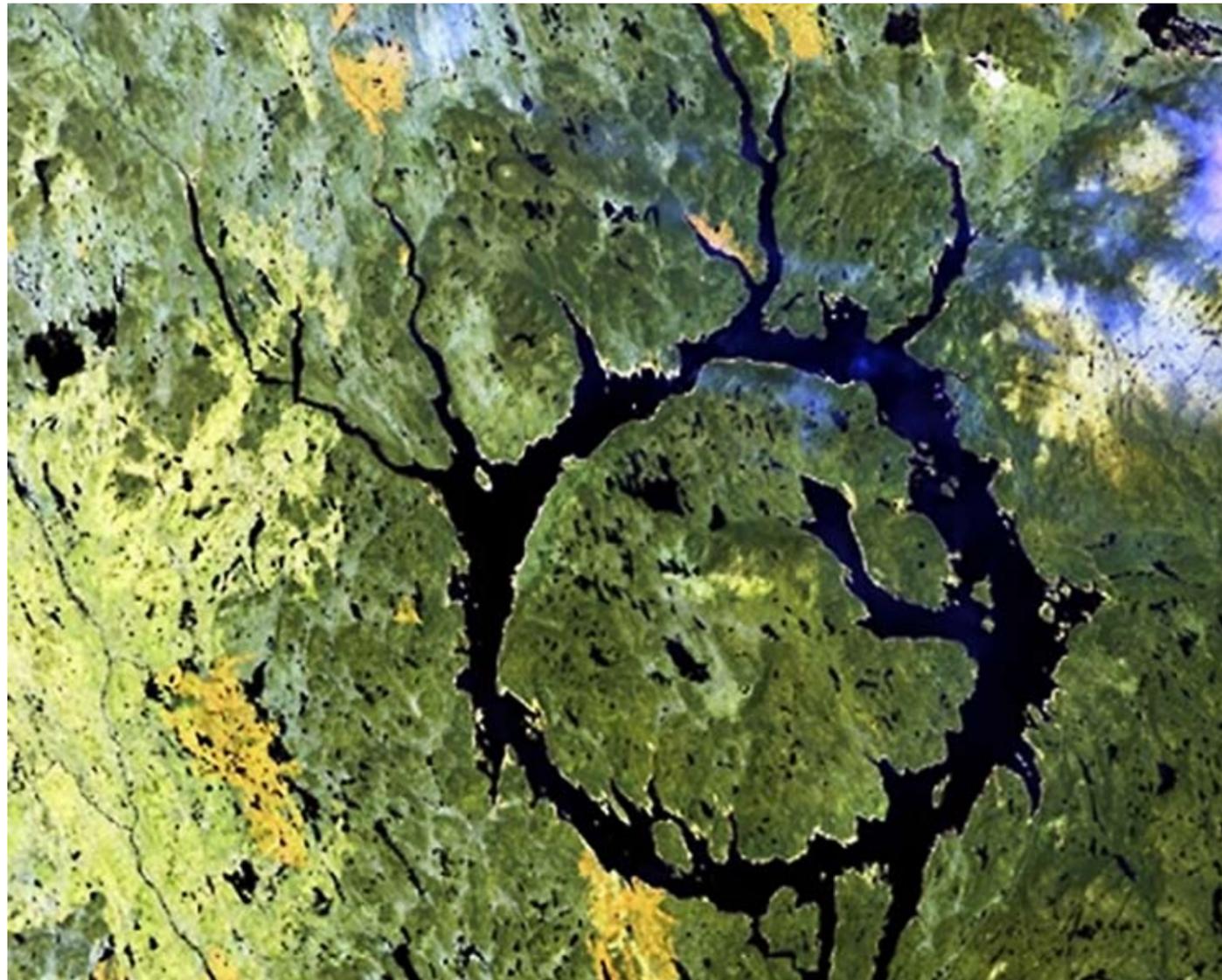


1/2011



Cover: Landsat 7 / Ronald W. Hayes, USGS
In the satellite image: the imposing Manicouagan crater in Canada with a diameter of approximately 100 kilometres. This as well as other craters still puzzle geologists and chemists.

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Matthias Kleiner

The Horror That Puts Everything in Perspective

Between humility and helpfulness: The disaster in Japan is also a turning point for the scientific community. What tasks it must tackle now, how it can help in big and small ways – and what both have to do with integrity and excellence

We still have the dramatic media images before our eyes: workers in Fukushima struggling to prevent a nuclear meltdown; recovered bodies in Sendai in the aftermath of the tsunami; people in Tokyo, Natori and elsewhere trying to get back to their lives as much as possible. And the whole world still looks to Japan in shock and trepidation.

None of this was on anyone's mind on 10 March, when we discussed within the DFG Executive Committee who should win the next Eugen and Ilse Seibold Prize, an award given to Japanese and German researchers for outstanding contributions to promoting a better understanding of the other country. That afternoon, we were delighted by the large number of prizeworthy nominations. And like the jury, we felt confident to have selected two extraordinary winners in chemists Kazuyuki Tatsumi and Gerhard Erker – all the more because they jointly lead the first German-Japanese Research Training Group in Nagoya and Münster, where they combine their own excellent research with the training of young scientists. Less than 18 hours later, the earth shook.

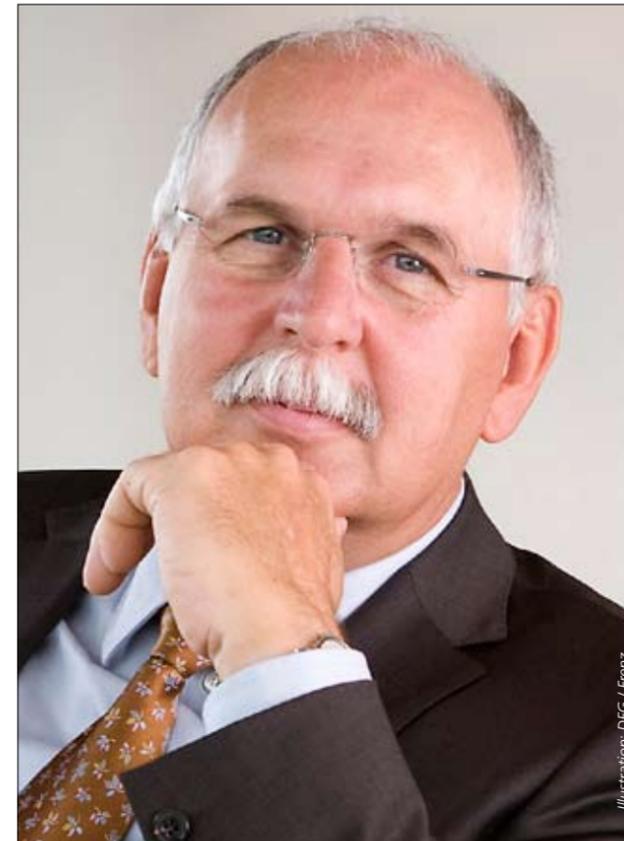
The disaster in Japan is also a turning point for the scientific community – and an appropriate moment to pause. The quake and the flood have reminded us of a truth that is often doubted but continues to assert itself: At the end of the day, humankind and its technologies are no match for nature and its forces. And the exploding reactor block raises questions about science's responsibility and limitations once more and

with special poignancy. As an engineering scientist, I was reminded by the pictures from Fukushima once again of concepts such as humility, doubt, prudence and modesty.

But asking about limitations also raises questions about the capabilities of science and what it can do to help. What can and should we do now, after the disaster?

Paradoxical though it may sound, science and research had already done much to mitigate the effects of the disaster before it even happened. Without the insights from geology and physics, from statics and the materials sciences, that went into the construction of tall buildings and technical facilities, the destruction would probably have been even more devastating. And now, scientific data centres in Germany and elsewhere help out by sending to Japan satellite images of cities, buildings and streets, taken before and after 11 March, as an important tool for rescue workers on the ground and for reconstruction efforts in the destroyed regions.

The most important tasks for the scientific community, however, arise from the lessons the disaster has taught us – as hard as it is to say so. The warning systems, for instance, that were buried by the tsunami in spite of safeguards, must be made even more robust. And because even Fukushima will not immediately end the nuclear age, reactor safety must be improved further. Finally, if we want to prioritise the production and use of renewable energies, it is especially the scientific community that will be called on.



Big ways of helping can be complemented by small ways of helping. The DFG Executive Committee would like to enable German-Japanese cooperation projects to offer emergency assistance to Japanese partners. For example, measurements or experiments currently not feasible in Japan could be done in Germany instead.

Above all, there is a deep sense of sadness and sympathy. We commemorate the victims of the disaster. We fear and hope with our colleagues and friends, and with all those who must now struggle with the consequences. We wish, from the bottom of our heart, that their plight will soon improve. And we will do anything we can to help, wherever our help is wanted.

It may appear highly inappropriate to segue from the disaster in Japan and scientific aid to plagiarism, honest scholarship and the first results in the second phase of the Excellence Initiative. After all, 11 March 2011 is a horror that puts everything in perspective. And if it was baffling even prior to that for an entire nation to

find nothing more important to discuss than a federal minister's doctoral thesis, this affair has now definitely been cut down to size.

And yet all these topics can be seen in connection. After all, it is the best science that can provide the most effective help. And only a research community that values integrity above all else will be taken seriously and accepted as helper. Allow me therefore to make a few comments on the two events that were on our minds during the weeks prior to the disaster.

One of these events turned the world upside down by incriminating and indicting the research community even though it was the actual victim. We must counter such degradation – which was careless at best, coldly calculated at worst – with our most elementary principles of honesty, truthfulness and trust, as well as the rules of good scientific practice, and we must shed light on the facts. And this is exactly what the research community has been doing vis-à-vis society and its political representatives.

Even the affair itself has taught us a lesson. If the benefits of doctoral qualification within regulated and well-structured settings are becoming more obvious now, then this will be a fortunate consequence of an unfortunate occurrence. This is the very type of doctorate that has been gaining traction, with increasingly good results, in DFG-funded projects, Collaborative Research Centres and Research Training Groups, as well as in the Excellence Initiative's Graduate Schools and Clusters of Excellence.

As part of this Excellence Initiative, the Joint Commission of the DFG and the German Council of Science and Humanities selected, just days before the disaster in Japan, the new projects that will now be allowed to compete with the institutions already being funded under the Excellence Initiative. That it would be an exciting and tough contest, strengthening science and research and even our country as a whole, is something we expected even before the picks were made – and we were right. Put in the right perspective, it is a bright spot, even in these days of trouble, that gives us hope for the future.

Matthias Kleiner

Prof. Dr.-Ing. Matthias Kleiner
is President of the DFG.

Uwe Schütz and Christian Billich

To the Limits

Two marathon runs every day for 64 days: the TransEuropeFootRace pushed not only the participants to their limits, but also the radiologists accompanying the athletes who used the latest techniques to study how the runners' bodies responded to the ultra-stressful conditions



It was a matter of superlatives: the TransEuropeFootRace 2009 started in Southern Italy and went all the way to the North Cape – a distance of more than 4,500 kilometres. This ultra-marathon, held from 19 April to 21 June, is the most extreme multistage competition in the world. This means that even very experienced and fully fit ultra-runners must go beyond their endurance limit and pain threshold every day to finish each run and hold their own in the competition.

This extreme footrace aroused the curiosity and medical interest of two radiologists from the University Hospital of Ulm. Their idea was to study changes in the human musculoskeletal system, the cardiovascular system and the central nervous system as a result of ultra-marathon stress using the modern measuring technique of magnetic resonance imaging (MRI). This idea was developed into the first longitudinal study of extreme stress under defined conditions – two marathon distances every day for 64 days without a break. Particular focal points were changes and adaptation responses of the organ systems without sufficient regeneration time.

The team's most important tool was a 1.5 tesla MRI scanner mounted on a mobile unit, the only one of its kind in Europe. It was transported by a semi-trailer weighing a total of 27.5 tonnes. The semi-trailer had an internal diesel generator to power the helium cooling circuit for the MRI over the ten-week period. However, it did not generate enough electricity for continuous MRI measurements and was therefore supplemented by a more powerful external diesel generator (140 kVA) that had to be transported on



4,500 kilometres right across Europe: the TransEuropeFootRace from Bari to the North Cape. Radiologists from the University of Ulm accompanied the runners and carried out research. Below: the project logo.

a separate trailer. The semi-trailer and the specially hired high-performance truck tractor weighed a total of 37 tonnes.

The adventure could begin. This included solving not only the complicated issues of insuring the vehicles and large equipment, but also a number of applications for permits required for the trans-European route: EU driving licences, driver and company tachograph cards, certificates of exemption for HGV transports on Sundays and public holidays, exemption from HGV tolls in the various countries (Austria, Germany, Italy) and customs papers to export the MRI out of the EU (Sweden to Norway) and to reimport it into the EU (Norway to Finland).

After consultations with the organisers of the TransEurope-FootRace, the study could commence. Forty-four ultra-runners (66 %) volunteered as test subjects. During the 64 daily stages, which brought the study team as well as the runners to their physical and mental limits of endurance, highly complex data were collected according to the specifications of the study protocol. By the end, the team had travelled more than 11,000 kilometres, used more than 25,000 litres of diesel, crossed 14 international borders and three Alpine passes as well as the Baltic Sea twice. And huge amounts of data had been collected.

The study protocol had to be expanded in view of the numerous experts from the fields of experimental radiology, sports medicine and orthopaedics, cardiology, neurology and psychiatry who were interested in this unusual group of test subjects, the study design and the collected data. The test subjects were randomly assigned to modular- and topic-related MRI protocols that had been specially created in an interdisciplinary content. The study team also used newly developed MR techniques.

Each test subject was scanned in the MRI every 3–4 days, which meant 15–17 MR examinations over a period of 68 days. The subjects were also randomly assigned to other examinations, and protocols were created for daily urine and blood sampling as well as biometric and longitudinal clinical studies.

Directly after the end of the race, international research teams started the scientific evaluation and interpretation of the data that should help to answer a number of questions. A primary focus is the musculoskeletal system. Here, questions focussed on stress- and overstress-induced changes in the lower extremities due to running.

All tissue systems – subcutaneous tissue, muscles, ligaments, fascia, tendons, bones and cartilage – were studied with special quantitative and qualitative MR techniques. This should help explain how the different tissues react to the severe stress that continued for days and weeks without any pauses for regeneration or even resting phases because two marathon distances had to be completed every day. How does the water content and collagen matrix in the carti-



Running as far as their feet can carry them: ultra-marathoners have to face their pain threshold every day. Below: Even the running shoes have their own stories to tell ...



lage of the knee and ankle behave in such a situation? Or what sort of degeneration or modification or even damage occurs here?

Special cartilage degeneration markers in the blood were analysed and compared to the recorded MR data. It is surprising, particularly for those outside the running community, that in spite of the daily runs, the leg muscles of the athletes degenerated owing to the immense energy consumption. Little is known about this phenomenon at the cellular level. These catabolism

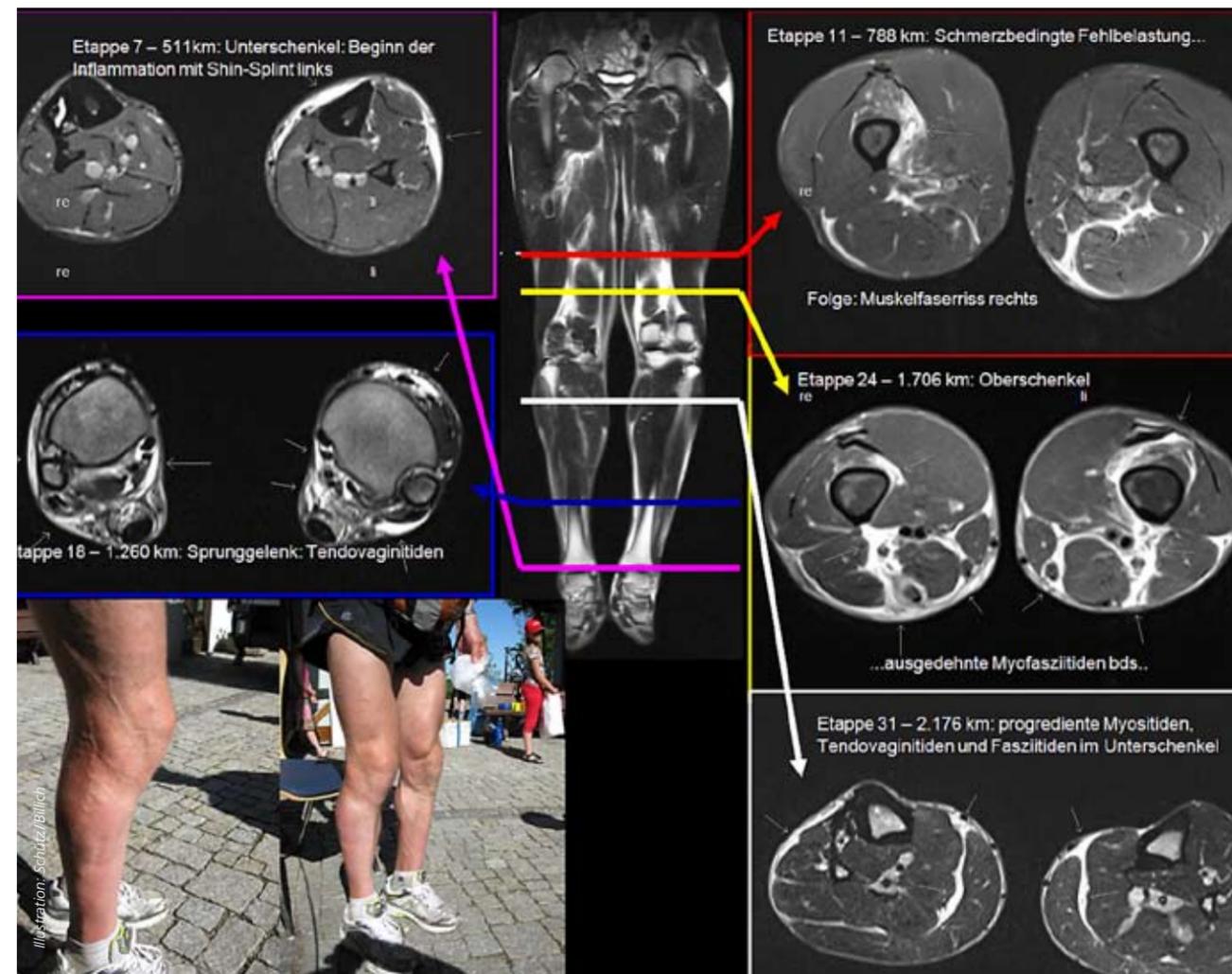
and associated changes in musculature were analysed with new MRI techniques.

In the field of neuroradiology, so-called ice-water and electrostimulation pain tests in combination with functional MRI should provide new insights. One key question is whether such long-term running stress causes changes in brain plasticity and whether processing of pain in athletes can be clarified in more detail. For example, how do finishers and non-finishers differ mentally with respect to their

motivation and pain processing? Is there a volume increase in certain regions of the brain that are responsible for controlling the legs? Or had some of the runners developed brain oedema due to electrolyte shifts?

Of great interest is a longitudinal analysis with respect to tissue changes in the entire body. The runners inevitably lost weight over the weeks in spite of consuming enormous amounts of calories. When and where does catabolism

MRT images recorded after the individual stages of the race provide fine details of how the extremities adapt and change.



A runner before an examination in the magnetic resonance imaging scanner. Each test subject was examined in the MRI 15–17 times during the ultra-marathon.

(break down of substances) occur in body tissues? These questions are being addressed by means of special whole-body MRI techniques in collaboration with MRI researchers at the Department of Experimental Radiology at the University Hospital of Tübingen.

There are very complex questions on stress-related progressive changes in the body and tissue texture. The data are currently being analysed in detail with respect to the distribution of fat, water and muscles in collaboration with PD Dr. Beat Knechtle (BIA, biometry), an ultra-athlete and expert in sports medicine. Furthermore, the blood and urine analyses are being studied in collaboration with the Department of Sports Medicine at the University of Basel (Prof. Dr. Arno Schmidt-Trucksäss). Cooperation with other research groups

is unavoidable in view of the huge data pool and the very different study topics.

This is also apparent in the field of cardiovascular studies. Even fully fit endurance athletes are expected to show adaptive changes that can be documented by MRI. Modern cardiovascular examination methods can be used to detect and evaluate the progress of organic adaptation processes.

But many questions remain unanswered. For example, does running stress cause clockwise rotation of the heart axis? Or, in spite of being very fit, do the test subjects show an increase in heart muscle mass or cardiac volume, and if so, to what extent? Or, although unexpected but similar to the skeletal musculature, is there a reduction in heart muscle mass due to the generally unavoidable catabolism?

These issues were addressed by recording electrocardiograms at regular intervals and by studying the occurrence of “functional disturbances” over the 64-day period. A comparison of the diagnostic laboratory (stress) parameters and the measured ECGs with the cardio-MRI data promises to shed light on these questions.

In summary: the enormous data pool collected during the Trans-EuropeFootRace and the many study topics call for an evaluation as an interdisciplinary cooperative effort. The legendary staying power of long-distance runners is needed in this case as well. The profile and consequences of ultra-distance running stress at the organic, suborganic and cellular levels have been documented. They will provide detailed information on changes and adaptations of the various organ systems.



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www.transeuropalauf.de
www.transeurope-footrace.org

Mario Trieloff

Tracing the Tracks of Cosmic Rain

A collision of two large asteroids between Mars and Jupiter occurred 470 million years ago. Even today, every third meteorite that strikes Earth can be traced back to this prehistoric crash. From fallen fragments, geoscientists gain new insights into the history of the solar system



Illustration: picture-alliance/dpa / Fousat

Since its formation, Earth has collided with extraterrestrial bodies. In the beginning of our solar system, impacts of large minor planets were actually part of the “natural” growth process of the terrestrial planets. Even today, Earth is hit by relatively large bodies measuring from several hundred metres to several kilometres in intervals of a few million years. What’s special: Unlike small meteorites, such large objects undergo very little deceleration in the Earth’s atmosphere. They typically strike Earth at speeds of between 10 and 70 kilometres per second, vaporising completely on impact. All that remains is an impact crater.

Smaller bodies hit the Earth with much greater frequency: millimetre-sized grains of dust burn up and vaporise in the atmosphere as shooting stars. More seldom are meteoroids, which measure between a few centimetres and metres. They survive the trip through the atmosphere, as well as the impact with the ground – and remain as meteorites.

The majority of the known meteorites originate from the asteroids between Mars and Jupiter. These minor planets form the “asteroid belt”, where collisions occur frequently. In such crashes, the asteroids – once having measured hundreds of kilometres across – are shattered into smaller fragments. Influenced by the neighbouring giant planets, Jupiter and Saturn, the asteroids move into elliptical orbits, putting them on track to intersect the orbit of Mars or Earth.

The meteor crater in the U.S. state of Arizona is one of the best preserved in the world and measures 1,380 metres in diameter.

The impact craters visible on the surfaces of Earth’s Moon, Mars and Mercury provide information on the number and frequency of past impacts of extraterrestrial bodies. Crater counting and dating techniques have revealed that the number of extraterrestrial impacts has remained approximately constant over the past 3.5 billion years. The meteorites found on Earth are of no use for such an estimate because nearly all of them fell over the past two million years. Older specimens have not generally survived our planet’s intense weathering processes.

Scientists unexpectedly discovered the remnants of prehistoric, fossilised meteorites in a Swedish quarry.

In a Swedish quarry, researchers unexpectedly discovered the remnants of prehistoric, fossilised meteorites.

But there are occasional exceptions: Approximately 15 years ago, the working group of Birger Schmitz at Lund University discovered numerous remnants of prehistoric, fossilised meteorites in a Swedish quarry embedded in limestone from the Middle Ordovician geological era. Based on this, they would be approximately half a billion years old. No other known extraterrestrial object that landed on Earth that long ago still exists today. The number of findings corresponds to a “fall rate” approximately one hundred times greater than current rates.

The extensive weathering made a mineralogical-chemical assignment of the fossilised meteorites to the known classes of meteorites difficult. Schmitz and his staff suspected that

they were so-called “L chondrites”. These take their name from originally small rock pellets (Greek chondros, corn) and have a low (L=Low) iron content. They account for 38 percent of all meteorites found in the world and originate from a single, once large, parent asteroid.

The dating of L chondrites with the potassium-argon method often yields a “degassing age” of approximately half a billion years. This age corresponds to the time at which the rock that makes up the meteorite was melted for the last time, or was at least heated to the point

that the argon – an inert noble gas – contained in the rock could escape. After cooling, the radioactive decay of potassium-40 (potassium atomic nuclei with atomic mass 40) resulted in the formation of argon-40. From the quantity of argon-40 and its parent nuclide potassium-40, the law of radioactive decay can be used to calculate the time that has passed since the last complete degassing. It is this time span that defines the degassing age.

As relatively small bodies, asteroids have only undergone geologic activity of their own immediately following their formation 4.5 billion years ago, which was brought about by strong internal heat generation. The only process that could cause a subsequent strong increase in the temperature of the rock, and thereby degas and thus reset the potassium-argon clock to zero, was heating through energetic collisions.

In other words: the potassium-argon dating method indicates the time of collision of the meteorite parent body: the asteroid.

During such cosmic collisions, shockwaves with a peak pressure of several hundred kilobars occur. Under these conditions, minerals and rock are transformed; specialists speak of “impact metamorphism”. This is very pronounced in L chondrites and indicative of a major energetic collision. Nevertheless, in almost no L chondrites the noble gas argon-40 that was present prior to this event escaped completely. There are still remnants from the time prior to the impact in the form of so-called “relict” argon-40. This “excess” argon poses the greatest problem and is the greatest source of errors in dating the time of the major collision of L chondrites.

In the autumn of 2004, Ekaterina Korochantseva, a visiting researcher from Moscow, brought pieces of a meteorite from the desert in Oman to Heidelberg, within the scope of the then already started DFG project. It was determined that this L chondrite also contained relict or “excess” argon-40 – though in an unexpectedly high concentration. More precise analyses showed that the relict argon-40 did not – as previously assumed – simply remain in the original material during the heating that occurred as the result of a collision.

It did indeed escape, but was then recaptured by other minerals in the rock fabric. This small, but subtle difference resulted in a decisive gain in knowledge: during its brief period of freedom, the excess argon-40 was able to mix with other argon atomic nuclei with different

atomic masses present in the meteorite. This excess argon-40 can be detected through so-called “isotopic marking”. This enabled the project team to, for the first time, perform a precise correction and re-determine the exact degassing age.

After using this method to date several L chondrites, the age values for the impact metamorphosis could be narrowed down much more precisely to 470 (plus/minus six) million years. Previously, the degassing age of the L chondrites was believed to be approximately 500 (plus/minus 40) million years. The age of the sedimentary rocks in which the fossil meteorites were embedded could also be more precisely placed on the geologic time scale. Based on this new knowledge, the deposition occurred 467 (plus/minus two) million years ago.

A remarkable finding: Researchers present the remnants of a 470-million-year-old fossilised L chondrite in a sawed limestone slab.



Distinctive fragment of the Ghubara meteorite, found in the desert of Oman. The dark rock contains iron inclusions.

The agreement of these two values allows the events that occurred at that time to be reconstructed in detail: 470 million years ago, one of the largest known collisions in the asteroid belt shattered a large, minor planet that measured several hundred kilometres across. As this occurred, the rocks from both asteroids were penetrated by enormous shock waves that lasted seconds. The minerals formed by the high-pressure metamorphosis and their chemical composition allow statements to be made on peak pressures, temperatures and cooling rates.

The conclusion: during the collision, the peak pressure must have been sustained for approximately one second. This is an indicator that the impact body was several kilometres in size; the parent asteroid that was hit, on the other hand, measured several hundred kilometres. Metre-size fragments subsequently entered orbits around the sun that intersect that of Earth. As a result, for a period of one to two million years, approximately one hundred times as many meteorites fell on Earth as do today.

Following the collision twenty million years ago, an above-average number of hundred-metre to kilometre size fragments also reached Earth. This is illustrated even today by eight impact craters, which are between 450 and 470 million years old with diameters from two to thirty kilometres: The craters are named Neugrund (Estonia), Granby (Sweden), Ames (Oklahoma, USA), Kärdla (Estonia), Tvären (Sweden), Lockne (Sweden), Slate Islands (On-



tario, Canada) and Calvin (Michigan, USA). Statistically, only two impact craters with such dimensions should have formed during this period.

The energy released by such large impacts was considerable and most likely had global consequences. For example, a 30-kilometre-diameter crater, such as the Slate Islands in Canada, was formed by an impact explosion that released an amount of energy equivalent to ten million Hiroshima bombs. Put in illustrative terms: an object the size of the Feldberg Mountain of the Black Forest impacted the Earth at a speed of approximately 50,000 kilometres per hour.

Following the impact, large fragments continued to cross our solar system. One notably large fragment smashed into Earth 35 million years ago, leaving behind the imposing, 100-kilometre-diameter Popigai crater (Siberia). From time to time over the past millions of years, metre-size bodies have been broken off of other asteroid fragments as the result of

smaller impacts and have fallen to Earth as modern L chondrites. They make up over a third of all meteorites. Thus, we continue to feel the effects of the cosmic collisions that occurred 470 million years ago – an event that, without a doubt, had significant consequences for our solar system.



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Antje Boetius

Tiny Helpers Fight the Spill

The well in the Gulf of Mexico has been sealed, but the consequences of the ecological catastrophe remain unknown. Contributing to the degradation of the massive contamination are microorganisms that literally devour the oil in the water and on the ocean floor. Marine researchers have been investigating the hungry bacteria for many years



Oil catastrophe in the Gulf of Mexico: on 20 April 2010, a gas explosion caused the offshore drilling platform “Deepwater Horizon” to sink. The accident resulted in one of the greatest environmental disasters in the history of mankind. On 16 July 2010, when the leak at the borehole was sealed by capping it, tens of thousands of tons of crude oil and natural gas had leaked every day – with unforeseeable consequences for the ecosystem.

During the course of this event, perceived by the public as a catastrophic environmental destruction, an increased demand developed for knowledge about the possibilities and limits of bacterial degradation of oil in the sea. Burning questions are: Where did the oil end up? How long will it take before the sea and beaches are cleaned? How can the bacterial degradation of the oil be accelerated? What actually happens to the oil in the deep sea? Can nature alone overcome the oil spill?

A sticky situation: naturally leaking asphalt on the sea floor.



Oil escapes constantly from natural sources but does not accumulate in the seas and on beaches. This can be attributed to the activity of microorganisms. There are two different microbial degradation pathways: aerobic (with oxygen) and anaerobic (without oxygen). Aerobic degradation is particularly important for natural remediation. Here, with the help of microbial enzymes, oxygen is first integrated in the inert hydrocarbons and the resulting fatty acids are consumed as sources of energy. When no more oxygen is available, anaerobic, very slowly growing bacteria, take over, forming poisonous hydrogen sulphide from the sulphate in the sea water.

There are at least 1,000 natural oil springs in the Gulf of Mexico. Together, they release up to 200 tons of oil into the environment per day. In comparison, approximately 10,000 tons of oil and natural gas were released from the borehole of

the sunken “Deepwater Horizon” platform every day. In accidents of this magnitude, the contamination is so large that methods such as burning off, collecting, vacuuming up or dispersing the oil with the aid of chemicals are necessary in order to limit the damage to the environment.

Oil escaping from the deep sea usually has very high gas content. Thus, in addition to the 700,000 tons of oil that leaked into the Gulf of Mexico, an estimated 250,000 tons of natural gas escaped as well. Normally, a gas-oil mixture rises to the water surface in just a few days due to its lower density in comparison to water. But the smaller the oil drops are that form, the longer it takes for them to rise. At the “Deepwater Horizon” accident site, most of the oil-gas mixture was – similar to a salad oil dispenser – discharged under high pressure through a small pipe producing very fine droplets of less than a millimetre in diameter. Having very little buoyancy, they drifted laterally through the water column. Measurements, such as those the marine chemist Richard Camilli and his team performed in May and June, found a clear signal of such oil dispersal at water depths of 1,000–1,300 metres and at distances of up to 35 kilometres from the spill site.

Data released in August 2010 on the whereabouts of the oil by the government agency NOAA (National Oceanographic and Atmospheric Administration) show that only eight percent of all of the oil were removed at the surface by burning or collecting it by ships. Up to 17 percent of the oil could be captured directly above the bore-



Power pack in action (top): The deep-sea robot “Quest 4000” of the Bremen cluster of excellence MARUM. Bottom: Using a manipulator arm, the robot collects numerous asphalt samples from the bottom of the Gulf of Mexico, which are examined later in laboratories.



hole by tankers hosing the oil from the leak. As a result, about 75 percent of the leaked oil remained in the sea or washed up on shore.

The light volatile components of oil reaching the ocean surface (25 percent) vaporised into the atmosphere. The large quantities of added chemical dispersants were able to spread another portion of the oil below surface. The bacterial degradation rates of the petroleum residues on the water surface and at depth are, however, unknown. In any case, the oil has not disappeared: in September 2010, the team working with geomicrobiologist Samantha Joye found massive deposits of oil on the sea floor at water depths of 100–1,500 metres, by now many more reports are available from oil drifting at depth or being deposited, including on deep water coral reefs.

In the immediate vicinity of naturally occurring natural gas vents, an average of up to 0.1–0.5 percent of the gas discharged into the water column is degraded biologically. Our rate measurements at natural oil seeps in the Gulf of Mexico reveal rates of a similar magnitude for the easily decomposable hydrocarbons, which are discharged in the form of oil drops. Tar balls on the sea floor are much more difficult to decompose: it takes hundreds of years for them to be broken down by microorganisms as there is very little oxygen in the compact accumulations of oil. Likewise, scientists from the Centre for Environmental Research in Leipzig working with environmental microbiologist Hauke Harms discovered that oil buried in Alaska’s beaches as a result of the 1989 “Exxon Valdez” accident still leaks poisonous residues to the environment.



From left to right: Degasification of fresh asphalt samples from a water depth of 3,000 metres. – A pressure vessel with which the asphalt

How can that be explained? Oil-degrading bacteria are present in all of the world's oceans. If large quantities of oil are present, mass reproduction of these special bacteria takes place. In the event of tanker accidents and drilling leaks, the reproduction and degradation capacity is, nevertheless, too slow to prevent widespread contamination. Thus, the idea of making oil layers and oil slicks disappear by spraying them with particularly efficient or even genetically modified bacteria colonies is wishful thinking. Actually, there is no lack of oil-degrading microorganisms in the sea. Depending on the environmental conditions at the site affected by the oil as well as the type of oil, diverse microbial communities propagate. There must only be sufficient nutrients present, such as nitrogen, phosphate and iron; the oil must not be too compact and oxygen must not be limited. In warm bodies of water, degradation is generally faster than in cold bodies.

Furthermore, bacteria that consume oil act together in concert to share the work. Microbial teamwork is always an advantageous principle in natural recycling of organic matter. Otherwise, all-round super bacteria would have formed in nature. The survivability of laboratory strains in nature is questionable. To date, less than 0.1 percent of marine bacteria are cultivated, because they require conditions for growth that are difficult to reproduce in the laboratory. As a result, cultivated strains released in the environment are certainly at a disadvantage in comparison with natural populations.

Bacteria require water as their natural environment. The finer the drops and the larger their surface, the faster the oil-degrading bacteria can grow. For this reason, chemical dispersants are often used following oil spills to assist with this process. The effect on the overall ecosystem is still un-

known for most dispersants. For animal life, the dispersants are at least as poisonous as the oil itself, particularly to larvae and eggs. As described above, during the "Deep-water Horizon" accident, mechanical dispersal of the oil into fine droplets could be observed at the discharge point. Thus, it is questionable whether the 2,400 tons of dispersant that were fed into the deep sea were actually necessary. A fundamental examination of the effects of dispersants under natural conditions is an important prerequisite for optimising their use in future accidents. For this purpose, a better understanding of life and its functioning in the deep-sea ecosystem is also necessary.

The deep sea and the sea surface are not separate systems. It is, therefore, important that the whereabouts of the remaining oil in the deep sea be investigated. There are many types of marine animals that wander up and down hundreds of metres every day during

and oil can be analysed under deep-sea conditions. – Residents of the deep sea: giant clams from the asphalt fields in the Gulf of Mexico.

their search for food that could be harmed by the oil in the deep sea. The sinking petroleum residues and tar balls change their habitat. The natural communities of the deep sea are adapted to low-nutrient conditions. They consist primarily of animals that dig in the sludge for food or which filter nutrients from the bottom water. Such a community changes immediately upon contact with oil. Hence, it is likely that the naturally occurring communities will disappear almost completely as a result to pollution.

At the end of 2003, a large, natural asphalt field was discovered in the deep sea of the Gulf of Mexico. In 2006, the team working with marine geologist Gerhard Bohrmann (University of Bremen) was able to sample the oil discharge with the new, deep-sea robot QUEST (MARUM) on board the research vessel "Meteor". When viscous petroleum residues are distributed on the sea floor, they

are exposed to the cold, oxygen-rich, deep-sea water. The ocean currents remove gases and light volatile oil components from the tarry substrate. It becomes cracked and is colonised by bacteria. The surface biofilm of oil-degrading microorganisms consumes oxygen. In the underlying zones, methane-producing and anaerobic, sulphate-reducing bacteria and methane-degrading microorganisms grow. They produce hydrogen sulphide. This, in turn, attracts large sulphur bacteria, which form a thick lawn. This bacterial lawn is then grazed by opportunistic marine animals. If, after a number of years, the tarry substrate has been detoxified, corals, symbiotic clams and tube worms may settle on the degraded asphalt. However, the natural deep-sea communities adapted to life in the fine mud cannot return to their habitat.

At the present time, there are still many unanswered questions regarding the accident and its con-

sequences. One can only hope that society, politics and science will learn a great deal from this catastrophe.



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Microbiological background information (author: Prof. Friedrich Widdel) and additional links:

www.mpi-bremen.de/Abbau_von_Erdl_durch_Bakterien_-_Grundlegende_Gesichtspunkte_aus_mikrobiologischer_Sicht.html

Regina Göckede

Hard Roads to Unfamiliar Places

The Weimar Republic's architecture avant-garde also fell victim to the German Nazi regime. The movement's leading representatives were driven into exile. These circumstances shaped the transformation of the "Neues Bauen", even after 1945



Illustration: Lore Greulich, München

My dear Scharoun, now it is your turn. I know it's late enough." It's January 1947 and exiled architect Adolf Rading has already been living and working in the Palestinian seaport of Haifa for several years. Like many prominent representatives of the Weimar architecture avant-garde, he was forced to leave his homeland after the events of 1933. He's now attempting to make contact with colleagues scattered all over the world, as well as with his former office partner Hans Scharoun, who remained in Germany. "Anyhow, I can always console myself with the fact that I was still the first to write, while people like Mies and Gropius didn't even think it necessary to respond. May they rest in peace!"

In 1933, Adolf Rading and his Jewish wife Else fled the National Socialist terror in Berlin. The couple fled to southwest France before the advancing German Wehrmacht forced them to move further, to Palestine, where the letter-writer is now working as an architectural and town planning adviser for the building department of the British mandatory administration.

The recipient of his lament, Hans Scharoun, who will later enjoy world renown as the architect of the Berlin Philharmonic concert hall, manages to continue working in Germany. While, shortly after the war, Scharoun finds himself between the consolidating fronts of the occupying forces in his role as head of the Senate of Berlin's municipal planning office, Rading becomes so

Car trouble in impassable Tanzania: The architect Ernst May and his wife Ilse dig to free their trapped vehicle. Photo taken around 1936.



Illustration: The Art Institute of Chicago / Edward A. Duckert Collection, Ryerson and Burnham Archives, The Art Institute of Chicago. Digital file # 198602.860construction

Talking shop: Mies van der Rohe on the construction site of one of his apartment buildings on Lake Michigan in Chicago, around 1950/51.

caught up in the maelstrom of the escalating conflict between the Arabs, Jews and British that he leaves the recently-founded state of Israel in 1950.

The two emigrants to America mentioned in his letter, Ludwig Mies van der Rohe and Walter Gropius, fare considerably better. They manage to find their feet as influential university lecturers and key figures of an international modern architecture movement. Admittedly, however, the optimistic spirit of reform fuelled by common goals that characterised 1920s Germany seems to have receded into the distant past, and it is not until the beginning of 1951 that Gropius will recall that "Small Republik der Geister" [Small Republic of Minds], which was once mustered to transcend national boundaries. But the rupture caused by exile has long since been rendered irreversible.

What links the architects mentioned with other architects, town planners and theoreticians of what's known today as the Classic Modernist movement, despite their very different destinies, is their affiliation to the architectural avant-garde of the Weimar Republic. "Neues Bauen", as the movement described its socially responsible artistic activities, had one overriding objective: to make a radical break with the architecture of the past and create a better standard of living for large sectors of the population. The fact that their buildings, which often resembled simple, white-painted cubes, did not always reflect the taste of the masses was a gift to the National Socialists. These polemicalised very early against the buildings' lack of regional conformity and turned criticism of the ostensibly "un-German" flat roof into a long-term issue.



"In the New Network": In 1946, Walter Gropius founded The Architects' Collaborative. The photo shows him (bottom centre) surrounded by his colleagues in Richard Lippold's "World Tree" sculpture. The Harvard Graduate Center is in the background.

In this vein, the 1927 pilot settlement in Stuttgart-Weißenhof, now considered a milestone of modern architecture, was stigmatised as an "Arab village". With the dramatic worsening of the economic conditions towards the end of the 1920s, the vehement criticism escalates afresh. While the architects of "Neues Bauen" meanwhile enjoy high regard abroad, the continued attacks against renowned figures and institutions, such as the Bauhaus school, which closed its doors in 1933, cause several members of the movement

to leave the country even before Hitler's accession to power.

Popular targets of the Nazis' hate campaign are two of the "Neues Bauen" movement's most successful representatives: Ernst May, formerly the influential head of the Frankfurt Hochbauamt (Municipal Building Department), who, together with numerous students and colleagues, decamps to the Soviet Union in 1930; and Bruno Taut, head architect of Berlin's GEHAG housing association, who also emigrates to

Moscow in 1932. When the Soviets attitude towards the well-paid foreigners worsens, many of them find that they are unable to return to Germany: stigmatised as "Kultur-bolschewisten" ("cultural Bolsheviks"), they became stateless.

Ernst May travels via Vienna to East Africa, arriving in Tanganyika, which is ruled by the British. Here, as well as in the neighbouring colony of Kenya and the Protectorate of Uganda, he will work as a farmer, an architect and a town planner until his return to Germany in 1953. The former pioneer of minimalist housing now designs country estates for privileged British colonists. Bruno Taut, on the other hand, returns to Berlin in February 1933, where he is already wanted by the police. Aided by friends, he manages to escape to Switzerland in early March, from where he travels to Japan on a tourist visa.

Until 1936, the architect, who today is renowned for his Berlin housing estates, now designated a UNESCO World Heritage Site, will work primarily in journalism. In addition to designing everyday objects, he is also the author of the 1937 study "Houses and People of Japan".

Despite his intensive focus on his adopted country, Japan, for Taut, remains merely a stopping-off point. In vain he attempts to obtain a visa for the United States, when he is offered the directorship of the architecture department at the Academy of Fine Arts in Istanbul, as well as of the building department at the Turkish Ministry of Education, through Martin Wagner, the former head of Berlin's municipal planning department, now exiled to Turkey. Taut accepts the challenge and leaves Japan in November 1936. After two years of hard work, he dies on the

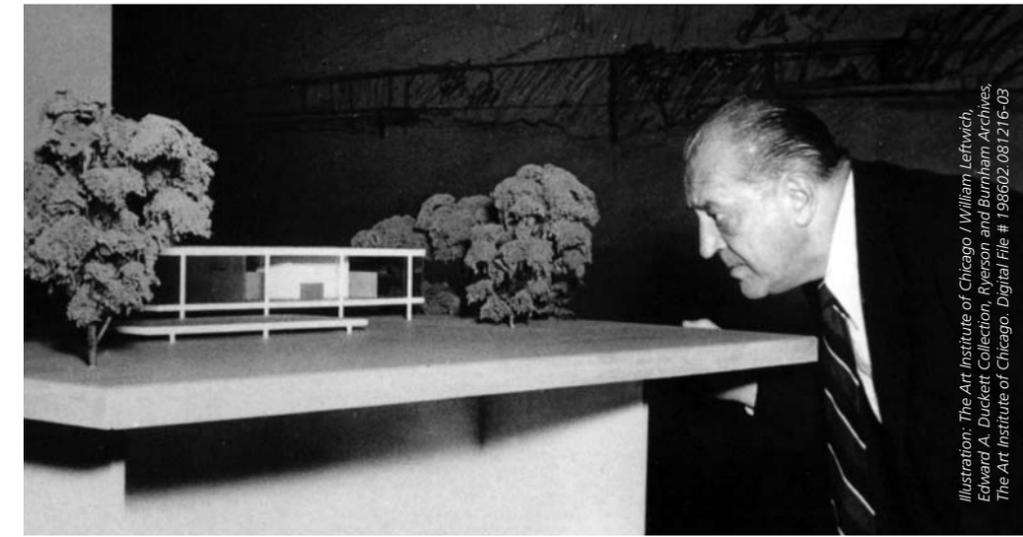
A keen observer: Mies van der Rohe examines the model of the Farnsworth House during the first major monographic exhibition of his work at the New York Museum of Modern Art. The picture was taken in 1947.

Bosphorus of complications following a severe asthma attack.

In Germany, meanwhile, the openly practised violence against Jews, persistent calls for boycotts and mass layoffs are making it difficult, if not impossible, for members of the movement to continue their work. The founding director of the Bauhaus, Walter Gropius, fails to return to Berlin after a lecture tour of Italy in 1934, initially settling in London. Upon receiving a call from Harvard in 1937, he sets off for Boston, where he will, from now on, head the famous "Graduate School of Design".

Others, like Ludwig Mies van der Rohe, are watching and waiting. When anticipated orders fail to materialise, he, too, must face the fact that it's time to go. In 1938, Mies takes up an offer from Chicago to set up the architecture department at the future Illinois Institute of Technology. Like Gropius, he will play a decisive role in determining the development of North American post-war architecture over the next years.

The year 1938 brought the last major wave of emigration for the architects of the "Neues Bauen". Contrary to indications by several success stories, the exodus of the "Neues Bauen" from Germany is, for many of its proponents, inextricably linked with isolation, despair and failure. The majority of the exiled architects do not triumph over flight and expulsion to carry the architecture of the Weimar Republic into the



world unchallenged. Instead, many of the now-forgotten members of the movement are forced into unfulfilling professional compromises.

Some, like Ludwig Hilberseimer, who achieved notoriety in the 1920s for his "inhospitable" urban designs, remain active in the architectural and town planning sectors during their time in exile, but question and revise their previous positions based on what they experience. For others, like the Berlin architect and town planner Erwin Anton Gutkind, the criticism of modernism causes him to abandon his practical building activities altogether and devote himself to architectural history and theory.

Until now, no sustained study has been made of these architects' diverse fates. A project entitled "Neues Bauen in der Fremde" ("Neues Bauen Abroad"), which was launched at the University of Technology in Cottbus in the autumn of 2008, aims to address this research desideratum. This project will undertake 26 case studies in order to examine the multifaceted transformation of German modern architecture abroad for the first time.

Researchers will explore the persistence and loss of old group ties

while also investigating the emergence of new networks. The project's aim is to uncover the fractured history of the exiled Weimar Modern architecture movement. Although the architects, who were scattered all over the world, maintain a decisive role in the theoretical debates on and constructed manifestations of a globalised Modern architectural movement, their individual works are defined by more than the ideas and conceptual pathways of their common Weimar origins. Instead, they have been influenced in at least equal measure by their continuing estrangement from such unique circumstances.



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Rainer Drewello, Burkhard Freitag, Christoph Schlieder

New Tools for Ancient Ruins

Architectural monuments are perpetual construction sites, and historical plans, drafts and photographs are essential for their restoration. Yet the archives of many churches, castles and palaces are either in poor condition or difficult to access. Cultural researchers and engineering scientists are now adding these sources to a database system in order to increase their usability

Architects are not computer scientists, and computer scientists are not cultural studies researchers. Just as a computer scientist's daily tasks do not normally include drawing, cultural studies researchers are not required to programme computers, and interpreting historical sources is not part of an architect's remit. All these differing skills may, however, be required of someone involved with historical monuments. After all, cathedral, castle or palace complexes are not just converted spaces or Facility Management objects. Instead, their form, function and history have transformed them into living witnesses to the past, to places where architectural, social and cultural history intersect.

In architectural monuments, historical tradition plays an important role. The two main churches in Nuremberg, St Lorenz and St Sebaldus, to name just two examples, have archives containing 3000 papers and documents dating back to 1580. They also contain around 1500 articles published in books and magazines, 2200 black and white photographs, and 6500 slides, not to mention 1500 hand-drawn maps. While these documents are

tremendously significant both for historical and practical reasons, they are neither appropriately catalogued nor accessible to either private persons or scientific researchers. And Nuremberg is no isolated example, as the Dombaumeister [master cathedral architects] who manages and restores around 140 major properties in Central Europe – from Vienna to Trondheim, via Cologne – will attest.

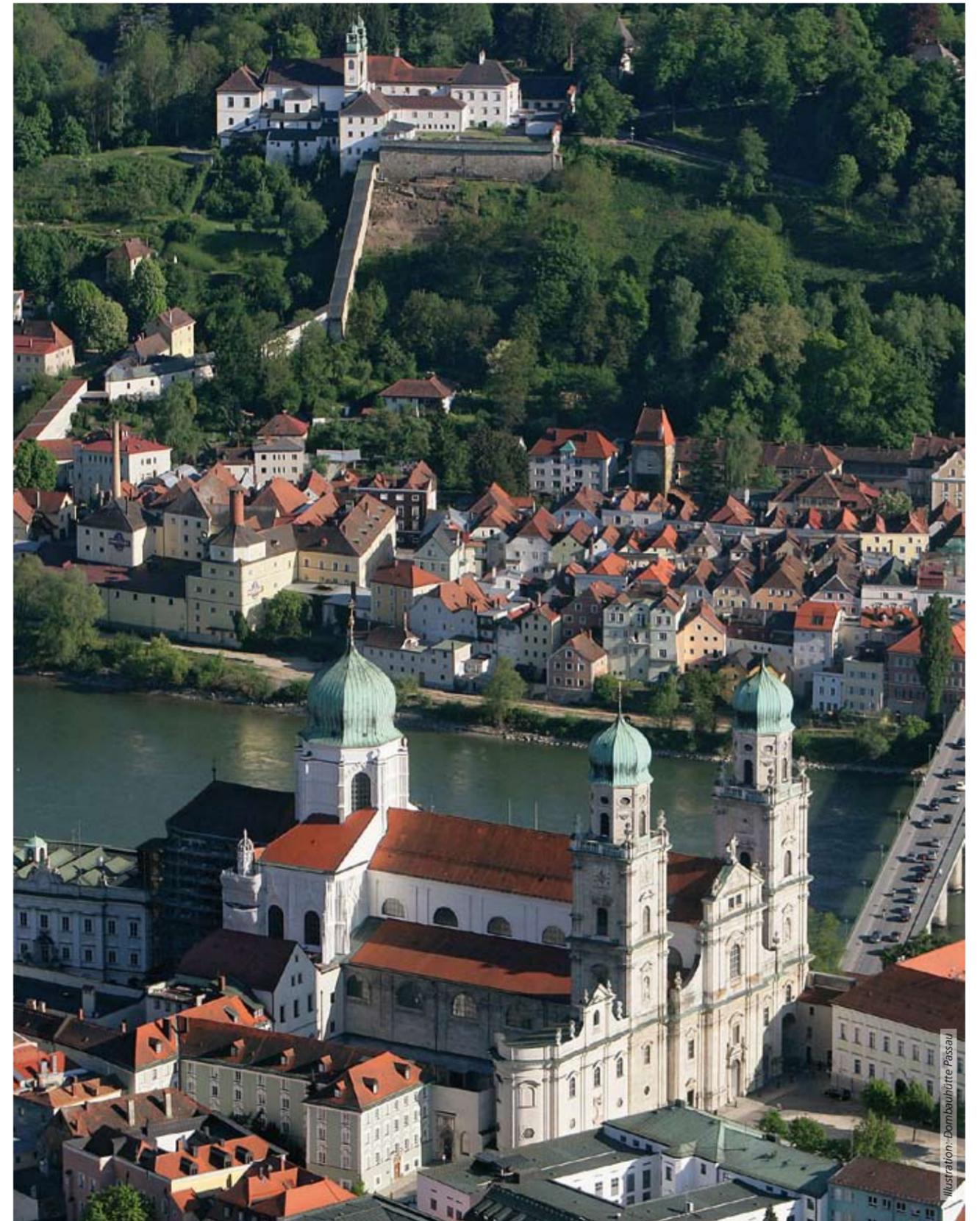
One major problem with architectural archives is their incomplete or outdated document filing systems. Written documents, pictures and plans are usually categorised, either chronologically or by source type, using only the most basic of systems. Boxes of photographs or rolls of blueprints do not, however, permit content searches, reducing research to games of chance or patience.

Architectural monuments are not only historical or technical witnesses, however. They are also large-scale construction sites. Each time a renovation is undertaken, the documentation from the previous renovation must be referenced: consequently, these documents are often accessed and used. Architects

and art historians are, for example, still using exquisite ink drawings from around 1900 – an anachronism in this digital age of almost unsurpassable surveying techniques. This purposeful usage of older sources, however, has its advantages. These buildings are so complex that even the most accurate digital measurements can be translated into a usable form only through considerable investment of time and effort. This effort is often avoided, not least because it is not possible to ensure the longevity of this valuable data without a long-term archiving solution. Instead, tried and true solutions are employed.

Yet the fascinating opportunities afforded by digital technologies speak for themselves, particularly when these take into account different user requirements and working habits. The digital age and its associated qualitative leap require dual-purpose storage and archiving systems to be established. These

The Cathedral and Old Town in Passau. The Cathedral archive houses numerous documents. These are now being indexed with the help of a database.



systems must serve two functions. Firstly, they must be capable of managing traditional archive objects. Secondly, they must archive next-generation documents, with all their compatibility issues, in such a way as to render them usable and readable in 100 years' time.

Take, for example, the Cathedral in Passau, where the church masons' guild has defined a comprehensive naming key. This key is designed to ensure that every last stone of the building can be catalogued, and to facilitate access to its data. The simplest way to do this would be to "virtually attach" existing documents to their appropriate locations – such as towers, wall frescoes, altars, or even individual stones of the church. It is crucial that the keys to the data storage archive are the spatial references for the objects in the inventory system.

The spatial referencing concept has taken centre stage due to the difficulties involved in describing buildings which are, because of their history and architectural styles, seldom homogenous. Dis-

cussions typically centre on naming and counting methods ("What do you call the transition between a church's nave and transept?" Should structural elements be counted from east to west, or by cardinal direction? Should numbers or letters be used?" And so on.). Fortunately, the engineering sciences, architecture and art share similar tools and a common language: that of the pen, the sketch and the plan. Each line and area of crosshatching is a stipulation, while every outline is an abstraction that can be understood with few words. It is the normative properties of the line which enables plans to form an almost perfect basis for archiving building data.

This is where the Digital Monument Archive (DMA) comes in. An organisation which offers specialist databases for historic buildings, the DMA stores documents with the most diverse provenances, whether these are plans, text and image sources, tables or photographs, as well as videos and



3D data. What is unique about it is that the DMA uses a freely definable building structure key, which begins with the building as a whole and ends with its individual components. Documents to be archived are attached to "their" locations and furnished with metadata, which are assigned to thematic catalogues. This enables data pertaining to a structural element to be found either by navigating through a data tree or via a plan. Keyword searches and filtering by thematic category are also possible. These enable objects to be found by category or theme, irrespective of their actual position in the building.

Creating a digital archive, however, requires the prior organisation

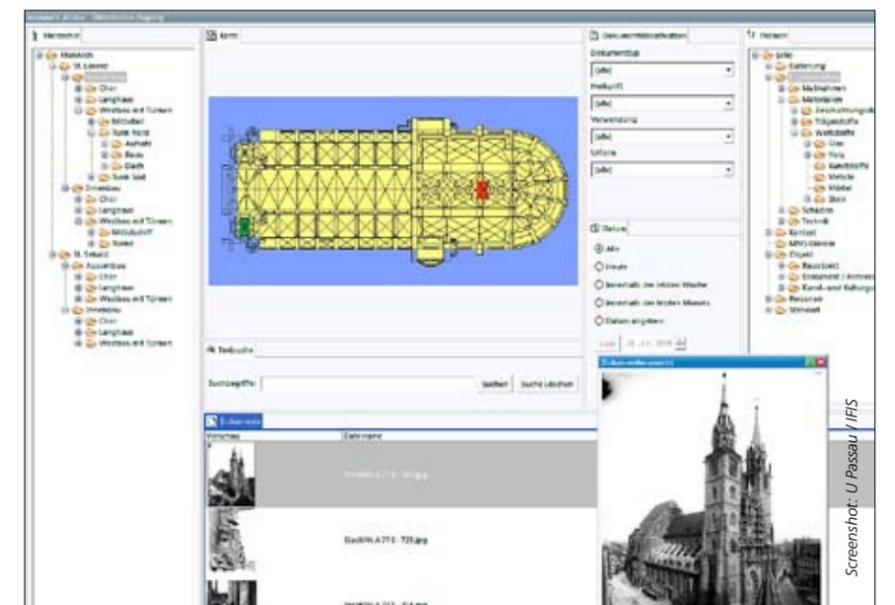
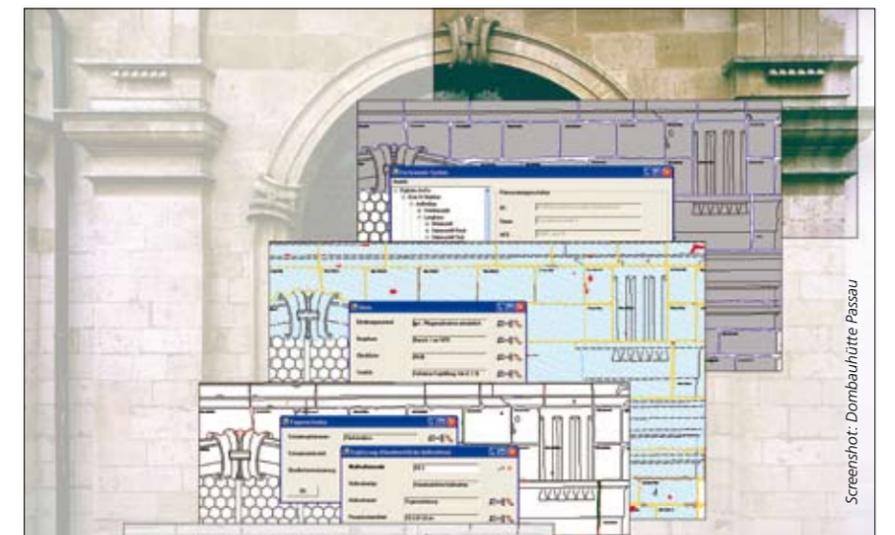
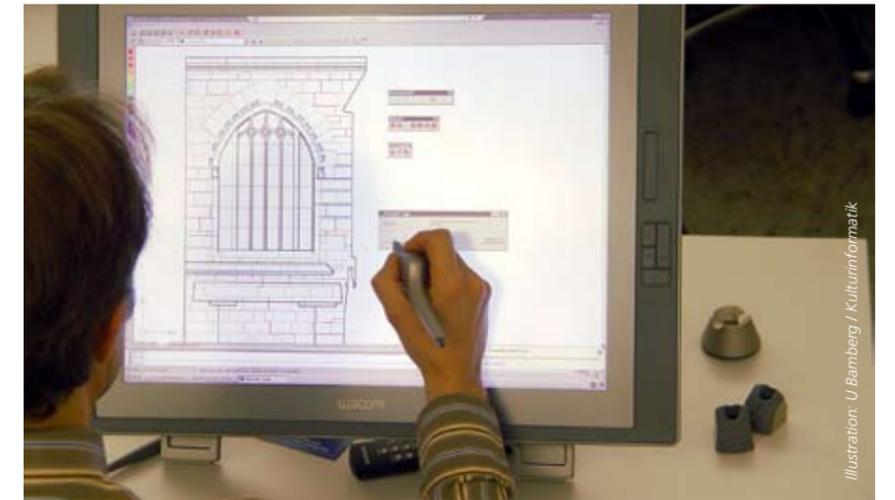
Left: Restoring the façade of Passau Cathedral is an arduous process. Above: Historical graphical material belonging to the archives of St. Lorenz's Church in Nuremberg is studied before being digitised.

Right: On-screen mapping of historical planning documents. Centre: Every stone of Passau's Cathedral is assigned a number, enabling extremely precise spatial assignments to be made. Below: All the information is added to the Digital Monument Archive, where it can be electronically accessed.

and digitisation of the existing resources. The effort involved in this task is well-invested, as it provides archivists with two standalone solutions. Linking archives via the web would then create a network of distributed servers within which specialist information could be exchanged. Whether and how this could work has been tested using the example of the two Nuremberg churches. Their document archives are to be made accessible via the Internet, enabling them to be viewed via web browsers.

Expanding the information base is crucial to this concept. After all, drawings and maps are more than lines and planes. Instead, they also contain information which can be deciphered by careful reading. One aid in highlighting particular features is the MMS (Mobile Mapping System), which converts the bits and bytes of scanned plans into tangible information, attaches it to the correct position in the drawing and scans it into the Digital Monument Archive. In this way, plans become information databases which can be expanded and used for comparisons.

In his 2003 publication on the western façade of Cologne Cathedral, Marc Steinmann illustrated the usefulness of "semantic maps" in an exemplary way. In this work, he analysed the medieval façade plan "F" using all the rules of art (his-



tory). The sketch, which is pieced together from sheets of parchment and rendered in ink, is both a microcosm of the medieval intellectual world and a flawless technical masterpiece. Juxtaposing the decoded knowledge and the drawing would deliver a master plan for High Gothic.

In practice, however, to achieve detailed observations of this type and intensity is almost impossible. The tremendous dimensions of the drawing, which is over four metres tall, make things extremely difficult. A semantic map would, doubtless, be a blessing for every future user of this imposing plan, to say nothing of the experiential value gained by observing the meticulously drawn details, which prove an object of fascination for every visitor.

Clearly delineated structures have, however, always had their detractors. Austrian writer Arthur Schnitzler, a representative of the Viennese Modern Age movement in around 1900, coined the dictum that order is unnatural, and that chaos is the natural order of

things. Whether, however, human-wrought city structures represent utter chaos or organic time/space constructs, is a matter of perspective. What is certain is that it takes time to get one's bearings in urbanised regions, and the faster these areas grow up, the more confusing they seem. Even in small mazes, people reach their limits very quickly.

One example to support this assertion is provided by the old town of Bukhara in Uzbekistan, which was built during the 16th century and which is considered, in principle, to be of a readily comprehensible size. It is, in fact so difficult to get one's bearings there that it is impossible to find one of its 144 monuments without a guide. Anyone wishing to carry out an analysis of one of the town's quarters and its Islamic buildings, particularly one involving different scientific disciplines, will quickly realise the advantages and opportunities of a plan-based inventory system.

Such a system becomes indispensable as soon as the researchers involved need to communicate in

a mixture of Persian (Islamic context), Uzbek (the local language), Russian (the official language) and German (research interest) terminology.

Whether state-of-the-art technology can go beyond providing technical advantages to generate synergies – and thus, to help create bridges between cultures or define new intersections in research – remains to be seen. It will, in future, be impossible to progress without building such bridges. After all, tools are meant to be used for the benefit of humankind.



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www.monarch-project.eu
www.uni-bamberg.de/buchara-projekt



Illustration: Dombauhütte Bamberg

Rembert Unterstell



Illustration: Unterstell

"I still have a suitcase in Dresden..."

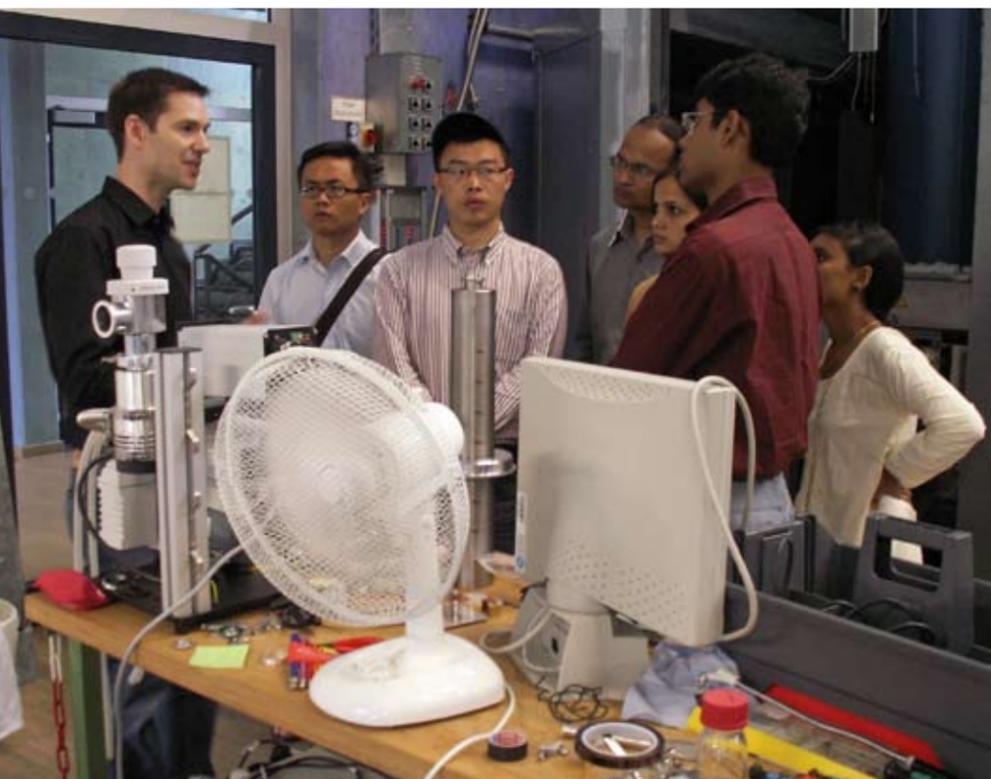
An opportunity to make new contacts in the international research community – following the 60th Nobel Laureate Meeting at Lake Constance, twenty young Indian researchers embarked on a tour of Germany's research landscape, visiting universities and institutes around the country. We spoke with two of the participants about their experiences

Dresden tastes of the future – at least according to Srivarsha Rajshekar from Rajasthan in northern India. Rajshekar was so impressed that she elected to leave her suitcase at the Max Planck Institute of Molecular Cell Biology and Genetics (CBG) at 108 Pfotenhauserstraße, Dresden. "People are so helpful here", says the 21-year-old student with a winning smile. Cur-

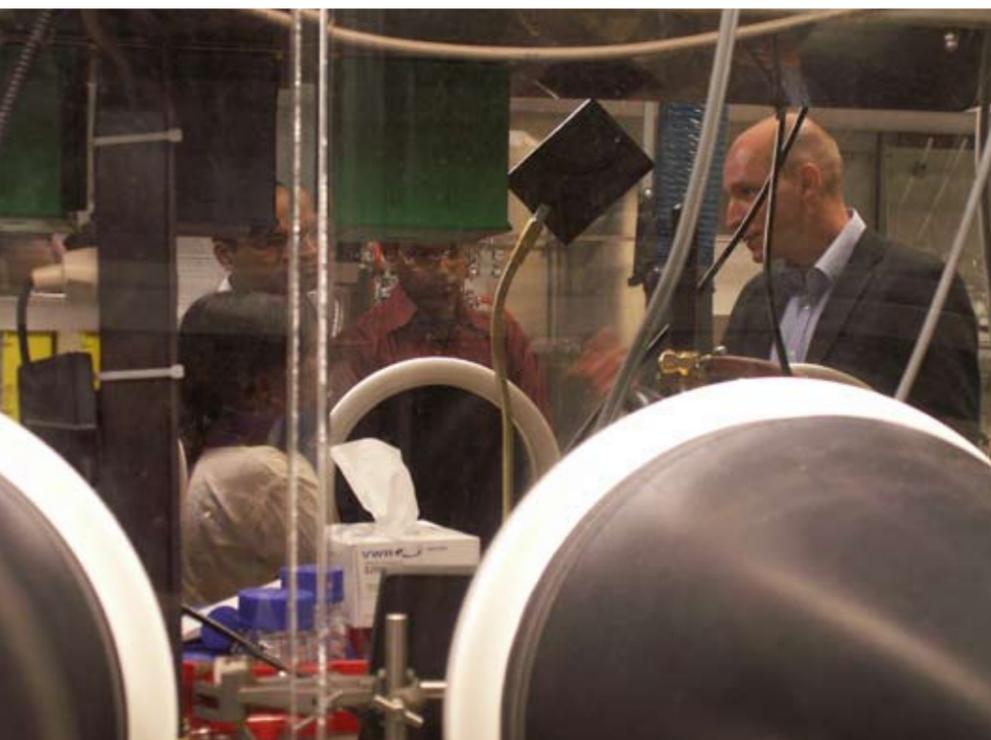
rently studying at the Birla Institute of Technology and Science in Pilani, Rajshekar returned to the CBG last autumn to study zebra fish and learn laboratory techniques for six months as part of her undergraduate studies. Could this be the beginning of a successful career in science and research?

Following a gruelling selection process, Srivarsha Rajshekar was

one of 20 "high potentials" from across India to be awarded a DFG scholarship to attend July's Nobel Laureate Meeting in Lindau and participate in an extended tour of Germany's research landscape. Of the 40,000 young researchers nominated to attend the meeting, just 675 researchers from 68 countries were invited to convene at the small island town on Lake



Gaining insights: Visits to laboratories and other research facilities prompted a host of questions on scientific methods (above) and equipment (below).



Constance. In Lindau the talented young Indian researchers met with 59 laureates from the disciplines of physics, chemistry, medicine and physiology respectively. Flush with excitement, the visitors were full of praise for the “powerful aura of scientific enthusiasm” and “the inspiring and open discussions” that characterised the meeting.

At the invitation of the DFG, 212 Indian students and post-doctoral researchers have participated in the Lindau Experience since 2001, enjoying the opportunity to meet and talk with a host of high-powered intellectual giants. “If the mere aura of scientific discovery can inspire and motivate, then Lindau is the go-to place”, explains Rajshekar.

Leipzig, Dresden, Jena and Bonn were the stations on their week-long informational tour of universities and institutes in East and West Germany, which included side trips to Neuschwanstein Castle and the Wartburg along the way. Organised by the DFG’s office in New Delhi, the young researchers received a warm welcome at laboratories and research centres around the country. The guests were impressed by the sheer diversity and interdisciplinary focus of the various research activities; in particular the collaboration in the fields of chemistry and physics at the Leipzig School of Natural Sciences – Building with Molecules and Nano-objects, and the MPG Institute for Chemical Physics of Solids in Dresden. The Indian researchers were also struck by the level of interdisciplinary cooperation in the fields biology and chemistry; evident, for example, at the Leibniz Institute for Natural Product Research and Infection Biology in Jena.

Meetings and discussions with Indian researchers currently working in Germany rounded off the programme and helped to promote Germany’s standing as an international research hub. And the question on everyone’s lips? Just how much German do you need to know to get by in Germany? The rather sceptical tone of this question has much to do with the high-profile of India’s academic elite, whose expertise is sought after both in India (in particular by industrial interests) and abroad. While German researchers have an excellent reputation on the Indian subcontinent, the hopes and dreams of most young Indian researchers are still focussed on the USA, where they are able to work in an English-speaking environment.

We spoke with 27-year-old nano researcher and physicist Dr Dattatray Sadashiv Dhawale, a post-doctoral

researcher from the Shivaji University in Kolhapur, Maharashtra, who said that he would be keen to re-search in Germany “for at least a few years” in spite of the language barrier. And as Dhawale pointed out, while German is no doubt the preferred language in lecture halls across the country, English is the lingua franca in research laboratories working at an international level. Meanwhile, Dhawale has already made contact with a number of physicists in Leipzig, and is now one step closer to a position at a German laboratory.

Dhawale and his compatriots were keen to learn more about the funding opportunities available through German science and research organisations, and experts from the DFG Head Office in Bonn and from the Alexander von Humboldt Foundation were on hand to

Dresden’s famous Procession of the Princes, the largest porcelain mural in the world.



Srivarsha Rajshekar returned to Dresden following the tour to study laboratory techniques.

outline the available programmes and funding prospects. The programme’s blend of first-hand information, research facility tours and face-to-face meetings with colleagues makes for a huge success, explained biochemist Professor Michael Famulok from Life and Medical Sciences (LIMES) at the University of Bonn. Famulok, a Leibniz prizewinner and member of the Advisory Committee at the DFG office in India, encouraged the young researchers to draw on their experiences and new contacts – and to set their sights on Germany.

In the meantime, Srivarsha Rajshekar has done just this. Following the Lindau tour, she completed a six-month stay at a laboratory in Dresden. Back home in India, the 21-year-old continues to recall the German “taste of the future”.

Dr. Rembert Unterstell is Publishing Executive Editor of “german research”.

www.dfg.de/indien

The Deutsche Forschungsgemeinschaft

The Deutsche Forschungsgemeinschaft (DFG, German Research Foundation) is the central self-governing organisation responsible for promoting research in Germany. According to its statutes, the DFG serves all branches of science and the humanities. The DFG supports and coordinates research projects in all scientific disciplines, in particular in the areas of basic and applied research. Particular attention is paid to promoting young researchers. Researchers who work at a university or research institution in Germany are eligible to apply for DFG funding. Proposals will be peer reviewed. The final assessment will be carried out by review boards, the members of which are elected by researchers in Germany in their individual subject areas every four years.

The DFG distinguishes between the following programmes for research funding: In the *Individual Grants Programme*, any researcher can apply for financial assistance for an individual research project. *Priority Programmes* allow researchers from various research institutions and laboratories to cooperate within the framework of a set topic or project for a defined period of time, each working at his/her respective research institution. A *Research Unit* is a longer-term collaboration between several researchers who generally work together on a research topic at a single location. In *Central Research Facilities* there is a particular concentration of personnel and equipment that is required to provide scientific and technical services.

Collaborative Research Centres are long-term university research centres in which scientists and academics pursue ambitious joint interdisciplinary research undertakings. They are generally established for a period of twelve years. In addition to the classic Collaborative Research Centres, which are concentrated at one location and open to all subject areas, the DFG also offers several programme variations. *CRC/Transregios* allow various locations to cooperate on one topical focus. *Cultural Studies Research Centres* are designed to support the transition in the humanities to an integrated cultural studies paradigm. *Transfer Units* serve to transfer the findings of basic research produced by Collaborative Research Centres into the realm of practical application by promoting cooperation between research institutes and users.

DFG Research Centres are an important strategic funding instrument. They concentrate scientific research competence in particularly innovative fields and create temporary, internationally visible research priorities at research universities.

Research Training Groups are university training programmes established for a specific time period to support young researchers by actively involving them in research work. This focusses on a coherent, topically defined, research and study programme. Research Training Groups are designed to promote the early independence of doctoral students and intensify international exchange. They are open to international participants. In *International Research Training Groups*, a jointly structured doctoral programme is offered by German and foreign universities. Other funding opportunities for qualified young researchers are offered by the *Heisenberg Programme* and the *Emmy Noether Programme*. In so called *Reinhard Koselleck Projects*, the DFG supports especially innovative research undertakings by outstanding scientists and academics.

The *Excellence Initiative* aims to promote top-level research and improve the quality of German universities and research institutions in the long term. Funding is provided for graduate schools, clusters of excellence and institutional strategies.

The DFG also funds and initiates measures to promote scientific libraries, equips computer centres with computing hardware, provides instrumentation for research purposes and conducts peer reviews on proposals for scientific instrumentation. On an international level, the DFG has assumed the role of Scientific Representative to international organisations, coordinates and funds the German contribution towards large-scale international research programmes, and supports international scientific relations.

Another important role of the DFG is to provide policy advice to parliaments and public authorities on scientific issues. A large number of expert commissions and committees provide the scientific background for the passing of new legislation, primarily in the areas of environmental protection and health care.

The legal status of the DFG is that of an association under private law. Its member organisations include research universities, major non-university research institutions, such as the Max Planck Society, the Fraunhofer Society and the Leibniz Association, the Academies of Sciences and Humanities and a number of scientific associations. In order to meet its responsibilities, the DFG receives funding from the German federal government and the federal states, as well as an annual contribution from the Donors' Association for the Promotion of Sciences and Humanities in Germany.



Illustration: Ausserhofer

The families of outstanding researchers don't normally take centre stage, but the annual Gottfried Wilhelm Leibniz Prize award ceremony is a celebration for everyone, and many of the winners of this, Germany's most prestigious research prize, like to attend with their partners, parents and children – an expression of their gratitude for their support and the sacrifices of living with a cutting-edge researcher. This year this included the three children of neuroscientist Christian Büchel from Hamburg, who evidently enjoyed the festivities – and perhaps the "Thirst for Knowledge" drinking bottle contributed in some small way.

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