is the requirement - provided that exams are mutually recognized - that students can go on "university travels" without loss of semesters after their seventh semester. It must be possible to master the studies within the required period of time within which a student should complete his studies.

Admission to universities is free, therefore many who did not pass the Fachhochschule¹⁾ entrance examination choose universities next. The expansion of those schools means the loss of a good potential of intelligent adolescents. Therefore universities are challenged to improve their attractiveness so that they are first choice for students.

Next to mediating subject-specific competence it is also the obligation of universi-

1) Fachhochschule: a university level study program of at least three years duration with vocational-technical orientation.

move and in change

Universities are confronted with great challenges in the fields of education, research, administration and knowledge management. Information technology will bring decisive influence to bear.

ties to mediate method, leadership and social competence, for subject-specific qualification means a continuous investment in life-long learning which can only be mastered by method competence. After all social competence is vital for the successful integration in business and social systems. Nowadays the organizational structures of enterprises require leadership competence.

Not only universities and the state are under pressure on the research front. Economy on the whole is concerned, because economic success in a country like Austria has to be sought in the advance in technology. Universities have the opportunity of providing an interdisciplinary network of institutes and university units as well as extra-university competence centers for the economy. Economy has to administer the marketing of innovations in time, to enforce both the continuing education of employees and the interdisciplinary collaboration of diverse institutions on a national and international basis. The capacities of science and economy for a state-supported technology offensive have to be made more transparent. Together with the

state a supporting strategy for a lasting positive economic development on the basis of technology has to be worked out. Because of the externalization of research activities on the part of industry universities are increasingly challenged to deal with the field of pure research intensively. It is obvious that a neglect or too low esteem of pure research can impede the development of technology - which leads to a decline of affluence.

From the perspective of international collaboration concerning knowledge, the magic word "cluster" - as far as education, research and technology are concerned - will be of vital importance for the future development of universities.



*Bergat h.c. Dipl.-Ing. Dr. Wolfgang Pöhl
Rector of the University of Leoben*

Management

BOARD OF DIRECTORS



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Employment Committee Chairmen (faculty):
O.Univ.-Prof. Dipl.-Ing. Dr.mont. Eduard CZUBIK (until Sept. 99)
Ao.Univ.-Prof. Dipl.-Ing. Dr.mont. Anton MAYER (after Okt. 99)

Employment Committee Chairman (staff):
Amtsrat Helmuth TSCHOGGL

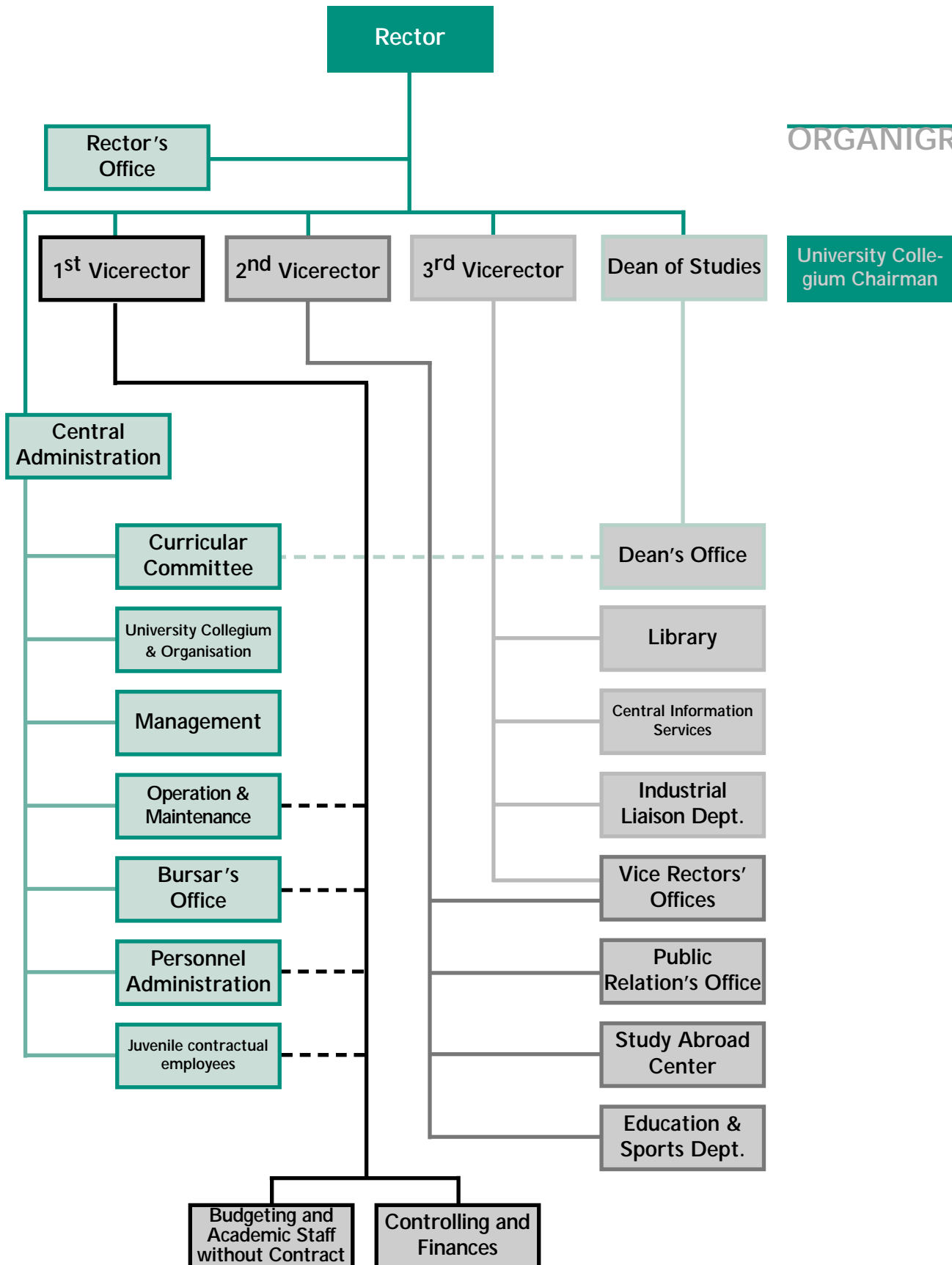
Student Union Chairman:
Josef SCHACHNER

Working committee on Equal Treatment Chairpersons:
Amtsrätin Gerhild STORMANN (until Sept. 99)
Dipl.-Ing. Dr.mont. Tanja LUBE (after Okt. 99)

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Mag. Dipl.-Ing. Dr.mont. Rudolf WÜSTRICH

Organisation

ORGANIGRAM



Strong Position

Univ. Prof. Dipl.-Ing. Dr. Peter Paschen, rector of the University of Leoben from 1995 to 1999 on his work and the development of the university.

A LOOK BACK

The workload that had to be managed during my years as rector allows neither a complete nor an explicit report, therefore only short statements on six topics.

University of Leoben internally

The first months were marked by the implementation of the new UOG (University Organization Act) which rearranged the total organizational structure. The vice rectors and the dean of studies were authorized with the supervision of singular organizational units in the sense of real team work.

A more than encouraging chapter for the university were the rankings. The "Mangermagazin" published a very extensive evaluation of 76 technical universities in the German-speaking area. The University of Leoben was ranked number three only after the Rhineland-Westphalian Technical University of Aachen and the University of Stuttgart. Another Austrian-wide evaluation carried out among the students by the ÖH (Austrian National Union of Students) under the title "Schluss mit lustig" came to the conclusion that the university is number one by far. In the third ranking, sponsored by the Bank Austria and published by "Standard", the University again is number one.

Research and teaching

The University of Leoben has an extraordinarily strong position in research nationally and internationally. It holds a top position in the number of publications, and this in connection with the internationally shameful share in Austrian research expenditures of only almost 1,6% of the gross

domestic product, only the smaller half of it from the Federal Government. The University of Leoben and its departments therefore try to tread new paths in cooperation with industry and extra-university research centers. That the research achievements of the University of Leoben are recognized nationally and internationally is proved by several highly esteemed awards which were given to employees and graduates in the past four years.

Concerning education: Since the enacting of the UOG 93 there is the position of the dean of studies. He is responsible of the organization and evaluation of studies and examinations. Immediately after his first election the dean of studies has taken up a problem very specific to Austria: the free admission of high school graduates of diverse educational levels which in combination with the lack of any examination obligations leads to the prolonged durations of studies and the high drop-out ratios. We have set the crucial point of the reforms right within the first year of studies - with the aim to raise the basic education above "Matura"-level and to obtain positive results at examinations before the start of the third semester. We succeeded. The curricula of all 10 fields of studies were generalized so that every student can change his field of study without problems during the first two semesters, and the examination methods were coordinated and well timed. The drop-out ratio decreases, the total duration of studies will probably settle at 12 instead of previously 16 semesters.

Resources

Considering the resources (finances, staff,

premises) the influence of austerity measures, which led to an employment stop in 1996, is clearly visible. It is very concerning that there is only little money available for new investments. Equipment and facilities are antiquated which will have fatal consequences for a research institution. However, there is a positive development concerning income from contractual work, which has not been fully exploited.

Public relations work

Achievements can be registered at the recruitment. This was made possible because of open days, the edition of a CD-ROM, the production of a video, new informational material, participation at all vocational fairs and the extension of the presentation via internet. The increasing attractivity of the University of Leoben for European students (Sokrates/Erasmus program) can be seen clearly. This is also true for the development with our partner university Colorado School of Mines, USA. The amount of scholarship recipients could be more than tripled from 1995 to 1999, the amount of the months spent abroad by them is more than fivefold. In my position as rector I have represented the university at many public events, press conferences and panel discussions in order to fulfill my part of public relations work.

Academic environment

A quantum leap was made by us in the past years concerning international relationships. A listing of everything which has been going on in the meantime as to collaboration with universities on all five continents, EU-research programs, exchange of students, assistants and professors, reciprocal visits of research personalities and academic politicians from all over the world, is absolutely impossible. This also includes the many academic conferences, which were held at the University of Leoben.



Academic and social politics

Science and politics cannot be separated, since universities in Austria are maintained by the state. An important political topic is the one of "Fachhochschulen"¹⁾. We don't hold anything against "Fachhochschulen" but we are opposed to their enormous and merely ideologically based preference by academic politicians. The "Fachhochschulen" can recruit their students with the help of entrance examinations and are massively extended and promoted, which has been denied to universities so far. The Act of the tripartite structure of studies with the academic degrees Bachelor and Master, passed in a great hurry in July, 1999, as well as the mutual international recognition of these titles are the reality. We have foiled the planned devaluation of the "Diplomingenieur" degree in comparison to the Master's degree. A baccalaureate as an interim completion of studies after seven semesters is justifiable if it makes an unproblematic change of universities within Europe possible, when the bachelor then finishes his studies at another European university with a Master's or Diplomingenieur degree. This automatically recognized exchange is not practised at all in Europe at the moment. A final completion after seven semesters results in small-time academics. A thorough, broad and academic education within seven semesters is not possible in engineering.

¹⁾ Fachhochschule: a university level study program of at least three years duration with vocational technical orientation.

Prof. Dipl.-Ing. Dr. Paschen places the rector's office in the hands of Dipl.-Ing. Dr. Wolfgang Pöhl on Oct. 1, 1999
Foto Freisinger

Alma Mater

A stable number of students, a fall in multiple inscriptions and an improving performance at the beginning of the study as well as a gratifying increase in the number of graduations - that is the résumé of the student statistics.

TEACHING

REGULAR DEGREE STUDIES at the University of Leoben

	Year 1997		Year 1998		Year 1999	
	Men (Women)	Total	Men (Women)	Total	Men (Women)	Total
Number:	2439 (388)	2827	2417 (399)	2816	2365 (464)	2829
Percentage of women:		14		14		16

CHART 1: number of enrolments including doctorates, individual diploma programs (without preparatory year, qualifying date: end of registration period of the academic year)

At the moment there are approximately 2100 students enrolled at the MU Leoben, and this number has almost remained stable for years. Since multiple inscriptions are possible, the number of students is about 25% below the number of enrolled studies, which are listed according to ÖNORM (see chart 1).

The MU Leoben still is the Austrian university with the lowest proportion of women. Also in the preceding years the proportion increased only minimally: from 14% in 1997 to 16% in 1999. The efforts to encourage young women with an interest in technology to study at Leoben have

to be enforced.

The proportion of foreign students at the enrolled studies is about 9% (see chart 2). As the distribution of Austrian students enrolling for the first time according to their home address demonstrates, Styrians have the MU Leoben well in hand (also see chart 3). Therefore the MU Leoben furthermore must take efforts to attract adolescents from all over Austria and from abroad for their diploma studies. Attention has to be directed to recruiting more students for studies such as Metallurgy which guarantees good employment chances at domestic industries. As demonstrated in chart 4, this still is rather difficult.

It is gratifying that starting with 1998 the number of matriculations corresponds to the number of registered students. This means that there are hardly any multiple inscriptions. The MU Leoben sees this as a result of its increased informational work. Young people now come to Leoben with very specific expectations.

According to chart 5 the actual duration of

PERCENTAGE OF FOREIGN STUDENTS AT REGULAR DEGREE STUDIES

	YEAR 1997	YEAR 1998	YEAR 1999
EU-countries	75	82	78
Non-Eu-countries	169	181	176
TOTAL	244	263	254
% of inscriptions	9	9	9

CHART 2: Number of inscriptions of foreign students (without preparatory year, qualifying date: end of registration period of the academic year)



PLACES OF ORIGIN OF THE AUSTRIAN FRESHMEN

Numbers in %	YEAR 1997	YEAR 1998	YEAR 1999
Styria	52	54	51
Lower Austria	7	11	12
Upper Austria	11	9	12
Carynthia	7	6	13
Vienna	6	3	4
Burgenland	3	2	3
Salzburg	5	9	3
Tyrol	6	5	1
Vorarlberg	3	1	1

CHART 3: Distribution of freshmen according to provinces (Source: internal questionnaire at registration)

PRIMARY INSCRIPTION OF REGULAR DEGREE STUDIES

Field of study	YEAR 1997		YEAR 1998		YEAR 1999	
	Men (Women)	Total	Men (Women)	Total	Men (Women)	Total
Mining Engineering	12 (4)	16	10 (1)	11	8 (1)	9
Mine Surveying	3 (2)	5	4 (0)	4	4 (0)	4
Petroleum Engineering	31 (7)	38	17 (7)	24	30 (7)	37
Petroleum Engineering (ISP)	31 (4)	35	18 (2)	20	26 (5)	31
Metallurgy	21 (1)	22	9 (0)	9	15 (2)	17
Refractory Materials	7 (3)	10	10 (8)	18	12 (4)	16
Mechanical Engineering	15 (2)	17	14 (0)	14	14 (2)	16
Material Science	31 (6)	37	29 (2)	31	30 (8)	38
Plastic Engineering	25 (9)	34	17 (6)	23	26 (8)	34
Applied Geosciences	14 (9)	23	7 (6)	13	11 (6)	17
Industrial Environmental Prod.	30 (22)	52	31 (12)	43	23 (21)	44
Total	220 (69)	289	166 (44)	210	199 (64)	263
Percentage of women		24		21		25

CHART 4: number of primary regular degree inscriptions according to fields of studies (Without preparatory year, qualifying date: end of registration period of the academic year)

studies still remains a problem even if there is a tendency towards the required duration of studies. Here the MU Leoben expects a real breakthrough as soon as the first students will graduate who benefit from the reform of the first year of studies and the total reform of studies according to the University Studies Act. The legitimacy of these expectations is proved by chart 6.

There is also a satisfactory increase in the number of graduations: from 165 in 1997 to 198 in 1999 (see Chart 7. This increase does not go together with a loss of quality. As demonstrated by chart 8 the percentage

of graduations with the grade "Excellent" remains at about 30%. Chart 8 also demonstrates, that the grades of female graduates are far above average.

The performance rates of doctorates can also be proud of. In 1999 there were more doctorates than in the preceding 2 years (see chart 9). The fact that more than 50% of the doctorates receive the grade "Excellent" gives strong evidence of the excellent academic quality of the achieved performances.

AVERAGE DURATION OF STUDIES UP TO GRADUATION

	Graduations	average duration of studies
1997	165	16
1998	183	15
1999	198	14

CHART 5: Total number of graduations and average duration of studies in semesters (period: 1.2. to 31.12. of the calendar year)

Further Statistics

TEACHING

PERFORMANCES FROM 1 st TO 3 rd SEMESTER			
	1997	1998	1999
Number of students in 3 rd sem. (= number of freshmen one academic year ago)	197	210	263
Total number of passed examinations	2432	2412	2641
Number of passed examinations per student	12	11	10
Average performance during the first 2 semesters in percent at the beginning of the 3 rd semester (% without previous knowledge of descriptive geometry)	68 (62)	63 (57)	56 (50)
Total amount of the examinations failed	377	440	503
Number of failed examinations per student	2	2	2

CHART 6: Examinations passed by freshmen up to the 3rd semester (Qualifying date: 31.12 of the calendar year which follows the primary inscription)

GRADUATIONS						
Field of study	JAHR 1997		JAHR 1998		JAHR 1999	
	Men (Women)	Total	Men (Women)	Total	Men (Women)	Total
Mining Engineering	8 (0)	8	7 (2)	9	4 (0)	4
Mine Surveying	1 (1)	2	1 (0)	1	1 (0)	1
Petroleum Engineering	14 (0)	14	18 (2)	20	18 (1)	19
Petroleum Engineering	-	-	6 (0)	6	5 (0)	5
Metallurgy	17 (1)	18	12 (0)	12	17 (0)	17
Refractory, Materials, Ceramics, Cement and Glass	5 (1)	6	5 (1)	6	5 (0)	5
Mechanical Engineering	8 (0)	8	8 (0)	8	8 (0)	8
Materials Science	52 (1)	53	40 (4)	44	46 (5)	51
Plastic Engineering	28 (3)	31	28 (6)	34	28 (3)	31
Applied Geosciences	5 (2)	7	11 (2)	13	14 (3)	17
Industrial Environmental Protection	17 (0)	17	28 (2)	30	40 (5)	45
Other (individual diploma study, petroleum geology etc.)	1 (0)	1	-	-	-	-
Total:	156 (9)	165	164 (19)	183	181 (17)	198
Percentage of women		5		10		9

CHART 7: number of graduations according to fields of study (period: 1.1. to 31.12. of the calendar year)

GRADUATIONS PASSED WITH DISTINCTION

	1997	1998	1999
Number of excellent graduations	48	58	57
<i>Percentage of total number of graduations</i>	29	32	29
Number of excellent graduations of men	44	51	49
<i>Percentage of total number of graduations of men</i>	28	31	27
Number of excellent graduations of women	4	7	8
<i>Percentage of total number of graduations of women</i>	44	37	47

CHART 8: Graduations passed with distinction
(Period: 1.1. to 31.12. of the calendar year)

TEACHING

DOCTORATES

	YEAR 1997		YEAR 1998		YEAR 1999	
	Men	Women	Men	Women	Men	Women
Austrians	22	4	20	-	24	2
Foreign students	6	2	9	-	9	1
Total:	34		29		36	

CHART 9: number of doctorates of Austrian and foreign students (period: 1.1. to 31.12. of the calendar year)

DOCTORATES PASSED WITH DISTINCTION

	1997	1998	1999
Total number of doctorates passed with distinction	17	13	15
<i>Percentage of total number of distinctions</i>	50	45	41
Number of excellent doctorates of men	14	13	13
<i>Percentage of total number of doctorates of men</i>	50	45	40
Number of excellent doctorates of women	3	-	2
<i>Percentage of total number of doctorates of women</i>	50	-	67
Number of excellent doctorates of female foreign students	3	1	3
<i>Percentage of total number of distinctions</i>	38	11	30

CHART 10: Doctorates passed with distinction (period: 1.1. to 31.12. of the calendar year)

Life Long Learning

In 1999 the MU Leoben offered continuing education ranging from lectures and workshops to two university courses.

TEACHING

CONTINUING EDUCATION OFFER 1999 BY THE DEPARTMENTS AND SERVICE UNITS OF THE UNIVERSITY OF LOEBEN

Quality Management

Type	University course with the degree ZQM Manager and Academic Quality Manager
Organisation	Department of Economics and Business Management
Location	University of Leoben
Term	3 Semesters, taught in blocks all over the year

Performance Based Maintenance

Type	Workshop
Organisation	Industrial Liaison Department
Location	Semmering
Term	5. - 6.10.1999

Blasting Engineering

Type	University course and workshop
Organisation	Department of Mining Engineering
Location	University of Leoben
Term	27.10. - 4.11.1999

Refractory Metals

Type	Lecture for continuing education
Organisation	Department of Nonferrous Metallurgy
Location	Universidade Federal de Ouro Preto, Brasilien
Term	29.11. - 3.12.1999

Forging Technology

Type	Seminar
Organisation	Department of Plastic Deformation and Plant Machinery
Location	University of Leoben
Term	December 1999



Practice-oriented Research

A large part of the academic projects is aimed at applicability-oriented research. The University of Leoben still stands by its traditional obligation of close collaboration with the industrial environment

The following chart lists the research projects, which were completed at the MU Leoben within the framework of the restricted legal capacity of the departments in 1999. Altogether more than ATS 67.750.000 of income from contractual work have been raised for that purpose. Therefore the result of the year 1999 is approximately ATS 4.750.000 above the three year average of 1997 to 1999. The large number of the projects carried out or finished in 1999 makes it impossible

to list them all. 9 projects will be explained explicitly on the next pages. They demonstrate the spectrum of academic efforts, which ranges from Geosciences via raw material extraction, Materials Science and Environmental Protection to Industrial Management.

This selection does not at all diminish the scientific importance of those projects, that are not represented themselves.

Research projects at the University of Leoben completed in 1999

Type of the project	EU	FWF	FFF	Christian-Doppler-Laboratories	Federal Government, provinces, communities)	Other customers/sponsors
Number	5	12	12	7	30	289

TOTAL: 365

EU: European Union
FWF: Austrian Science Fund
FFF: Industrial Research Promotion Fund

Transparent Alps

An interdisciplinary joint project of the Department of Geophysics in cooperation with research institutions in Germany, Italy and Switzerland "X-rays" the Alps. Aim: The discovery of processes which developed the Alps.

RESEARCH PROJECTS

Approximately 100 million years ago the African continent collided with Europe. One result of this collision process are the Alps. The processes leading to this formation of mountains are only roughly known. Geoscientists assume that important indications for these processes can be found in the earth crust underneath the Alps.

In order to examine these processes more closely the Department of Geophysics at the University of Leoben cooperates with university and research institutes in Germany, Italy and Switzerland in the multidisciplinary TRANSALP-consortium.

View down to 70 km below sea level

For research into the earth crust down to a depth of 70 km a deep seismic reflection profile 320 km across the Alps is made, heading from north to south between Munich and Venice. At this technique artificial seismic waves are produced and their echos are registered on the surface by geophones. After intense processing on the computer the measured data display an exact three dimensional copy of geological structures. Deep seismic reflection thus allows a view "from above" down to the roots of the Alps. The measurements are completed by recordings of deep and distant "natural" earth-



Seismic reflection of the Alps on a 350 km long north-south traverse from Munich to Venice. (foto.: Department of Geophysics)

quakes done by mobile earth quake stations, which allows a view "from below" into the roots of the Alps.

The data and results of seismic measurements are analysed both by geologists and mineralogists and are completed and confirmed by their additional research work in order to improve and scrutinize the interpretation.

The field work ended in the fall of 1999, scientific results will be available by the end of 2000. So far, one thing is for certain: the results will not only contribute to a better understanding of the processes which led to the formation of the Alps, but it will also be possible to get a detailed picture of the development of deposits and last but not least of the hazard potential of earthquakes in the still tectonically active area of the Alps.

As far as Austria is concerned the TRANSALP-project is supported by the Ministry of Science and Transportation. (BMWV).

Vibrator trucks produce the artificial seismic waves necessary for the evaluation.

(foto: Department of Geophysics)



Hard Rock

The Department of Mining Engineering essentially contributed to the capability of cutting even hard rock through the EU-Project "Improvement of capabilities of cutting tools and cutting systems for hardrock conditions".

The deployment of cutting systems is of immense importance for the construction of tunnels in urban areas. Whenever underground transportation systems (subways, road tunnels) have to be constructed, the techniques of drilling and blasting are always hazardous because of the spatial proximity to buildings. In comparison to blasting techniques the use of cutting tools has many advantages with regard to process engineering and is generally applied more frequently. However, the real problem is that the use of cutting tools still is restricted to poorly consolidated hard rock (less than 100 Mpa).

In cooperation with the VOEST ALPINE Mining Company, the Swedish hard metal producer SANDVIK, the German tunnel construction company THYSSEN, the Portuguese mining company SOMINCOR as well as the French research organisation ARMINES and the Austrian research institution SEIBERSDORF, the Leoben Department of Mining Engineering took up the problem.

The aim is surpassed

The result: The stability of cutting tools has tripled. The attempt to extend the operational area of the mechanical extraction of rocks to rocks with up to 180 Mpa strength was successful. Therefore the goal to extract rocks with more than 150 Mpa was highly exceeded.

On the one hand the contribution of the Leoben Department can be found in the

area of basic research in the milling process, on the other hand in planning and managing an extensive underground application of the prototype machine, weighing 102 tons, in the experimental mine VEBSTER, which is operated by the Department of Mining Engineering at the Styrian Erzberg.

This project is another perfect example of a successful cooperation of university and industry. The result of the increase of the efficiency of cutting tools and systems, demonstrated in practice, has won international recognition.

RESEARCH PROJECTS



A selective cut heading machine in hard rock (Foto: Department of Mining Engineering)

Plug and Drill

An EU-project of the Drilling, Petroleum Production and Economics Department improved the technique of slim-hole drilling and developed a new drilling system.

RESEARCH PROJECTS

At the beginning of the nineties the in mining technology frequently applied method of slim-hole drilling was rediscovered again for the exploration of oil and gas as an economical alternative to conventional rotary drilling. Slim-hole drilling, however, is afflicted with problems: worse circulation of drilling mud while coring in comparison to conventional rotary drilling, lack of research in optimizing and stability of small drilling bits as well as a long round trip cycle of rotary bits when switching from coring to drilling.

In order to solve these problems and to keep slim-hole drilling competitive, the Department of Drilling, Petroleum Production and Economics enforced an EU-sponsored project in cooperation with RIG DESIGN SERVICES, Great Britain and the BOHRGESELLSCHAFT RHEIN-RUHR, Germany from 1996 to 1999.

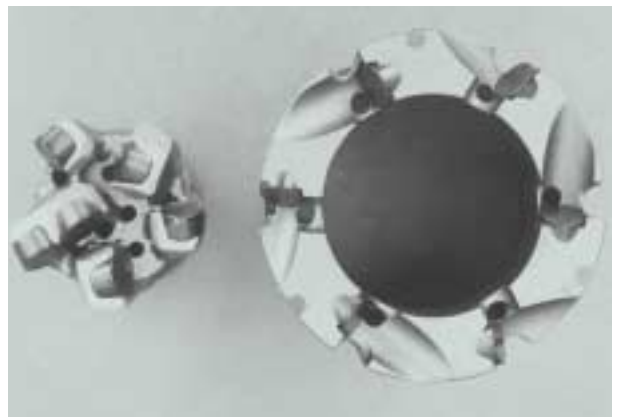
Intensive laboratory tests - even a special drilling rig was installed for that purpose - and computer simulations resulted in decisive improvements in the dynamic behaviour of drill bits and in the hydraulics of drilling fluid. The newly developed core barrels could be tried in a field test in the fall of 1999. The pleasant result: a rate of penetration up to six times higher compared to conventional diamond core bits.

More economical drilling

Additionally the research team developed the concept of a specific drilling system

named "Dual- Body- Bit". This "Dual-Body-Bit" makes it possible to exchange the inner part of the drill bit (the "plug"), which plays an important role for the stability of systems at drilling, within a short time. Since this "plug" is pulled on a cable, the uneconomically long round trip cycle of the total boring rod is dropped. In addition to that the extraction of rock samples for laboratory tests (coring) can be started at once after the removal of the "plug" and the installation of a core barrel. The "Dual-Body-Bit" concept is ideally apt for boring when because of the geological point of view coring is necessary between drilled passages again and again.

The "Dual-Body-Bit" concept can be applied to slim-hole drilling as well as conventional drilling. After the successful laboratory tests within the framework of the project and after the first promising practical use other field tests with the newly developed drilling system are planned within the framework of a demonstrational project.



The newly developed Dual-Body-Bit makes more economical drilling possible



Intensive tests with an especially installed laboratory drilling rig

(Fotos: Department of Drilling, Petroleum Production und Economics)

In (Top) Form

An international research project of the Department of Physical Metallurgy and Materials Testing on the "stability of functional properties of shape memory alloys" led to the clarification of fatigue phenomena and thus to the optimization of shape memory effects.

RESEARCH PROJECTS

Materials with a "shape memory" have the ability of regressing permanent and considerable deformations when they are warmed above a certain temperature: the material adopts its original shape. This effect, which is founded on a temperature dependent conversion from one crystal modification to another, has been used for 20 years with great success in medical technology and aerospace. Elements are applied which have experienced a singular deformation triggered by a change in temperature.

If this process could be repeated reproducibly a couple of times, then it would also be possible to replace a magnifold of conventional motion elements (small motors etc) by simply structured shape memory agents. So far this failed because of insufficient understanding of the change of behaviour, when with an increasing number of operational cycles a "fatigue" of this effect occurred .

Optimal stability

The project "Stability of functional properties of shape memory alloys" led to the clarification of the mechanisms of fatigue phenomena. Scientists systematically examined the interaction between microstructural alloy formation and stability of the shape memory effect. The characteristics of a micro structure, which presents an optimum in its functional stability, can be deduced from this discovery.

By the way, this research project is a wonderful example of international scientific

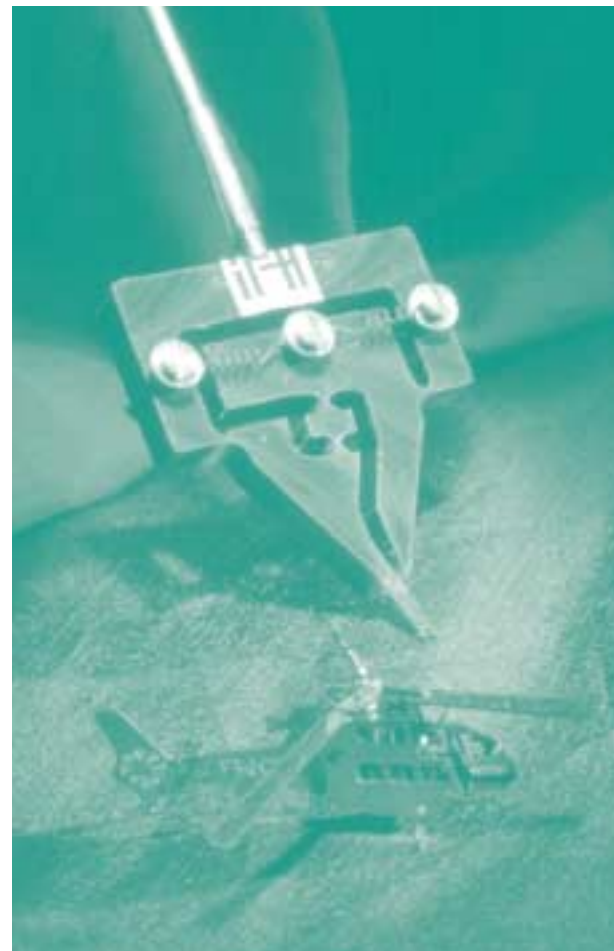
cooperation. The Department of Physical Metallurgy and Materials Testing at the University of Leoben collaborated with the Department of Materials Engineering, TU Ostrava (Czech Republic), the Faculty of Mechanical Engineering, University of Maribor (Slovenia) and the Institute of Materials, Ruhr-University Bochum (Germany).

The scientific findings can be applied industrially in process control engineering. Whenever circuit elements are activated thermally or electrically triggered, shape memory agents can be applied advantageously. Since these elements unite sensor and actor in one component and are also simply structured and reliable, they surpass all conventional problem solutions.

The success of the project is the motive for further research. After examinations of experimentally easily manageable wires the work shall be extended to thin layers.

Actors with a thickness of approximately $10\mu\text{m}$, with which very high transformation frequencies can be realized, shall be produced.

Micro manipulator with shape memory elements
(foto: Ruhr-University Bochum)



More Flexible Systems

The Department of Plastics Processing developed a new technique of PVC-processing, which makes it possible to produce different window profiles with one system.

RESEARCH PROJECTS

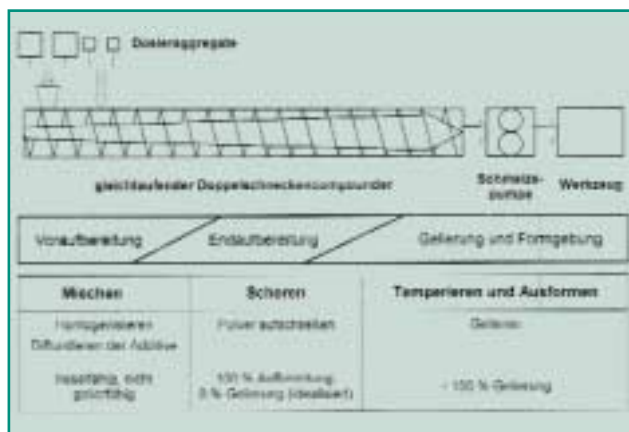
Up to now window profiles out of PVC were mainly produced using contra-rotating twin-screw extruders. The great advantages of this method are the so-called forced feeding and the low residence time in the extruder. It has turned out to be a great disadvantage, however, that the compounding condition of PVCs cannot be al-

Department of Plastics Processing was successful at the search for a new concept of the extruder. The compounding condition of the materials and also the profile quality can be varied now on a wide range.

Quantum leap at PVC-processing

caused by the use of a co-rotating twin-screw extruder with a down-flow melt-pump. This configuration makes it possible to separate the steps of material compounding and pressure build-up, which are necessary for this process. This new extruder-concept means a quantum leap for the industrial production of window profiles, as far as the flexibility of the system is concerned.

PVC-processing - the new concept



tered directly by variation of process parameters. Still, the compounding condition essentially influences the product quality.

In cooperation with GREINER Extrusionstechnik Ltd (Wartberg/ Krems), MAAG Pump Systems Textron AG (Zürich) and KRAUSS-MAFFEI Kunststofftechnik Ltd (München) the

The production of various profiles with the help of different dies on one and the same extruder will be possible without changing the material recipe. So far it has almost always been necessary at the exchange of one component (material, extruder, die) to adapt the remaining others.



The new system
(Foto: Department of Plastics Processing)

Safeguarding Quality

In one project of the Department of Automation a technique was developed, which optically tests materials with refined surfaces during processing.

RESEARCH PROJECTS

For several reasons surface defects and damages can occur at processing high-quality rough material with specially treated surfaces. These defects reveal themselves differently, still they have one thing in common: They reduce the quality of the product. To identify, locate and classify those defects, which cannot be measured by means of conventional methods, has been and will be the aim of the research project "Surface inspection by means of digital image processing", carried out by the Department of Automation.

The new technique "fotographs" defects with a digital camera and thus facilitates a contactless measurement of processes in metallurgical processing. An optical system was developed which uses a holograph for obtaining ultimate lightning in order to record defects digitally.

100.000 images a second

The processing velocity of the product and the claim of discovering defects with a diameter of only 0.1 mm demands that approximately 100.000 images per second are recorded. The result is an enormous flood of data, which has to be dealt with in real time. The department developed a technique for the evaluation, which consists of two phases:

1. Statistical evaluation for the identification of abnormal areas on the surface;
2. Feature estimation and defect classification.

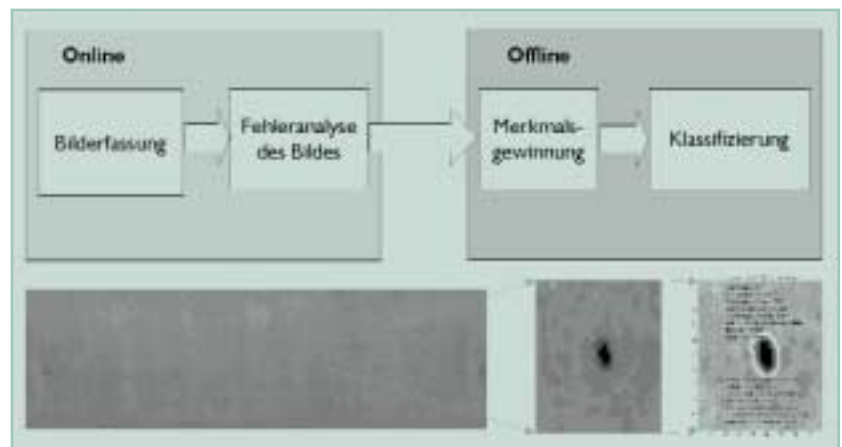
The knowledge gained in this project is converted by two companies at the moment -BOHLER UDDEHOLM AG and MEC.COM-, with the aim of raising the

product quality and reducing the testing costs. This technique makes it possible to test a product 100 percent.

Surface inspection occupies a central position at the Department of Automation. This field of research has gained more and more importance, because materials with refined surfaces are used more and more frequently for products. In addition to the already available methods one intends to further develop the technique of photometric stereo for surface inspection in real time. Then it will be possible to test an extended group of surface properties automatically.

A new two-phase technique of surface inspection facilitates contactless testing of high-quality rough material

(Graphic: Department for Automation)



On Rails

The Department of Mechanical Engineering examines the strain and wear of rails and switches in a project.

RESEARCH PROJECTS

The surface of rails and switch components, mainly the contact zone, are used under extremely high strain when trains roll over them. Wear and fatigue cracks are the result. In addition switches are exposed to high impact loads because of a sudden slope change of the rolling planes.

In cooperation with the VOEST ALPINE Schienen GmbH and the VOEST ALPINE Rail Systems the Department of Mechanical Engineering examines the consequences of the rail-wheel contact. The project is based on thorough three-dimensional modellings of complex strain on rails and switch components, which were carried out at the CD-Laboratory for Micro Mechanics of Materials and later at the Christian-Doppler-Laboratory for Function-oriented Materials Design. Additionally due to the modellings of the past 15 years there exist the requirements for analyzing the strain in the micro and

macro area of rail and switch surfaces (considering the only a few micrometer high surface roughness) and their influence on structural change and cracking.

Since measuring is hardly possible during the rolling process experimentally, only numeric methods and computer simulations can produce a more precise picture of the processes in the surface area of switch components.

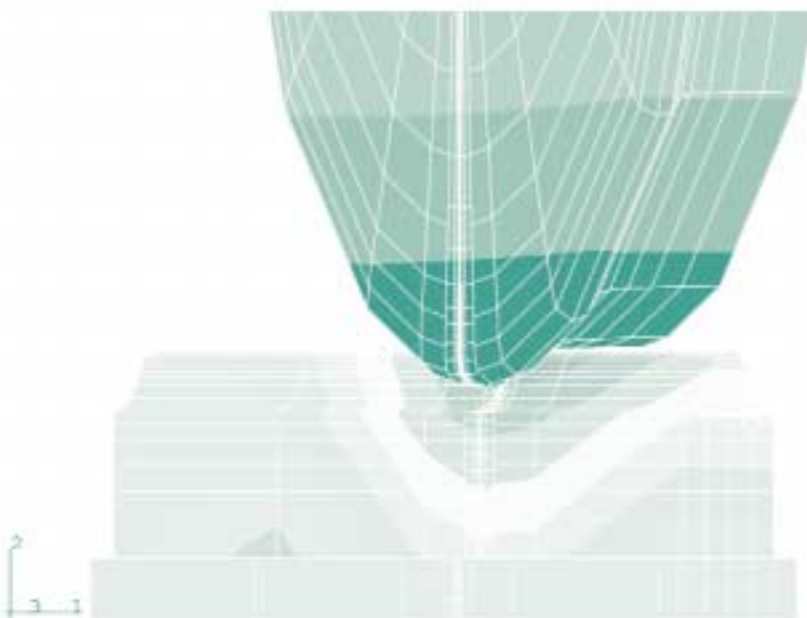
Improved rail geometry

The understanding of the real material strain is the basis for a specific development of an improved rail or switch geometry and switch construction or optimized metallurgical properties of rail or switch materials. With these research results it should be possible for the producer to get a clear picture of the life cycle of a switch component for a certain strain spectrum.

An optimal material configuration and an improved design are the aim. In areas of high energy load and strong structural change in texture, for example, a high strength and hard material is necessary. Research work within the framework of this project therefore contributes to improve the safety of track transport.

Computersimulations facilitate the examination of the rail-wheel contact zone.

(illustration: Department of Mechanical Engineering)



Recycling

One project of the Department of Waste of Disposal and Landfill Technology is devoted to the thermal recycling of wastes in industrial incinerators and promises important insights not only in the sense of environmental protection.

RESEARCH PROJECTS

The Landfill Ordinance forbids the deposit of heating valuable waste from 2004 onwards. Since the capacity of national incineration plants is not sufficient, the status of co-incineration of those wastes in industrial incinerators in the sense of their thermal utilization rises quickly. In addition to that there is the attractiveness of operating efficiency, because a partial substitution of primary fuel by (biogenic) wastes essentially contributes to saving disposal and energy costs. The ecological potential for climate protection according to the protocol of the World Climate Conference in Kyoto in 1997 is also considerable. This means the avoidance of landfill gas emission as well as the substitution of fossil fuels by widely renewable carbon sources.

A FFF-project of the Department of Waste of Disposal and Landfill Technology deals with the question, how exactly a thermal utilization of biogenic wastes can function at the example of industrial incinerators in cooperation with FUNDER Industry Corporation and AE Energy Technology Corporation. The research project pursues three main targets:

1. Both existing fluidized bed incinerators of FUNDER Industry are checked whether they are apt for the thermal utilization of alternative fuels and of waste fuels.
2. Two incineration and dedusting technologies are compared concerning their materials flow and their dependence on the input material. A more precise and simplified design of new plants and an increase of efficiency at the adaptation of existing plants

are achieved.

3. The development of new ash utilization technologies: If it is known how residues - and particularly ashes - are composed, these could be used for raw materials or products.

Although this research project has not yet been finished, the results up to now are promising. They encourage the Department Waste of Disposal and Landfill Technology to create a "quality union of secondary fuels ÖG-SET)". The development of quality criteria, test regulations as well as the ecological and economical evaluation of the use of secondary fuels shall be the goal.

This research work proves to be a very topical ecological project which opens new ways of utilizing wastes.

The fluidized bed boiler plants of FUNDER Industry Corporation are checked concerning their aptitude of thermal utilization of alternative fuels (foto: Depoartment of Waste of Disposal and Landfill Technology



Success Factor Knowledge

One project of the Economics and Business Management Department ordered by the BÖHLER-UDDEHOLM AG deals with the organizational basic conditions for the networking of the research and development activities of the combine.

RESEARCH PROJECTS

The BÖHLER-UDDEHOLM AG, one of the leading high-grade steel producers, carries out its research and development activities at several locations in Austria, Germany and Sweden. One goal of the combine is the networking of decentralized bases of knowledge whose orientation is given due to the specific location. Then the synergy potential could be used optimally and specific knowledge of the varied areas could be made available to all research and development scientists of the

combine.

Those could acquire new knowledge and have the possibility of adaptation of knowledge which is already present at the combine.

Taking these measures the hope of the combine to create new competitive advantages is more than justified.

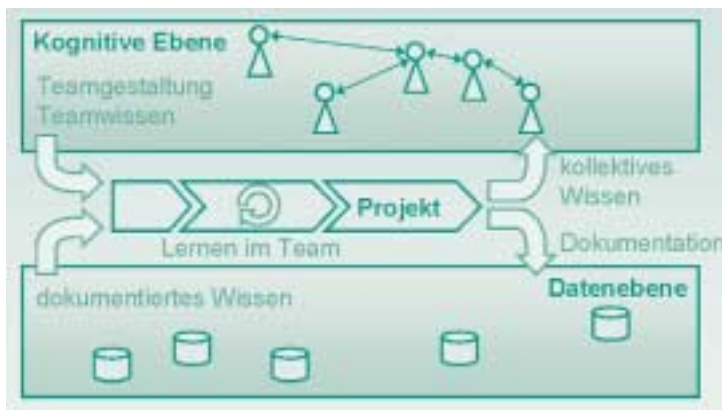
Knowledge and Network

By order of the BÖHLER-UDDEHOLM AG the Department of Economics and Business Management dealt with the organizational basic conditions of the desired networking. The scientific findings led to the development of so-called "knowledge-based network organizations". The basic idea is to view an organization not under the aspect "topography" but under the mo-

re relevant aspect "knowledge". An organization thus becomes a network of fields of knowledge, which in their turn have to be seen as social systems of collective knowledge acquisition. Therefore fields of knowledge themselves become a network of people and resources, which are spread out over different locations.

This project delivers a basic concept for those organizations, which have realized that "knowledge" is an essential success factor. The setting up of fields of knowledge and also the organization of their networking require a corresponding embedding in the setting up and development organization of the enterprise as well as an adequate support by a corresponding infrastructure for communication and interaction.

The Department of Economics and Business Management already works on the further development of this methodology. The concept presently on hand comprises as a matter of priority models with the aim of supporting organizations at the networking of knowledge by the design of basic conditions. The further development is aimed at the networking of individual knowledge by the systematical use of instruments and methods. It is of decisive importance at the realization of a project that the processes "documentation of knowledge" and "information" are optimally supported by use of instruments and methods. This research project is a good example for the "usability" of scientific achievements of a rudimentary institute.



The knowledge oriented network organization can turn knowledge into a success factor.

(graphics: Department of Economics and Business Management)

New Clusters

Cooperative Materials Research Materials Center Leoben (MCL)

The Materials Center Leoben, MCL, run as an organization since Jan.1, 1999, is registered as a research institution, Ltd on Oct.2,1999. Partners on the part of MU Leoben are the Departments of Physical Metallurgy and Materials Testing, Metal Physics, Structural and Functional Ceramics and Mechanics. Additionally the Department of Mechanical Engineering participates in projects. Nine groups of researchers from Leoben, Graz and Vienna have joined in the MCL, the university in charge is the MU Leoben. Next to the four departments of MU Leoben the members are:

in Leoben:

Laser Center Leoben (Joanneum Research Ltd.), Erich-Schmid-Institute of Materials Science (Austrian Academy of Sciences);

in Graz:

Department of Materials Science, Welding Engineering and Chipless Forming Techniques (TU Graz);

in Vienna:

Department of Materials Science and Materials Testing, Department of Chemical Technology of Anorganic Materials (TU Vienna).

The research groups have internationally acknowledged experience and predominantly complementary competence in the fields of materials and processing techniques. Due to their merging to MCL an overcritical research and development unit is established which efficiently supports domestic industry at research and development tasks on the one hand and also gives international impetus on the other hand.

17 Austrian companies (small businesses as well as big combines) participate in the momentary initial phase at MCL. The partner companies will have a share of 40% in the total capital of the first period of MCL

which is estimated at about ATS 168 million.

Flow and Combustion Simulation CD-Laboratory for Applied Computational Thermofluidynamics

The Christian Doppler-Laboratory for Applied Computational Thermofluidynamics is installed at the Department of Mathematics, Division of Applied Mathematics on Jan.1, 1999. This research unit is supported by the Christian-Doppler-Society and collaborates with three renowned partners from metallurgy, refractory and motor industry. The aim of the CD-Laboratory is getting deeper insight into the course of complex flow and combustion processes.

Main research areas:

1. Steady state and transient turbulent flows in complex geometries (engines, air-conditioning and aeration systems)
2. Homogeneous and non-premixed combustion in engines, burners and furnaces;
3. Atomization, particle transport and spray mixing in engines and chemical engineering devices.

Personnel 1999: 6 academic members and 1 secretary

Optimization of Building Material CD-Laboratory for Building Materials with Optimized Properties

Another Christian-Doppler-Laboratory was installed at the Department of Refractory Materials in April 1999. The CD-Laboratory for Building Materials with Optimized Properties aims at working out the scientific principles for the improvement of the durability of building materials. The laboratory collaborates with four

RESEARCH- INSTITUTIONS

CD-Laboratory for
Building Materials with
Optimized Properties at
the Department of
Refractory Materials

(Foto: Department of Refractory
Materials)



renowned partners from the building materials, refractory and steel industry.

Main research areas:

1. Mechanic and thermomechanic definition of building materials at ambient and high temperatures.
2. Prognosis of mechanic and thermodynamic behaviour of refractory materials.
3. Development of refractory materials with reduced brittleness.

Personnel 1999: 3 academic members and 1 technical member.

New Analysis Standards

ICPMS-Laboratory

A chemical laboratory for plasma-mass spectrometry (ICPMS-Laboratory) is opened on June 11, 1999 at the Department of General and Analytical Chemistry after two years of construction work and investments of about ATS 10,000,000. The analysis technique applied by the ICPMS-laboratory is one of the few measurement principles with the help of which stored data in the ultra-trace area can be obtained, provided that there is an appropriate technique of working (purity and laboratory thermostatisation) It may be assumed that this technique, which is recognized by the world's highest committee of measurement technology (Bureau International des Poids et Mesures, Paris), will develop to a new industrial standard.



Opening of the ICPMS-Laboratory



Center of Applied Technology

Foto: Außeninstitut

From University to Self-Employment

Center of Applied Technology (ZAT)

The project "Center of Applied Technology (ZAT)" was started in spring 1999 at the Industrial Liaison Department of MU Leoben. ZAT is Austria's first university spin-off center which is comparable to "incubator institutions" abroad. These institutions accompany future entrepreneurs on their way from university to self-employment. In this process technical research and educational units which become

independent play an important role, since the business areas which are concerned often belong to the field of high technology. Apart from the MU Leoben, the pilot scheme ZAT is also financially supported by the Austrian Federal Ministry for Science and Transport. The Styrian Society for Economic Aid, the Federal Province of Styria and the municipality of Leoben. For routine operation the municipality and the university founded a specific limited company which is managed by the Industrial Liaison Department. Three graduates from MU Leoben are the very first candidates. Next to financial support and economical infrastructure the test candidates under this guardianship have access to a network of experts. The maximum time of guardianship by ZAT is three years.

Look back at 7 successful years

CD-Laboratory for High-Tech Ceramics

In 1999 the Department of Structural and Functional Ceramics shuts down the Christian-Doppler-Laboratory for high-tech ceramics after 7 years, the maximum term for a CD-Laboratory. With a total capital of more than ATS 12,000,000 for the implementation of research projects the laboratory was very successful. The impressive end result are 24 publications, 2 patent applications as well as the submission of 5 doctoral and 19 diploma theses. In the future the experience of the Department of Structural and Functional Ceramics (in the area of high-tech ceramics) will be available to the recently established Materials Center Leoben (MCL).

Knowledge networking

UNIVERSITY COOPERATIONS

Networking - a keyword of our decade - has been applied by the MU Leoben for a long time. For approximately 20 years bilateral agreements have existed between the German technical universities Clausthal and Bergakademie Freiberg as well as the University Miskolc in Hungary. 8 years ago the first agreement with the Colorado School of Mines, Golden, USA was signed, which - due to its great success in student exchange - was extended on a broader basis.

These agreements with the aim of fostering science and research (joint projects, exchange of scientists) as well as teaching (mainly student exchange) were and will be carried on on the basis of cooperating institutions.

In addition to that numerous departments of the MU Leoben demonstrated initiative of their own and initiated close connections to related institutions all around the globe. In the preceding years many universities have joined within the framework of the EU-programs (SOKRATES, TEMPUS and so on), so that a listing of all active cooperations is impossible. Therefore only those agreements are listed below which were reached in 1999.

<p>University of Leoben Michigan's Technological University (MichiganTech), Houghton, USA Research and teaching</p>	<p>Signatory institution Partner Field of cooperation</p>
<p>University of Leoben Technical University Ostrava, Czech Republic Research and teaching, general agreement</p>	<p>Signatory institution Partner Field of cooperation</p>
<p>Department of Mining Engineering Ecole Nationale Supérieure des Mines de Paris, Frankreich Coordination of research projects in the field of blasting engineering, joint research program (3 years)</p>	<p>Signatory institution Partner Field of cooperation</p>
<p>Department of Refractory Ecole Polytechnique de Montreal (Département de génie physique et de génie des matériaux), Kanada Research and teaching, intensification of student exchange</p>	<p>Signatory institution Partner Field of cooperation</p>
<p>Department of Geosciences 1. University of Mining and Geology, St. Ivan Rilski, Bulgarien 2. University St. Kliment Ohridski, Sofia, Bulgarien Tempus Project No. S-JEP 12342-97 „Restructuring of Curricula for B.Sc. and M.Sc. Levels in Earth Sciences“</p>	<p>Signatory institution Partner Field of cooperation</p>

An Impetus to Economy

COOPERATIONS

Following a tradition the MU establishes close contact with economy. The spectrum ranges from "minor" reports to major research contracts. Since there are so many cooperations between departments of MU Leoben and economy and industry, the listing is restricted to those cooperations with a contract extent beyond ATS 200,000.

In this category there has been cooperation with 49 different enterprises in 1999. Thereof 21 have their headquarters in Styria, a clear indication for the impetus given to the direct industrial environment by MU Leoben. Eight foreign companies are also mentioned that assigned research contracts of a larger extent to the MU Leoben.

Department	General and Analytical Chemistry
Partner	BÖHLER Edelstahl GmbH, Kapfenberg, Steiermark
Project	Trace analysis in steels with ICP-MS

Department	Mechanical Engineering
Partner	ELTRONA-RKT, Rottenmanner Kabeltechnik GmbH, Steiermark
Project	Construction of a robot manipulator

Department	Automation
Partner	VOEST ALPINE Bergtechnik Ges.m.b.H, Zeltweg, Steiermark
Project	Automation of highly dynamic plant machines
Partner	VOEST ALPINE Stahl Linz GmbH, Oberösterreich
Project	Digital image processing, vibration analysis for system diagnosis and preventive maintenance
Partner	BÖHLER-UDDEHOLM AG, Wien
Project	Digital image processing for automatic inspection of metallic surfaces, thermography and digital image processing for the detection of cracks in steel ingots
Partner	AVL LIST GmbH, Graz
Project	Methods for spectral analysis of blood

Mining Engineering	Department
OMYA GmbH, Gummern, Kärnten	Partner
Working scheme with backfill	Project
GEOMONTAN Wien	Partner
Deposit modelling for Erzberg open cast mining	Project
VOEST Erzberg, Eisenerz, Steiermark	Partner
Development of standards for the remediation of mining and quarrying areas	Project
VOEST ALPINE Bergtechnik Ges.m.b.H, Zeltweg, Steiermark	Partner
Improvement of the Capabilities of Cutting Tools and Cutting Systems	Project
MONTANWERKE Brixlegg, Tirol	Partner
Measuring of seismic activities at the mine Schwaz, Tyrol	Project

Ferrous Metallurgy	Department
VOEST ALPINE Stahl Linz GmbH, Oberösterreich	Partner
1.High-temperature mechanical properties for modulation of continuous casting	Project
2.Crack formation in continuous casting	
BÖHLER Edelstahl GmbH, Kapfenberg, Steiermark	Partner
Nonmetallic inclusions in high-grade steel	Project

Electrical Engineering	Department
DB Energie, Frankfurt/Main, Deutschland	Partner
Static-system-die-frequency converter	Project
ALTERNATIV TECHNIK TEAM Wachauer, Hiefrau, Steiermark	Partner
Electric traction application in the range of several kilowatt	Project

Department of Geosciences	Department
NAINTSCH Mineralwerke Ges.m.b.H., Graz	Partner
Geotechnic documentation of exploratory drilling in connection with the measures taken after the mining disaster at Lassing	Project
GKB-Bergbau GmbH, Köflach, Steiermark	Partner
Raw material potential of GKB-exploratory areas	Project
VOEST ALPINE Stahl Linz GmbH, Oberösterreich	Partner
Mineralogic-petrographic analysis of iron-ore	Project
LECA Ges.m.b.H., Fehring, Steiermark	Partner
Expandability of clay material	Project
SCHRETTNER & Cie., Vils, Tirol	Partner
Quality of lime stone	Project

An Impetus to Economy (continued)

Department	WASTE MANAGEMENT AND LANDFILL TECHNOLOGIES
Partner	1. FUNDER Industrie GmbH, St.Veit/Glan, Kärnten
Project	2. AE ENERGIETECHNIK GmbH, Wien Determination of waste, utilization of biogene wastes and residues due to production
Partner	AVE Abfall-Verwertung-Entsorgung GmbH, Hörsching, Oberösterreich
Project	Determination of waste; costs, financing and insurance of a waste treatment plant, prediction of waste loads
Partner	A.S.A. Abfallservice Halbenrain GmbH & Co Nfg KG, Halbenrain
Project	Residual Waste - Splitting
Partner	BAUFELD Austria GmbH, Wien
Project	Determination of waste, thermal utilization of processed wastes in cement industry
Partner	ROTOFORM Druckformen GmbH, Graz
Project	Merging of environment and quality management to total quality management
Partner	AUDIT Software- und Handels-GmbH, Graz
Project	Visualizable processing results, materials flow optimization and cost analysis of the system SAB R/3 at VAE-AG

Department	GEOPHYSICS
Partner	GECO-Umwelttechnik GmbH, Kapfenberg, Steiermark
Project	Design of a dark field tool

Department	CERAMICS
Partner	VOEST ALPINE Stahl Linz GmbH, Oberösterreich
Projects	1. Testing of used and unused refractory materials and slags 2. Behaviour improvement of building materials under mechanic and thermomechanic strain
Partner	1. VOEST ALPINE Stahl Donawitz GmbH, Donawitz, Steiermark 2. RHI AG, Wien
Project	Behaviour improvement of building materials under mechanic and thermomechanic strain

Department	DESIGNING PLASTICS AND COMPOSITE MATERIALS
Partner	HÖRBIGER Ventilwerke GmbH, Wien
Project	Mechanical engineering, high-quality materials, processing techniques

Department	PLASTICS PROCESSING
Partner	GREINER Extrusionstechnik GmbH, Wartberg, Oberösterreich
Project	Development of a new extrusion technique

RESERVOIR ENGINEERING		Department
1. (RC) ² Reservoir Characterization, Research & Consulting, Inc. , Denver, Colorado, USA		Partner
2. HOT Engineering GmbH, Leoben, Steiermark		
Mathematical modulation of hydrocarbon reservoirs		Project
MECHANICS		Department
VOEST ALPINE Schienen GmbH & CO KG, Donawitz, Steiermark		Partner
Wheel/track contact		Project
VA TECH, Zeltweg, Steiermark		Partner
Wheel/switch contact		Project
SHELL International Exploration and Production, Rijswijk, Niederlande		Partner
Tube Expansion/Collapse Load		Project
VOEST ALPINE Industrieanlagenbau, Linz, Oberösterreich		Partner
Ripple factor of sheet metal		Project
DEUTSCHE BAHN		Partner
ICE-wheel		Project
A. KIRCHGASSNER GmbH, Salzburg		Partner
Buckling of lying containers		Project
PHYSICAL METALLURGY AND MATERIALS TESTING		Department
BÖHLER Edelstahl GmbH, Kapfenberg, Steiermark		Partner
Materials scientific principles for the thermal stability of tool steels		Project
RÜBIG GmbH, Wels, Oberösterreich		Partner
Development of a combined technique of die surface treatment for aluminium alloy casting		Project
METALL PHYSICS		Department
BÖHLER Ybbstalwerke, Böhlerwerk, Niederösterreich		Partner
Support material for bandsaws		Project
1) TEER COATINGS Ltd., Hartlebury, Kidderminster, Großbritannien		Partner
2) PRAXAIR Surface Technologies, Novara, Italien		
BRITE EURAM Project, Development of a computer-aided technique for the prediction of down-time wear of solid coatings		Project
NONFERROUS METALLURGY		Department
PLANSEE TIZIT AG, Reutte, Tirol		Partner
Fluidized bed reduction and gascarbonization of refractory materials		Project
METALEUROP Recherche, Trappes-Cedex, Frankreich		Partner
Zinc distillation column		Project

An Impetus to Economy (continued)

COOPERATIONS

Department	STRUCTURAL AND FUNCTIONAL CERAMICS
Partner	EPCOS OHG, Deutschlandsberg, Styria
Project	Determination and understanding of mechanical properties of electro-ceramic components
Partner	IBS Austria GmbH, Teufenbach, Styria
Project	Wear-resistant layers of ceramic material for paper machines
Partner	BÖHLER UDDEHOLM GmbH & Co. KG, Kapfenberg, Styria
Project	Optimization of wear behaviour of silicon nitride rolls for the processing of high-alloy steel cables and wires
Partner	VOEST ALPINE Stahl Linz GmbH, Upper Austria
Project	Optimization of cooling of copper blowheads in furnaces

Department	PROCESS TECHNOLOGY AND ENVIRONMENTAL PROTECTION
Partner	VOEST ALPINE Stahl Linz GmbH, Oberösterreich
Project	Measurement data for new desulfurization techniques
Partner	VOEST ALPINE Industrieanlagenbau, Linz, Upper Austria
Project	Development of competitive waste-gas purification systems
Partner	ROHRER, Niklasdorf, Styria
Project	Waste-gas treatment of the tankfarm Lannach
Partner	HOLDERBANK, Schweiz
Project	Development of special cement production techniques
Partner	BRAU UNION, Graz
Project	Thermal utilization of spent hops

Department	ECONOMICS AND BUSINESS MANAGEMENT
Partner	BÖHLER UDDEHOLM AG, Vienna
Project	Development and systematic use of knowledge in organizations
Partner	Hüttenwerke KRUPP-MANNESMANN GmbH, Duisburg, Germany
Project	Analysis of ore-delivery to plant, design and implementation of an ordering plan system
Partner	Österreichische PHILIPS Industrie GmbH, Vienna
Project	Total productive maintenance (training concept)

Exchanging knowledge

Science depends on an exchange of experience and ideas. In 1999 the departments and the Industrial Liaison Department organized 23 academic events on the whole, whereof 15 events took place at the university itself.

ACADEMIC EVENTS

The 5th Tooling Conference - an international conference, which brought about 350 scientists from more than 30 countries to Leoben for 3 days - deserves a special reference. Gratitude must be expressed for this successful event to the Department of Physical Metallurgy and Materials Testing as organizer as well as to Böhler-Uddeholm Inc. and Witten Steel Krefeld, Ltd as sponsors.

Erich-Schmid-Colloquium

(foreign lecturers also)

Organization Metal Physics

Location University of Leoben

Date all year round, 2-weeks-intervals

Selected Chapters of General and Analytical Chemistry

(seminar, foreign lecturers also)

Organization Physical Chemistry

Location University of Leoben

Date all year round

Patents & Registered Design

Organization Industrial Liaison Dpt.

Location Technologietransfer-Zentrum (TTZ) Leoben

Date Jan 21, 1999

Discrete Mathematics

Leoben-Laibach-Seminar

Organization Applied Mathematics

Location University of Leoben

Date Jan. 31 to Feb. 6, 1999

X-Ray and Neutron Scattering at European Research Plants

Organization Metal Physics

Location Plannersalm, Styria

Date Jan. 31 to Feb. 6, 1999

Plastic Deformation Colloquium

Organization Plastic Deformation and Plant Machinery

Location University of Leoben

Date Feb. 28, to March 6, 1999

Structure and Fraction

International conference

Organization Structural and Functional Ceramics

Location Ruhruniversität Bochum (Deutschland)

Date March 17 to 19, 1999

Improving Human Potential Resources (IHRP)

(within the EU-framework program)

Organization Industrial Liaison Dpt.

Location Technology Transfer Center (TTZ) Leoben

Date March 25, 1999

45th Metallurgy Colloquium

Organization Physical Metallurgy and Materials Testing

Location Lech, Vorarlberg

Date April 12 to 14, 1999

3 TP-Program (Growth and Lasting Development)

(within the EU-framework program)

Organization Industrial Liaison Dpt.

Location Technology Transfer Center (TTZ) Leoben

Date April 14, 1999

Exchanging knowledge (continued)

Seminar PC-Measurement Technology LabVIEW/DASYLab

Organization Electrical Engineering
Location University of Leoben
Date April 20, 1999

Annual ASMET Meeting

Organization Ferrous Metallurgy
Location University of Leoben
Date May 10 to 12, 1999

Innovation Management

Organization Industrial Liaison Dpt.
Location Technology Transfer Center (TTZ) Leoben
Date June 8 to 10, 1999

Academic Symposium at the Opening of the ICPMS-Laboratory

Organization General and Analytical Chemistry
Location University of Leoben
Date June 11, 1999

Patents

Organization Industrial Liaison Dpt.
Location University of Leoben
Date June 16, 1999

Austrian Technology-Transfer-Days

Organization Industrial Liaison Dpt.
Location University of Leoben
Date Sept. 22 to 23, 1999

5th Tooling Conference

Organization Physical Metallurgy and Materials Testing
Location University of Leoben
Date Sept. 29 to Oct. 1, 1999

III. Material-Physical Symposium „Kamptal Seminar“

Organization Metal Physics
Location Schloss Seggau bei Leibnitz, Styria
Date Sept. 29 to Oct. 2, 1999

15. Plastic-Colloquium Leoben

Organization Plastics Processing
Location University Leoben
Date Nov. 18/19, 1999

Refractory Materials Colloquium

Organization Ceramics
Location University of Leoben
Date Oct. 22, 1999

Research Seminar with the Centre de Géotechnique (CGES) of the Ecole Nationale Supérieure des Mines de Paris

Organization Mining Engineering
Location University of Leoben
Date Dec. 2/3, 1999

Foundation Day

Organization Industrial Liaison Dpt.
Location Technologypark Niklasdorf
Date Dec. 2, 1999

Workshop „Environment and Lasting Development“ for Preparation of a RTD Proposal within the 5th EU Framework Program

Organization Applied Mathematics, CD-Laboratory for
Applied Computational Thermofluid-
dynamics
Location University of Leoben
Date Dec. 7, 1999

Going Public

The academic performance, which can be demonstrated by the number of publications, is worth mentioning. If all submitted publications of the year 1999 are added, then there is a total of 781 publications

Trying to list all publications by scientists at the MU Leoben would go far beyond the scope of this annual report. Therefore the chart printed below confines itself to mentioning only the number of publications in the different categories.

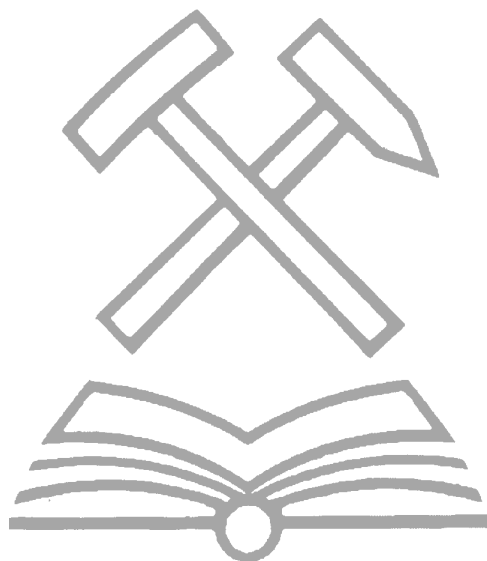
Without wanting to belittle the academic performances of the other publications, there are two worth mentioning to which scientists of the Department of Metal Physics made a major contribution and won an international award:

The publications of P. Roschger, P. Fratzl (Head of the Department of Metal Physics), J. Eschberger and K. Klaushofer under the title "Validation of Quantitative Backscattered Electron Imaging for the Measurement of Mineral Density Distribution in Human Bone Biopsies", published in *Bone*, vol.23, pp 319-326 or in *Bone*, vol 24, pp 619-621, were awarded the "Byk Tosse Osteology Prize 2000" (endowed with DM 15.000).

The publication of H. Lichtenegger, M.Müller, O. Paris (employees at the Department of Metal Physics), Ch. Riekel and P. Fratzl under the title "Imaging of the Helical Arrangement of Cellulose

Fibrils in Wood by Synchrotron X-ray Microdiffraction, published in *J. Appl. Cryst.*, vol. 32, pp. 1127-1133, is described as a highlight in the annual report 1999 of the ESRF (in the chapter "Materials", p.77). As a special acknowledgement an article itself was written about it in the magazine "International Union of Crystallography" (W. Fuller, *IUCr Newsletter*, vol.7, p.4).

PUBLICATIONS



PUBLICATIONS AT THE UNIVERSITY OF LEOBEN IN THE YEAR 1999

Publications reported on	255
Publications not reported on	121
Textbooks and reference books	5
Academic lectures and posters	510
TOTAL:	781

PERMANENT POSITIONS AT THE UNIVERSITY OF LEOBEN

	YEAR 1997	YEAR 1998	YEAR 1999
University Professors	40	40	40
Academic staff (professors excluded)	140	143	146
Non-academic staff	202,5	209,5	210,5
Number of permanent positions in the given calendar year			

RESOURCES

Not all permanent positions were occupied continuously in 1999. When employment is ended by retirement, termination of contract or - rather seldom - by dismissal or even death of the employee, a vacancy over a long period is the rule. As for re-appointments in the groups "academic junior faculty" and non-academic staff there are budgetary reasons for a longer vacancy. Is there a longer vacancy due to the sudden leave of a professor then mainly the problems at the search for eligible candidates impede a fast re-appointment. This was the reason why 2 chairs remained vacant throughout 1999, at the Department of Drilling, Petroleum Production and Economics the chair in succession to Professor Millheim (he handed in his notice in 1998) and at the Department of Conveying Technology the chair in succession to Professor Grimmer (deceased in 1998).

Faculty and Staff

In addition to permanent positions the university management knows of the following private employees, employed by the departments within the framework of their restricted legal capacity for contractual work re-search projects.

Academic staff	101 persons, a total of 59.3 man-years
Non-academic staff (incl. student assistants):	69 persons, a total of 14.8 man-years

All data on buildings and premises of the MU Leoben in the period from 1997 to 1999 are summed up in the opposite chart. In 1999 23 lecture halls and seminar rooms are available which are occupied to capacity to 78% by courses in the winter semester 1999/2000 from Monday to Friday between 8am and 6pm. Next to teaching another 106 events took place in the lecture halls, thereof 89 which were organized by university members.

Building projects which could be completed in 1999 help to diminish lack of space, to eliminate inadequacies in several edifices and to do without rented and expensive facilities. The total amount of money invested in building projects is ATS 12,000,000 approximately.

UTILIZABLE SPACE		
YEAR 1997	YEAR 1998	YEAR 1999
46.477	46.477	47.711
Utilizable space at the MU Leoben in m ² incl. hallways and sanitary facilities		

RESOURCES

Premises

ADAPTATIONS

Early in 1999 the Department of Foundry Technology can put into operation a high-quality real-time-controlled high pressure die casting machine with up to date equipment. Ever since this system has been used in cooperation with the Austrian Foundry Institute Leoben for pure research as well as for industrial projects.

The Department of Metal Physics carried out new adaptations of software and hardware of the Scanning-SAXS-Laboratory and improved the system concerning the possibility of test rotations. These adaptations open up completely new areas of application

for small angle scattering, especially for measuring three-dimensional scattering spectra, which is of importance for a strong anisotropic microstructure - such as in bones, for example.

The premises of the Department of Chemistry of Polymeric Materials are enlarged from 380 to 600m². Money is invested especially in the extension of the College of Technology for Formulation and Modification of Thermoplastics and of the Laboratory for Fluid Chromatography. (Total of investments of the department:ATS 3,322,207).

Financial Report

RESOURCES

BUDGET DISTRIBUTION			
	1997	1998	1999
UT 0 (personnel expenses)			
Personnel incl. DGB	198.623	202.463	217.890
Visiting professors incl. DGB	269	646	694
Allowances for faculty members	2.025	900	896
Total expenses UT 0	200.917	204.009	219.480
UT 3 (Investments)			
Appointments - Investments	13.614	20.082	13.107
Investments Departments	5.060	4.559	17.079
Equipment	780	948	1.284
Investments Service Sector	6.299	6.304	7.217
Orther expenses	565	4910	1233
Total expenses UT 3	26.318	36.803	39.919
UT 7 (External Teaching)			
Adjunct faculty and visiting professors	5.335	6.801	6.735
Visiting lecturers	-	322	398
Student assistants and tutors	1.385	1.862	2.100
DLE, miscellaneous	1.982	1.962	2.763
Total expenses UT 7	8.702	10.946	11.996
UT 8 (Operating expenses)			
Operating expenses of departments	21.845	23.462	23.800
Operating expenses incl. services and others	44.557	47.691	48.260
Roland Berger Study	460	-	-
Foreign relationship	1.000	1.100	1.600
Z-posts (imbursements, contributions)	2.000	2.000	2.000
Total expenses UT 8	69.862	74.253	75.660
TOTAL	305.798	326.012	347.055
Allocation of Budget (all sums in ATS 1000)			
DGB social security and retirement contributions			
DLE service contribution			

Resources

The positive development of the budget distribution is used for structural remodelling

The budget distribution within the reported period shows mainly positive developments and structural remodellings. In 1999 financial resources for visiting professors could be expanded.

Personnel expenses

The reason for the considerably high increase in the area of personnel expenses can mainly be found in the transfer of contractual employees to the new salary plan.

Investments

The increase of investment resources from approximately ATS 26 million in the year 1997 to almost ATS 40 million in 1999 is most gratifying.

Altogether the university management still has only about 12% of the total budget for investments in fixed assets at its disposal.

External Teaching

As demonstrated by the opposite chart the budget funds for external teaching could be raised from ATS 8.7 million in 1997 to almost ATS 12 million in 1999.

Working Capital

Concerning working capital austerity measures are taken in the areas of energy and telephone costs, so that more budget funds can be allocated to the departments in the year 1999 (from almost ATS 22 million in 1997 to almost ATS 24 million in 1999).

RESOURCES

Budgetary Priorities

In addition to implementing reductions the following priorities at the budget distribution are set:

- Reinforcement of financial autonomy of departments;
- Reinforcement of public relations work and of international exchange programs by means of budget increases;
- Reduction of appointments (which reduces the expenses thereof);
- Increase of budget for continuing education.

Excellent!

Honors and awards for scientists at the MU Leoben

PARTICULARS

Awards from other universities

Em. Univ. Prof. Dipl.-Ing Dr. Günther B. Fettweis, the former head of the Department of Mining Engineering is awarded the honorary doctorate by the Moscow State University of Mining. This renowned Russian university honors the great achievements of Prof. Fettweis in the development of mining engineering and in international cooperation.

The Czech University Ostrava, Czech Republic, awards Univ.-Prof. Dipl.-Ing. Dr. mont. Albert Kneissl, Professor at the Department of Physical Metallurgy and Materials Testing, the gold medal "Georgius Agricola", honoring his excellent scientific and pedagogic merits in the areas of metallurgy and metallography as well as his engagement in the development of a cooperation between both universities.

Associate Professor Dr. Erich Königsberger, employed at the Dept. of Physical Chemistry gets an invitation as visiting professor from the Niigata University, Japan for the period of Oct. 99 to March 2000.

Associate Professor Dipl.-Ing. Dr. mont Peter Moser, employed at the Dept. of Mining Engineering is appointed "Directeur de Recherche Habilité" at the centre de Gèotechnique et d'Exploitation du Sousol (Ecole Nationale Superieur des Mines de Paris).

Awards from other institutions or enterprises

The Department of Economics and

Business Management is awarded the "Austrian Quality Award" 1999, which is bestowed by the Austrian Foundation for Quality Management (AFQM). The honored department is the first non-profit enterprise which could receive this renowned prize. Among others the AFQM dedicates itself to the dissemination of business-excellence-concepts in Austria and evaluates organisations by criteria which are based on the internationally established Business Excellence Model of the European Foundation for Quality Management. Management (leadership, strategy and planning, finances, quality system and processes) as well as the achieved results (profits, contentment of customers and staff and influence on society) are evaluated.

Dipl. Ing. Wilfried Marketz, employed at the Department of Mechanics and former employee of SHELL International Exploration and Production receives the "Petroleum Engineering International Award for Engineering Innovation". This award honors the results of the project "Tube Expansion", a cooperation of SHELL, the Department of Light weight and Aircraft Construction (TU Vienna) and the Department of Mechanics (MU Leoben).

Dipl. Ing. Hannes Senft, employed at the Department of Geosciences, Division of Environmental System Engineering Analysis, receives the "2nd Prize for Innovations in Waste Disposals 1999", donated by KOMPTECH-HEISSENBERGER & PRETZLER, LTD in honor of the results of his thesis.



Presentation of the „Austrian Quality Award 1999“ to Prof. Biedermann (in the middle), head of the Dept. of Economics and Business Management

Foto: Thomas Kunz

Univ.Prof. Mag. Dr.rer.nat Peter Fratzl, head of the Department of Metal Physics is appointed "Deputy Head of the Research Unit" of EURATOM-ÖAW by the Commission of Nuclear Fusion Research.

Hon.Prof. Dipl.-Ing. Dr.mont Gerhard Ruthammer, visiting professor at the Department of Drilling, Petroleum Production and Economics, is granted the title "Bergrat h.c" by the Austrian president.

Univ.Prof. Dipl.-Ing. Dr. mont Horst Wagner, head of the Department of Mining Engineering is elected president of the BVÖ (Austrian Mining Association).

Univ.Prof. Dipl.-Ing. Dr.mont. Heinz

Gamsjäger, head of the Department of Physical Chemistry is reelected secretary and Associate Professor Dr. Erich Königsberger, employed at the same department, is reelected associate member of the IUPAC Solubility Data Commission at the IUPAC General Assembly 1999.

Honors, awards and appointments by the MU Leoben

On Feb. 1, 1999 Univ. Prof. Dr.techn. Wilfried Eichlseder assumes office at the MU Leoben and becomes new head of the Department of Mechanical Engineering. With Prof Eichlseder, who was executive at the STEYR-DAIMLER-PUCH, Inc. before his appointment, the MU Leoben can welcome again among its professors a renowned scientist with extensive experience in industry.

The MU Leoben awards Hon.Prof. Dr. Alfred Lampl the honorary doctorate of Mining Sciences. Thus it honors his achievements as engineer in the field of Plastics Engineering as well as his 30 years of active life as adjunct faculty.

In honor of their extraordinary scientific achievements and their engagement as ad-

adjunct faculty at the MU Leoben, Dipl.-Geophys. Dr. rer.nat.habil. Jürgen Schön, employed at Joanneum Research, Leoben, and Dr. Wolfgang Schollnberger, chairman of Oil Industry F&P Forum at BP AMOCO, are appointed honorary professors. Dr. Schön is appointed for the field of Applied Geosciences and Dr. Schollnberger for the field of Basin Genesis and Petroleum Exploration.

Dr. Arnulf Grübler, employed at Iiasa in Laxenburg, is appointed associate professor for the field of System Management in Environment and Technology.

Honors and prizes for graduates and students at MU Leoben

PARTICULARS

Rector-Platzer-Ring

On the occasion of the 125th anniversary celebrations of the MU Leoben, the former "Mining Academy", an honorary ring - the Rector-Platzer-Ring- was donated for graduates who completed their studies with distinction. Representatives of this foundation are "ASMET" (Austrian Society for Metallurgy) and the Austrian Mining Association as founding members as well as the "Austrian Society of Petroleum Engineering" and the "Union of Plastic Engineers in Leoben". In 1999 the Rector-Platzer-Ring is awarded to the following ladies and gentlemen at their graduation:

- Dipl.-Ing. Martin Johann Grübmler,
Petroleum Engineering;
- Dipl.-Ing. Joachim Josef Bruno Lehner,
Ferrous Metallurgy;
- Dipl.-Ing. Christof Messner,
Materials Science;
- Dipl.-Ing. Bernhard Leopold Peschek,
Refractory Materials;
- Dipl.-Ing. Arnold Pfusterschmid,
Industrial Environmental
Protection
- Dipl.-Ing. Christian Ernst Peter Redl,
Petroleum Engineering.

Em.Prof. Dipl.-Ing. Dr.techn. Rudolf POSSELT's Travelling Fund

The fund annually donates a prize of ATS 30,000 and supports young scientists working at the MU Leoben for an intended study trip abroad. The 1999 prize winners are:

- Dipl.-Ing. Heinz Mayrhofer,
Physical Metallurgy and Materials Testing
- Dipl.-Ing. Christian Motz,
Metal Physics.

Hans-Theisbacher-Prize

This prize of ATS 60,00 (total) is donated by the foundation of Mrs. Friedl Theisbacher and is awarded for excellent theses in the field of refractory materials. This year's winners are the graduates of the field of Refractory, Materials, Ceramics, Cement and Glass:

- Dipl.-Ing. Barbara Lessing;
- Dipl.-Ing. Stefan Fehleisen;
- Dipl.-Ing. Bernhard Leopold Peschek.

Environmental Research Prize of VA Steel, Inc.

This prize of ATS 120,000 (total), donated by VOEST Alpine Steel, Inc. is an award for diploma theses/doctoral theses which contribute to the advancement of environmental protection. In 1999 the winners are:

- Dipl.-Ing. Andreas Kirchner, Industrial
Environmental Protection, Disposal
Techniques and Recycling;
- Dipl.-Ing. Thomas Schneeberger ,
Environmental Protection, Disposal
Techniques and Recycling;
- Dipl.-Ing. Gerhard Schuster,
Environmental Protection, Disposal
Techniques and Recycling;
- Dipl.-Ing. Christa Zengerer, Materials
Sciences.

OMV Scholarship

With this scholarship of ATS 30,000 (total) the OMV, Inc. honors students with excellent performances in the fields of Applied Geosciences (Petroleum Geology); Drilling, Petroleum Production and Economics; Petroleum Engineering and Plastic Engineering. In 1999 these students are the winners:

Hochfellner Wolfgang,
 Petroleum Engineering;
 Mostegel Markus,
 Petroleum Engineering;
 Redl Christian,
 Petroleum Engineering.

Veitsch-Radex Scholarship

This scholarship of ATS 100,000 (total) was donated by VEITSCH-RADEX. It is a special honor for the achievements of students of the field of Mining Engineering, Ferrous Metallurgy, Refractory, Materials, Ceramics, Cement and Glass and Materials Science. This year's winners are:

Wolfgang Höfer,
 Metallurgy ;
 Gerhard Strobl,
 Materials Science.

RAG-Sponsorship

The RAG, Inc. donated this Prize of ATS 100,000 (total) for the financial support of Petroleum Engineering students with excellent credits for the required semester abroad. In 1999 the winners are:

Markus R. Sauer,
 Herbert Fischer,
 Ralf Strasser.

Roland-Mitsche-Prize

This prize, awarded every two years, is donated by the "Society of Friends of MU Leoben". It is awarded to students and members of MU Leoben and honors extraordinary achievements in the areas of arts and sports. In 1999 prizes of ATS 12,000 each are given to:

Prof. Dipl.-Ing. Karl-Heinrich Tinti;
 Student Markus Nitsche.

IN MEMORIAM

The MU Leoben mourns the loss of one professor and one contract assistant, who were snatched from this life unexpectedly. On Dec. 13, 1999 Prof. DDipl.-Ing. Dr. mont. Eduard Czubic (foto), head of the Department of Mine Surveying since 1983, died on an official visit to the People's Republic of China. With Prof. Czubic the MU Leoben not only loses a merited scientist but also a man who has totally identified himself with his Alma Mater Leobensis ever since his student years.

On Oct. 15, 1999 Dipl.-Ing. Dr. techn. Gizella Karáné, contract assistant at the Department of Mathematics, Division of Applied Geometry from 1995 to 1997 and again since 1998, passes away. The deceased will always be remembered by the MU Leoben.



Prof. Czubic

Party Time!

EVENTS



Visitors from CSM (partner university)(Foto Freisinger)

3 academic ceremonies, the festive matriculation ceremony, the "Ledersprung", the welcome party for freshmen and the university ball are annual highlights at the MU Leoben. The following events are organized by the Education and Sports Department:

- the concerts of the university orchestra (annually 5);
- the artistic contest;
- the foto contest.

The following events also took place in 1999:

January 27

Election of the rector for the term 1999-2003.

February 11

FIT (women in technical jobs):
About 100 female Styrian highschool graduates absolved an extensive informational program on the fields of studies at MU Leoben.

June 11

Ceremonial opening of the ICPMS-Laboratory at the Department of General and Analytical Chemistry.

June 14-15

Austrian Rector's Conference

September 20-21

Important visitors from the American partner university Colorado School of Mines: Dr. Theodore Bickart, President, Dr. John Trefny, Vice President for Academic Affairs and Frank Erisman, CSM Board of Trustees.

September 23

Opening of the Materials Center Leoben (MCL) and the Center of Applied Technology (ZAT) under the presence of the Federal Minister for Science and Transport, Dr. Caspar Einem, and the deputy head of the Styrian province, Dr. Peter Schachner-Blasizek

October 28-30

BeSt 99 (Vocational and educational exhibition) organized by order of the Federal Ministry for Education and Cultural Affairs as well as AMS (a service institution for the labour market).

November 26

Ceremonial inauguration of Rector Bergrat h.c. Dipl.-Ing. Dr. Wolfgang Pöhl.

December 3, 1999

Ceremonial signing of a co-operation agreement between the Centre de Géotechnique (CGES) of the Ecole Nationale Supérieure des Mines de Paris and the Department of Mining Engineering.



Opening of MCL



Inauguration of Rector Pöhl (Foto Freisinger)



Co-operation with CGES
(Foto Freisinger)

EVENTS FOR STUDENTS AT MU LOEBEN extracurricular activities

April 17

A team from Leoben was ranked fifth at the Shell management plan competition "OILSIM". Among 47 participating student teams from all of Europe, the four Leoben students Thomas Mende, Laszlo Szeremly, Gottfried Steiner, Johann Zimmermann and the young academic employee Dipl.-Ing. Barbara-Annette Zahnt are the best Austrian team.

May 14

Rank three for the MU Leoben student team at the Austrian Academic Competition gained by Martin Pleil, Roman Pöltner and Thomas Fischer, in the three men jolly-boat-sailing competition.

October 5

In the USA Patrick Pattay receives an award of the Society of Petroleum Engineers (SPE) for rank one at the Paper Contest/Bachelor Division of the European SPE Conference 1999.

November/December

First place for MU Leoben students at the Styrian Academic Competition: Thomas Hiesch (uphill race), Kurt Huemer (Judo) Klaus Lamprecht (fencing).

Barbara costume

At the MU Leoben teachers and students like to demonstrate the high degree of identification with their Alma Mater and her history by donning the "Bergkittel", the traditional ceremonial outfit of miners. They do this on the occasion of certain events such as the matriculation ceremony, academic ceremonies, diploma examinations and festive balls. Thanks to the initiative of the Student union division for women's issues at MU Leoben the female professors and students finally have the choice between the traditional "male" Bergkittel

and a specifically female version, which was named "Barbarakleid" in honor of the mining patron.



Foto Freisinger

EVENTS

The "Barbarakleid", the very female alternative to the "Bergkittel"

(Foto Freisinger)

Oil business is just perfect for MU engineers: rank 5 at "Shell-Oilsim": Thomas Mende, Laszlo Szeremly, Gottfried Steiner, Johann Zimmermann, Dipl.-Ing. Barbara-Annette Zahnt





History

The history of MU Leoben is marked by a continuous development of the academic range of studies.

APPENDIX

Due to an initiative of Archduke Johann the "Styrian Corporate School of Mining" was established in Vordernberg on November 4, 1840. The inaugural address of Peter Tunner demonstrates the intention of keeping the instruction on an academic level and of developing his school to a center for all experts in mining and metallurgy from the alpine region.

The revolutionary year 1948 put an end to extremely successful years in Vordernberg and led to a significant change. Peter Tunner initiated the nationalization of his school and the transfer to the near town of Leoben. On November 1, 1849 the "Imperial and Royal School of Mining" could be inaugurated in Leoben with 48 students initially enrolled.

On December 15, 1874 the "Imperial and Royal School of Mining" received a new statute which guaranteed a sound and steady development. The status of the teachers was ranked equal to the status of professors at Technical Universities.

An imperial decree of July 31, 1904 changed the name of the mining academy to "University of Mining". Equal status to technical universities was finally gained when the academy was entitled to bestow doctoral degrees. In fall 1910 the university could move into new quarters which were extremely spacious for those days. Due to the rapid development of mining engineering the fields of studies Mining Engineering and Metallurgy were separated in the interval between World War I and II and a new study program was deve-

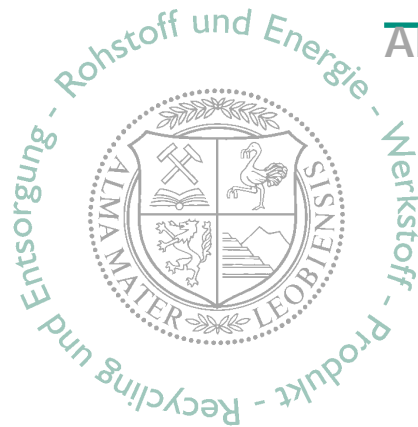
veloped. In 1934 the administration of the University of Mining and of the Technical University of Graz was united and the two preparatory years of studies were transferred to Graz. This meant a serious decrease of enrolment which was followed by severe lack of a young generation of academics for the Austrian mining industry. The reinstallation of the independent University of Mining by the federal law of April 3, 1937 is due to the joint efforts of industry, professors and all residents of Leoben.

An era of steady development was interrupted again by the annexation of Austria to the Third Reich in 1938. World War II brought serious interferences in studying. These problems could be mastered by a decisive rector after 1945 and an urgently necessary extension for laboratories was built. The rapid stabilization after the war can also be seen in the increasing enrolment. After 1955 new fields of studies were added continuously, which in addition to the core subjects encompass a broad range of subject areas from raw materials to materials. In 1970/71 the fields of studies Plastic Engineering and Materials Science were added. In 1990 the planning of two new fields of studies, Applied Geosciences and Industrial Environmental Protection was begun, they were installed in 1992. The construction of a new building, opened in 1970, also demonstrates the extension. Since October 1, 1975 the university is called "Montanuniversität Leoben" according to the University Organization Act.

Fields of Studies

The ten degree programs at MUL Leoben are a closed cycle of natural resources and the materials and products made thereof from mining to recycling and disposal.

Requirements	Mining Engineering Mining Processing and refining Geomechanics and tunneling
Requirements	Mine Surveying Geoinformatics and datamanagement Mine damages and environmental techniques
Electives	Petroleum Engineering International Study Program Simulation Technologies Business management
Electives	Metallurgy Ferrous metallurgy Non-ferrous metallurgy Metal forming Casting and component design Industrial economy, energy and environment technology
	Refractory, Materials, Ceramics, Cement and Glass
Modules	Mechanical Engineering Automation of plant machinery and systems Endurance strength and construction Plant machines
Electives	Plastic Engineering Polymeric materials development and characterization Production technology & component design
Requirements	Polymeric Materials and sustainable development Quality guarantee and management Operation & production management



APPENDIX

Electives	Materials Science Metallic Materials Metal physics and general material physics Ceramic Materials Materials of electronics
Requirements	Biomaterials Modelling and simulation Polymeric materials Project and quality management
Electives	Applied Geosciences Applied geophysics Petroleum geology Raw material geology Environmental geology and hydrogeology
Requirements	Industrial Environmental Protection, Disposal Techniques & Recycling Process engineering Waste disposal and waste management
Electives	Recycling technology Industrial engineering/design Environmental management/safety Contamination Automation Applied business management Plant construction Alternative energy Noise and radiation protection

Departments

E-mail-addresses and heads of departments

APPENDIX

General and Analytical Chemistry

allgchem@unileoben.ac.at
O.Univ.-Prof. Dr. WEGSCHEIDER

Mechanical Engineering

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Univ.-Prof. Dr. EICHLSEDER

Mineral Processing

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O.Univ.-Prof. Dr. STEINER

Automation

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O.Univ.-Prof. Dr. O'LEARY

Mining Engineering

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O.Univ.-Prof. Dr. WAGNER

Chemistry of Polymeric Materials

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O.Univ.-Prof. Dr. LEDERER

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