



Activity Report

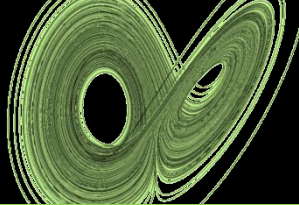
2014/ 2015



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Activity Report



Department of Applied Geosciences
Departments of Mathematics & Science

Dear Rectorate,
Dear Colleagues,

this academic year had again been an exiting and very successful time for GUTech and the Faculty of Science.

The Faculty of Science consist of the Department of Applied Geosciences and the Department of Mathematics & Science. It is running a Bachelor program in Applied Geosciences as well as a Master program in Petroleum Geosciences. The Bachelor was successfully accredited by ACQUIN for the next six years. All graduates obtained a job. The Master program is doing a lot of pioneering work as being the first Master program at GUTech.

The Faculty of Science has 14 staff members (Portugal, Germany, France, Oman, Philippines) who are supported by fly-ins and 10-15 interns during the lecture period to cover about 40 courses per semester.

Every professor at the Faculty is substantially involved in research activities ranging from fundamental and applicable areas to highly applied fields. Amongst others, these endeavors led to several grants and a high rate of papers published in top scientific journals. Aachen, Berlin, Bonn, Calicut, Cartagena, Delhi, Erlangen, Hakuba, Kyoto, Lisbon, London, Munich, Rennes, Tromsø, Vienna, etc., are just some of the places with which international research collaborations have successfully been established and are continuously carried out. Our global network advertises GUTech and the Sultanate of Oman as a research hub in the Middle East.

The "12th International Symposium on Fossil Cnidaria and Porifera" and the workshop "Economics of Conflict" were organized and conducted. Several excursions for students had been offered to Germany, Spain, UK and inside Oman.

Another highlight at GUTech was the Science Day 2015, where every staff member, several colleagues from other Faculties, the complete Rectorate, and many Engineering, Computer Sciences, Applied Geosciences, Logistic and Foundation year students had been actively involved.

The Faculty of Science is also responsible for running several laboratories (Chemistry, Physics, Rocks and Minerals, and Microscopy) supporting courses and research at GUTech.

Members of the Mathematics and Science Department contributed actively to the re-launch of the Core and Academic Foundation year program in the Tamayouz project.

Faculty members play an active role in advancing GUTech to the learning center in the Sultanate of Oman by applying and refining advanced teaching methods and using modern teaching tools as e-learning platforms, tablets and the RWTH Aachen App.

Of course, these activities could not be carried out without the overwhelming support of Student Affairs and all administration departments, whom we cordially thank.

Please, allow me to give a short outlook on some upcoming activities and events in the next academic year 2015/ 16: designing and establishing an Integrated AGEO MSC program with focus on PGEO (Petroleum Geology), HGEO (Hydrogeology) and MGEO (Mineral Resources), bringing the Imaginary exhibition to Oman, coaching the AGEO student team for participation in the Imperial Barrel Award competition, hosting a top researcher of Helmholtz Center München, intensifying our HighTea@Science and Young Researcher seminar activities.

On behalf of everyone at the Faculty of Science, I thank you for your continued support as we continuously improve our teaching to the benefits of our students and findings in research to the wealth of the people in the Sultanate of Oman.

Sincerely,

Prof. Dr. Bernhard Heim
Dean of the Faculty of Science
HoD Department Mathematics & Science



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Department of Applied Geosciences
Departments of Mathematics & Science

الأفاضل/ مجلس إدارة الجامعة
الأفاضل / أعضاء هيئة التدريس

ويلعب الأساتذة بقسم العلوم دور مهما في رفع مستوى التعليم في الجامعة لتكون مركزا في سلطنة عمان عن طريق تطبيق أحدث طرق التدريس كالتعلم الشبكي وتطبيقات الأجهزة اللوحية وتطبيق جامعة آخن. ويأتي هذا الدور مدعوما دائما من قبل الأقسام الإدارية وشؤون الطلبة في الجامعة .

وسيتم خلال العام الأكاديمي القادم تنظيم عدة أنشطة كتصميم وإنشاء برنامج الماجستير التكامل في علوم الأرض والذي سيركز على علوم الأرض البترولية والهيدروجيولوجيا والموارد المعدنية إضافة إلى تنظيم معرض "خيالي" في عمان وإرشاد طلاب علوم الأرض التطبيقية للمشاركة في جائزة إمبريال بارل وسيتم إستضافة باحثين من مركز هولمولتز بميونخ وتكثيف أنشطة الأبحاث للطلبة الواعدين بالجامعة.

أصالة عن نفسي ونيابة عن زملائي الأساتذة أتقدم إليكم بالشكر الجزيل للدعم الدائم لنا والذي بدوره يجعل منا قادرين على العطاء المتواصل وتطوير التعليم لما فيه مصلحة الطالب ويثري أبناء السلطنة.

ولكم كل التقدير..

B.A.

أ.د. برنارد هايم

عميد كلية العلوم
ورئيس قسم الرياضيات والعلوم
الجامعة الألمانية للتكنولوجيا في عمان



لقد كان هذا العام حافلا بالكثير من المتعة والنجاحات المتتالية للجامعة ولموظفوا العلوم.

ويعتبر قسم العلوم أحد أنشط الأقسام على مستوى الجامعة وهو يحتوي على قسم علوم الأرض التطبيقية وقسم الرياضيات والعلوم. والتي بدورها تتألف من تخصصات عدة كيكالوريوس علوم الأرض التطبيقية والذي تم إعتماده من قبل معهد الإعتماد والترخيص وضمان الجودة وماجستير علوم الأرض البترولية وهو أول برنامج ماجستير بالجامعة الألمانية.

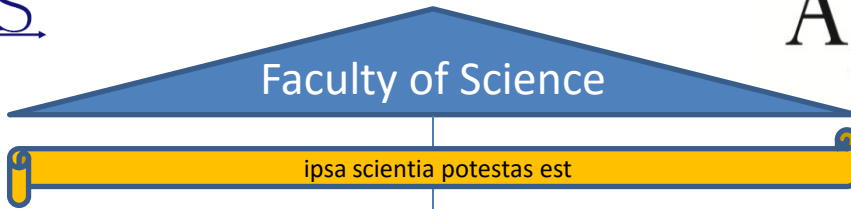
ويمثل قسم العلوم 14 أستاذ من أعضاء هيئة التدريس وهم من الجنسية البرتغالية والألمانية والفرنسية والعمانية والفلبينية مدعومون بحوالي 15 متدرب خلال تقديم محاضراتهم ل 40 مادة خلال الفصل. ويشارك كل أستاذ منهم بشكل جوهري في أبحاث نظرية أساسية وتطبيقية والتي حصلت على إهتمام دولي وتم نشرها في مجلات علمية في آخن وبرلين و بون وكليكات وقرطاجة ودلهي وإرلانجن وهكوبو وكويتو ولشبونة ولندن وميونخ وريين وترومس وفيينا. والتي بدورها فتحت مجال للتعاون في الأبحاث الدولية بينها وبين الجامعة الألمانية للتكنولوجيا في عمان كمركز أبحاث في الشرق الأوسط. إضافة إلى ذلك تم تنظيم المؤتمر الدولي الثاني عشر في أحافير اللواسع والإسفنجيات وورشة عمل في إقتصاد الصراعات وتم تسيير رحلات عدة للطلبة للمشاركة فيها والإستفادة منها في ألمانيا وأسبانيا وبريطانيا وعمان. وإلى جانب ذلك نظم قسم العلوم بالجامعة يوم العلوم 2015 والذي شارك فيه أعضاء هيئة التدريس من أقسام الهندسة والعلوم وإدارة الجامعة وطلبة البرنامج التأسيسي.

يدير قسم العلوم مجموعة من المختبرات العلمية كمختبرات الكيمياء والفيزياء والصخور والمعادن والمجهر والتي تدعم المواد التعليمية في الجامعة.

إلى جانب ذلك ساهم بعض الأساتذة في إعادة تشكيل نظام البرنامج التأسيسي في مشروع "تميز" بالجامعة خلال العام الماضي.

Activity Report

Department of Applied Geosciences
Departments of Mathematics & Science



Department of Mathematics & Science

Department of Applied Geosciences

Divisions

Divisions

- Chemistry
- Physics
- Modern Number Theory & Cryptography
- Computational Dynamical Systems
- Scientific Computing
- Discrete Optimization & Numeric
- Statistics & Probability Theory
- Cybernetics & Complex Simulations
- Financial Mathematics & Econometrics

- Applied Sedimentology & Stratigraphy
- Hydrogeology & Water Resources
- Mineral Resources & Mining
- Petroleum Geology
- Geophysics

Study Programs

- BSc in Applied Geology
- MSc in Petroleum Geology

Division to the established

Vision/ Mission/ Strategy

Vision/ Mission/ Strategy

Vision:

Being a leading institution for Research and Academic Education in Mathematics, Physics and Chemistry in Oman and the Gulf Region.

Mission:

Providing the youth of Oman with state of the art methods and tools in pure and core Mathematics and Science to sustainable succeed in the challenges of the future.

Strategy:

Providing a vivid center for international research cooperation (on-site and abroad) and implementing the Kaizen+ teaching paradigm in all courses of Academic Education

Vision:

Being a leading institution for Research and Academic Education in Applied Geosciences and the study of petroleum, groundwater and mineral resources in Oman and the Gulf Region.

Mission:

The Department provides students with a modern education required to become a highly qualified graduate with expertise in efficient exploration for oil. Gas and mineral resources as well as the sustainable usage of water resources.

Strategy:

Lectures, hands-on laboratory courses and practical field work, that are based on German excellence in science and education adapted for the Sultanate.

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The Faculty Team

Shafiq Al Foora is studying in Al Zahra for Girls College since 2005. Her specialties are Science in Finance and Banking as well as Accounting. Since the 15th of June 2013 she is working at the German University of Technology in Oman. She started with a trainee program involving training at the reception of the university Copy Centre, Financial and HR for 4 month. After that she joined the Department of Mathematics and Science as a secretary. She organizes the time table and supports the department and the complete Faculty of Science in administration matters. In particular, Shafiq helps the students of our department as well as those of the Faculty of Science and organizes the department's events.

Fatma Al Hatmi graduated from Sultan Qaboos University (SQU) on January 2009 with a Bachelor of Science in Physics and a minor in Mathematics. She did her undergraduate research at the Ministry of Regional Municipalities and Water Resources, Laboratories Centres of Foods and Water, Radioactive Materials Section. From October 2011 to June 2012 Fatma worked as research assistant in the nuclear radiation research laboratories of the Department of Physics of the Sultan Qaboos University (SQU). Moreover, she held a temporary Laboratory Technician position at SQU from February 2012 to December 2012. At the 1st of April Fatma joined our department, and is now a Physics Lab Technician at the German University of Technology in Oman. She is responsible for the preparation of the laboratory experiments for the Bachelor and foundation programs. In addition, she organizes the lab and takes care of the compliance with safety requirements. She helps the lab manager to design the new physics lab during summer 2014. Together with Dr. Sausan Al-Riyami, she improves the experiments in the physics lab.

Sausan Al-Riyami graduated from Sultan Qaboos University (SQU) with a Bachelor of Science in Physics and with a minor in Earth Science. She obtained her master in Science and Engineering with a first-class honour degree, and got her PhD in Applied Science for Electronics and Materials. Both of her master and PhD studies were done in Kyushu University in Japan. In addition, she received a diploma certificate in Novel Carbon Resources Sciences Global Centers of Excellence (Global-COE). During her study she received several academics awards and research grants such as the Japanese Government Scholarship "Monbukagakusho", the Sasakawa Scientific and the Research Grants for Science Fellows, and Research Grant from Global Centers of Excellence "Global COE" in Novel Carbon Resource. On the 2nd of February 2014 she joined the



Department of Mathematics and Science of the German University of Technology in Oman as a Physics Lecturer and later as the Institutional Focal point towards The Research Council (TRC) of Oman. Her research focuses on the preparation and characterization of n-type ultra-nano-crystalline/ hydrogenated amorphous carbon (UNCD/a-C:H) composite films that were prepared by pulsed laser deposition (PLD) technique for the first time in diamond field. This material is believed to be a candidate for several applications such as photovoltaics, coating and biotechnology. Beginning of 2015 Sausan was promoted to Assistant Professor of Physics. Sausan left GUTech in August 2015 to take a research appointment at a newly founded research cluster of the TRC and the German Helmholtz Center.

Haifa Al Salmi obtained her BSc in Mechanical Engineering from SQU in 2012. She then joined Shell Oman Marketing in the Supply and Distribution team. In the same year she obtained an Exxon Mobil MENA Scholarship and went for an MSc in Geology at Oklahoma State University (USA). Her Master thesis was on Border fault linkage and segmentation along the Malawi rift in Africa, and she presented the results of her thesis in EGU general assembly in Vienna in June 2014 and graduated in December of the same year. In February 2015 she joined the German University of Technology in Oman (GUTech) and is working as an Assistant Lecturer.

Tahiya Al-Shuaili finished her Bachelor Degree in General Chemistry from Sultan Qaboos University (2010). She worked as Call Center Employee in the "Project 2010" of the General Census of Population, Housing & Establishment, Oman. During her work at the General Census, she also completed a 2-month training in "Advanced Communication & Call Center" from Infoline Company, Oman. In January 2012, she started a new job in the German University of Technology in Oman (GUTech) as Chemistry Laboratory Technician. While in GUTech, she also completed a training program, "Project Management". Some of her activities as Chemistry technician are the support of teaching chemistry. This includes for example assisting in the implementation of good health, safety and cleanliness in the laboratory, keeping an inventory and good supply of laboratory material as well as the preparation of laboratory needs and issuance of these goods to all sorts of laboratory users.

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Wilfried Bauer obtained his Diploma (1991) and PhD (1995) in Geology from RWTH Aachen University. He continued his work in Aachen from 1995 to 2002 as a Post-Doc and later as a Research Assistant with a scientific focus on the structural geology, metamorphic petrology, mineral chemistry and geochronology of Precambrian metamorphic rocks in high-grade gneiss terranes of the East Antarctic Craton. In 1997/ 98 he worked as a member of an inter-disciplinary team on balanced cross-sections of the West-Uralian fold-and-thrust belt (EUROPROBE – URSEIS section) with special emphasis on the deformation of the Proterozoic crystalline basement within the southern Ural Mountains. In 2004 he worked for the commercial branch of the Norwegian Geological Survey in a mapping project that covered four sheets of the geological map 1:250,000 of Mozambique. From 2005 to 2007 he held a position as Senior Survey Geologist at the British Geological Survey and was the Deputy Leader of a team that mapped and compiled 40 sheets of the geological map of Madagascar 1:100,000 in a World Bank-funded project. Between 2007 and 2014 he led the Research & Development section of an Australian exploration company, focused on the exploration of gold, bauxite and graphite in Madagascar. In February 2015, he joined GÜtech as an Associate Professor of Geosciences. His research interests comprise structural geology, microfabrics in ductile shear zones and mineral exploration. Currently, his research is contributing to UNESCO-IGCP 648: *Supercontinent Cycles & Global Geodynamics*.

Elena Berdysheva obtained her BSc and MSc in Mathematics and Applied Mathematics at the Ural State University, Ekaterinburg, Russia. In 2000, she obtained her PhD in Mathematics there. She conducted her post-doctoral studies at the Mathematical Institute of the University of Erlangen-Nuremberg in Germany, in particular, as an Alexander-von-Humboldt Fellow. From 2002 to 2011 she worked at the University of Hohenheim, Stuttgart, Germany, where she obtained her Habilitation in 2010. She also served as an Adjunct Professor at the FernUniversität in Hagen and as a Visiting Professor of Numerical Mathematics at the University of Giessen, Germany. Elena joined GÜtech in 2011 as an Associate Professor of Mathematics. Her list of research visits include institutions as The Ohio State University, Columbus, Ohio, US, King Abdulaziz University, Jeddah, Saudi Arabia, and Alfred Renyi Institute of Mathematics, Budapest, Hungary, among others. She is also a member of the Editorial Board of Results in Mathematics (Birkhaeuser). Her research interests are in the field of Applied Analysis and include Approximation Theory, Harmonic Analysis, Special Functions and Orthogonal Polynomials as well as Numerical Analysis. In August Elena left GÜtech to take a position at the University of Giessen.



As the starting event of the new academic year 2014/ 15 the Dean of Science Prof. Dr. Bernhard Heim is handing over the Activity Report 2013/ 14 to the Rector Prof. Dr.-Ing. Michael Modigell.

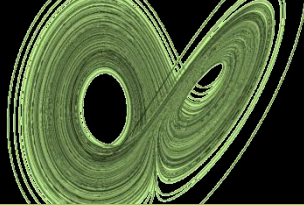


The members of the AGEO department: (from left to right) Matthias, Celine, Wilfred, Wiekert, Haifa, Guilhem (Drive-in and consultant), Ekkehard, Michaela and Ana.



Conference photo of the participants at the "12th International Symposium on Fossil Cnidaria and Porifera"

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Members of the Department of Mathematics & Science together with the interns of the winter term 2014/ 15.

Fatma (left) and Tahiya (far right) while performing experiments and supporting students in the Physics and Chemistry laboratories, respectively.



Michaela Bernecker obtained her Diploma = MSc (1989) and PhD (1995) in Geology and Paleontology from Friedrich-Alexander University (FAU), Erlangen Germany. She continued her scientific career at FAU Erlangen as Assistant Professor from 1995 to 2001, as Associate Senior Lecturer and Consultant to Petroleum Industry from 2002-2006 for Wintershall Germany, WiNo Norway, OMV Austrian Oil Company and Novus Petroleum through Oolithica, UK. Michaela received a prestigious scholarship for young female Professors from the State of Bavaria, Germany during that time and two EU SYNTHESYS grants for research at the Natural History Museum in London and the Geological Museum in Copenhagen, Denmark. She finished her Habilitation in 2007 to become PD (Privatdozent) and a member of the Faculty of Science at FAU. In 2008 she joined GUTech as an Associate Professor of Geosciences and is now Head of Applied Geosciences since 2014. She was involved in Curriculum Development and Accreditation of the BSc and MSc at FAU and GUTech over the last two decades. Her scientific expertise is in Applied Sedimentology and Stratigraphy with focus on Carbonate Reservoirs in the Middle East. Michaela has been the regional project leader for Oman in the Research Project: International Geological Correlation Program IGCP 572-UNESCO: Recovery of ecosystems after the Permian-Triassic mass extinction: Lessons for the present (2008-2012) and organized International Conferences including field workshops in Oman at GUTech in 2010 and 2015.

Céline Ducassou did her Bachelor studies in Pau (France) in 2001-2004 and her Master studies in Rennes (France) in 2004-2006. Afterwards, she obtained her PhD in Geosciences in 2009 in Rennes. There, she studied how sedimentary basins record the growth phase of reliefs and exhumation of basement rocks during the early stages of the Variscan orogeny. She developed a pluridisciplinary approach (sedimentology, structural geology & detrital geochronology) in order to constrain the paleogeographies, their evolution, and the nature of the material being eroded during the growth of the Variscan belt. After her PhD, she obtained a Research and Teaching position in Rennes for one year (2009-2010) and joined GUTech in October 2010 as Assistant Professor in Geosciences. From 2010 to 2015, Céline was involved in a research project (O:NLAP) funded by the French National Research Agency (ANR). The main aim of this project is to better understand the obduction and the specific conditions it requires. In the frame of this project, she was working on the syntectonic Muti Formation of Upper Cretaceous age in order to constrain the lateral and temporal evolution of the depositional environments during the emplacement of the nappes. In addition, she is involved in two geophysical projects (COOL & OBS-O:NLAP) aiming to improve our knowledge



During the celebrations of the 2014 National Day of Oman. From left to right: Conception, Elena, Sausan, Shafiq, Bernhard and Florian.

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on the structure of the Oman Mountains and the regional geology by acquiring sub-surface data.

Bernhard Heim studied Mathematics, Physics and Information Technology at the University of Freiburg, Germany. After his diploma in Mathematics with minor subject Physics, he continued his studies at the of University of Mannheim, Germany, and received a PhD in Mathematics (1997). Until 2000 he was a post doc at the Max-Planck Institute for Mathematics in Bonn (MPIM), Germany. After working 4 years for the German Railway company in several management positions he went back to the MPIM in Bonn and received his Habilitation in 2008. In 2009 he joint the German University of Technology in Oman (GUtech), serving as a Head of the Department of Mathematics and Science and as a Dean of Science since 2010 and 2012, respectively. His research field is the topic of automorphic forms, a discipline unifying algebra, number and function theory, with applications in string theory, statistics and engineering. He frequently is invited to conferences as a speaker or for research collaboration to Germany (RWTH Aachen, Mannheim, Bonn), Japan (Kyoto, Tokyo) and other countries. He recently organized a Conference in Oman in 2012 at GUtech and as a co-organizer in 2014. He has Master and PhD students, is an author of several research papers, and editor of two scientific journals. Moreover, he recently developed together with colleagues a new concept on teaching Mathematics for Engineering programs in the Middle East, called Kaizen learning. In 2015 he was involved in the Tamayouz project to streamline the GUtech Foundation program that led to the new GUbridge organization rolling out in the winter term 2015/ 16.

Ekkehard Holzbecher obtained his diploma in Mathematics at Cologne University in 1981 dealing with a topic on numerical methods for partial differential equations. In 1984 he started a position at the department of Nuclear Engineering of Technical University Berlin and obtained his doctorate degree at the department of Hydraulic Engineering in 1991 on groundwater modeling. In 1992/93 he got his first expat experiences at the Geophysical Institute of Kyoto University, Japan. After his return to Berlin he was employed at the Leibniz Institute of Freshwater Ecology and at Humboldt University, dealing with Eco-Hydrology. He obtained his habilitation for Hydrogeology from Freie Univ. Berlin in 2003. As Privat-Dozent he continued lecturing afterwards, when he changed to the Weierstraß Inst. of Applied Analysis in 2005 for a project on fuel cells. In 2008 he moved to Göttingen, where he was employed in Applied Geology, teaching within an international master course and leading several projects concerning geothermics and groundwater infiltration. Ekkehard joined GUtech in 2014 as

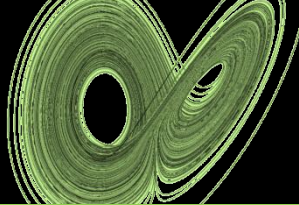


Hand-over of the new logo of the Department of Mathematics & Science. The logo was created by our interns Elizaveta Chistova and Paul Pellekorne. It shows, besides the Gaussian probability density used as the hull of an A in the letter combination MAS (the abbreviation of the Mathematics and Science Department), the Rutherford model of Helium with two electrons circling the center. The complete sign is located in a Cartesian Coordinate Frame. The department's name is given in English as well as in Arabic.



Impressions from the "Young Researchers' Seminary" where out interns discuss their theses and performed academic and industrial projects in order to generate a stimulating academic environment besides teaching.

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After a visit of the Botanical Garden Muscat with the interns (winter term 2014/15) and with our guide from the Botanical Garden Ms. Dareena Jaafar (front row, first from the right).

an Associate Professor for Hydrogeology. During his career he published multiple papers in several academic journals. Moreover he contributed to several book publications. He is author of three monographs printed by Springer Publications. His latest textbook *Environmental Modeling* appeared recently in the second edition. His current research interests are hydrology in arid and semi-arid zones and advanced modeling. He is the main investigator in the project 'Towards a flood-resilient Omani society: improved tools for flood management', funded by The Research Council (TRC).

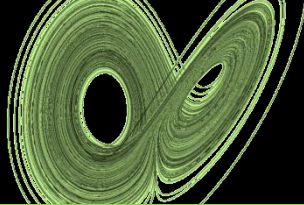
Ana Jesus did her academic studies at the Faculty of Sciences of Lisbon University (FCUL) in Portugal: BSc in Geology (1998), MSc in crystallography/mineralogy/metallogeny (2002), PhD in metallogeny (2011). Her MSc and PhD research focused on ore-forming systems (Fe-Ti-V oxides; Ni-Cu sulphides) associated with mafic/ultramafic layered intrusions, their petrogenesis and tectono-magmatic evolution. In 2009 she became the first Invited Professor at the Geology Department of FCUL where she stayed until 2013, having also lectured in the Economic Geology MSc. During that period, she was also a research consultant for a mining Company of Angola working with very diverse metallogenic systems (carbonatites, kimberlites, Iron Oxide Copper Gold and BIFs). Having worked as a consultant for GUTech since 2014, she was appointed as Assistant Professor of Geosciences in September 2015. Ana is initiating various metallogenic and petrologic investigations at multiple levels of the Samail Ophiolite of Oman, namely:

- a) the influence of the MORB to supra-subduction transition in the metallogeny of the Volcanogenic Massive Sulfide Mandoos and Shinas deposits (with Lisbon University);
- b) magma transfer processes between mantle dikes and lower crustal cumulates at Wadi Hilti (with CNRS Géosciences Environment Toulouse);
- c) the Oman Drilling Project, an international endeavour that will be performing scientific drilling of the Samail ophiolite to address multidisciplinary questions (see detailed article).

Matthias López Correa studied Geology and Paleontology at the University of Tübingen in Germany and at the Northern Arizona University in the US. He obtained his Diploma in 2004 and worked then as a Marine Geologist for the Italian National Research Council (CNR-ISMAR) in Bologna (2004-2005). In 2005 he started to work as a Geoscientist within the GeoZentrum at the University of Erlangen-Nuremberg in Germany. His work in Italy and Germany focused on paleoceanographic and geobiological studies of deep-sea cold-water coral ecosystems, and involved his participation to numerous international scientific ship-expeditions to the Atlantic, the Mediterranean and the Red Sea. In 2008 the German Paleontological Society awarded Matthias for his research with the Tilly-Edinger-Award. He further worked as a guest scientist at the University of Bologna, Italy (DAAD-CRUI funded) in 2006 and 2007, visited Columbia University, New York, US as a guest researcher in 2011, and was temporarily employed at the French National Research Council (CNRS, Gif-sur-Yvette) in Paris, France (2012). His work on the "Geochronology and Geochemistry of Atlantic and Mediterranean cold-water corals" is currently in preparation as a PhD-thesis at the University of Erlangen-Nuremberg. In the winter semester 2014/ 15 Matthias worked as an AGEO Senior Intern and then joined GUTech in February 2015 as a Geoscience Lecturer.

Concepcion S. Mendoza holds a MS Chemistry degree (1993) from the University of San Carlos, Philippines, a PhD degree in Applied Chemistry/Environmental-Analytical Chemistry from Kagoshima University, Japan (1997) and in 2001-2002, did post-graduate studies in Water Chemistry at Karlsruhe University (presently, Karlsruhe Institute of Technology), Germany. She has been involved in teaching, research and consulting at the Chemistry Department of the University of San Carlos, Philippines, Research Center for the Pacific Islands and Department of Applied Chemistry and Chemical Engineering, both at Kagoshima University, Japan, at Engler-Bunte Institute, Karlsruhe University in Germany, and at the Department of Applied Sciences of the Higher College of Technology in Muscat, Oman. Her experience in the industry was as Quality Control Chemist of Coca-Cola Bottler's Inc., Philippines. Since April 2012, Concepcion is employed as an Associate Professor in Chemistry at the Department of Mathematics and Science of the German University of Technology in Oman. Her research focus is on the analytical chemistry of water, soil, air, biota, industrial products and other environment-related topics like water quality assessment and monitoring, wastewater treatment and characterization, air pollution studies, soil-sediment evaluation studies, solid waste audit, basic research on metal chelation.

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Florian Rupp studied Mathematics at the Technische Universität München, Germany, and holds both a Diploma in Mathematics (2003) as well as a PhD in Mathematics from the TU München (2005). In 2008 Florian returned from a position as Management Consultant to the TU München. During his time in consulting he had a major management part in a due diligence, procurement organization diagnosis & restructuring project for a leading pan-European vending company (private equity investment), as well as a benchmarking & procurement diagnosis/ strategy project for a leading global automation technology company to name just two activities. Several research and teaching stays led him to the Center for Theoretical and Computational Chemistry (CTCC) in Tromsø, Norway, the King Abdullah University of Science and Technology (KAUST) near Jeddah, Saudi-Arabia, the TU Vienna, the TU München and the African Institute for the Mathematical Science (AIMS) in Cape Town, South Africa. In 2013 Florian joined the Department of Mathematics and Science at GUtech. Together with Prof. Bernhard Heim he developed the concept of Kaizen Teaching. His research interests comprise stochastic dynamical systems and their stability/ bifurcations, Hamiltonian systems and (classical) molecular dynamics, applications and mathematical modeling in Chemistry, Biology, Engineering, and in particular the Social Sciences, as well as the simulation of Partial Differential Equations with stochastic/ random forcing or controls. In February 2015 he received, as Principle Investigator, the Open Research Grant of The Research Council of Oman on "Computer-Based Analysis of the Stochastic Stability of Mechanic Structures Driven by White and Colored Noise".

Wiekert Visser obtained his MSc in geology/ geochemistry at Utrecht University, and his PhD in Geology at the University of Illinois at Chicago. He joined Shell in 1979 as research geochemist. After a few years, he changed disciplines to seismic interpretation and worked as an interpreter in Oman. Also during his time in Oman he developed the first basin-wide hydrocarbon charge model for the interior basins. In 1989 he became team leader of the Seismic Stratigraphy services group within Shell, managing interpretation projects in a dozen countries. Subsequently he moved on to head the geochemistry research effort. Under his watch the new kernel for Shell's hydrocarbon generation and migration model was created. He finished his career within Shell as Chief Geochemist for the company. During the years 1999-2003 Wiekert was Manager of Exploration and Field Evaluation at the State Oil Company of Suriname, being responsible for the field development of the producing heavy oil field, onshore exploration, and the development of a coherent offshore exploration licensing strategy. In 2003 he established his own consultancy company "Cepex", and the consortium "EPTS"



Some impressions from the launching ceremony of "High Tea @ Science" in the rooms of the Department of Mathematics & Science at the end of the spring term 2015. This event is intended as a monthly informal interdisciplinary exchange forum and seminary for Mathematics and Science, Applied Geosciences and Engineering at GUtech. First talks in this series will take place in the winter term 2015/ 16, including talks by external speakers.

(Exploration & Production Training Services) together with a partner. Over the years he has carried-out numerous consultancy projects on hydrocarbon charge issues, and delivered world-wide > 50 professional courses on basin/charge modelling, seismic stratigraphy, geochemistry, and exploration geology. In September 2011 he joined Gutech as a part-time Professor in Petroleum Geosciences and is responsible for the MSc program in that subject.

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Preparing the Future – The Faculties Pillars of Actions

BERNHARD HEIM & FLORIAN RUPP

It is of no surprise that the ideal of Humboldt’s university is questioned in a decade of strong financial and business oriented trends. Universities all across the globe prepare themselves differently for the future, either by establishing tangible connections to their alumni, going for international partnerships and off-shore facilities, or building graduate centers focusing on entrepreneurship and education in economics (MBA).

Of course the core of universities is transformed and strengthened as well: researchers are getting valuable support from administration to submit promising grant proposals or faculties are re-grouped in the interdisciplinary understanding that each applied endeavor needs to be linked to a science in order to materialize new goals.

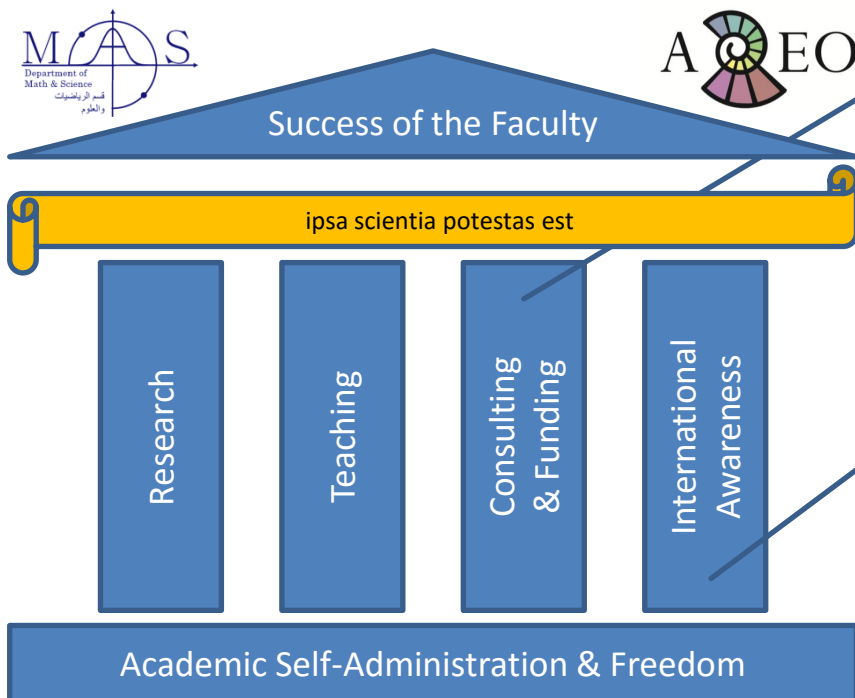
Teaching is another filed that displays the search for a new location in the global academic theatre best as current developments seem to be rather fast lived: Think about MOOCs. Hyped some years ago, their value is more than questioned; not only from the learning perspective but also from the financial side and in terms of reusability of contents.

A recent study, to name another example, surveyed the grade distribution in U.S. ivy league colleges. They found that students these days are much brighter than 20 years ago – or to frame it correctly: a continuous grade inflation is taking place.

To position itself in the global race and act as a reliable partner in the success of GUTech the Faculty of Science aims at succeeding in a four pillar score card (see below): Funded on Humboldt’s principles of academic self-administration and freedom (that of course contain certain services for the university as a whole, see the next article for instance) are the following categories:

- **Research** commonly measured in terms of journal papers, proceeding papers, book chapters, books, presentations, etc.
- **Consulting & Funding** including research grants for large scale projects, conferences, etc.
- **International Awareness** to market the brand GUTech and connect the Sultanate of Oman to the scientific world by research stays, invitations, hosting of conferences, etc., and
- **Teaching** (incl. the development of new teaching paradigms, like Kaizen learning, etc.)

In view of the growth of GUTech an essential question for the Faculty is how it is going to deal with increasing student numbers.



Current achievements:

- Research grants, e.g. from The Research Council of Oman
- Tamayouz – an in-house consulting project to restructure the pre-university program
- 3rd party funding for scientific activities, like the Oman drilling & seismic projects, international cooperation, workshops, ...

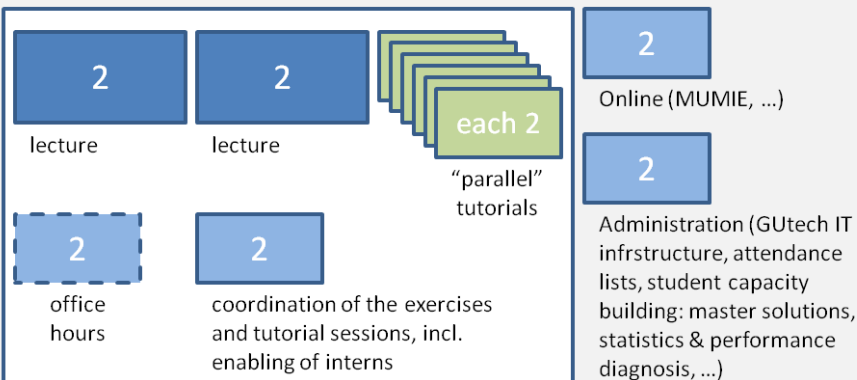
Current achievements:

- Research stays at pretentious international universities
- Organization of international conferences with leading scholars as speakers
- Editing of internationally recognized journals and books

Activity Report

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Elements of a larger Science lecture (more than 80 students) ...



... and organizational structure

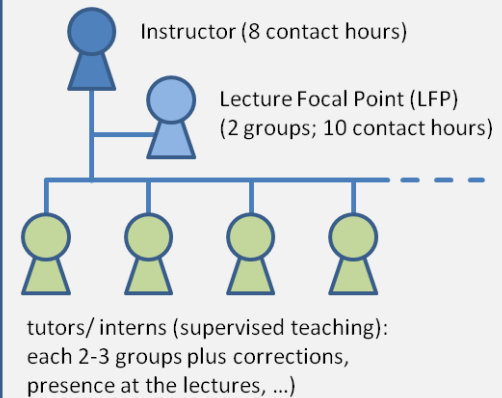


Illustration of a way of dealing with large lectures in order to include several side conditions for modern teaching.

How to structure the transition from small groups to lectures of many hundred students?

Continuously increasing student numbers and requirements by newly established study programs and combined lectures for different programs raise several challenging demands that are similar all over the world:

- no "typical" class-sizes and therefore no typical lecture schema
- education of students with heterogeneous and often insufficient pre-knowledge in the Sciences, especially in mathematics
- enabling weak students to perform well within the given frame of the syllabi
- optimal use of e-learning and blended learning in order to motivate students and keep required staff numbers low

In particular the increasing numbers of students lead to different types of lecture formats that cannot be evaluated and accounted to the contact hours in the same way:

- classes of 5 to 10 students
- classes of under 24 students (the labs allow for a maximum number of 24 students only)
- classes of under 80 students
- classes of over 80 students

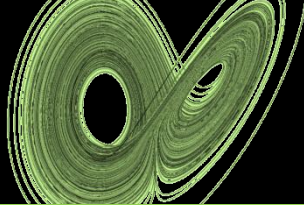
Certainly, different support systems are required for these types (small classes basically need no further support than the instructor), and large classes cannot be counted with all their tutorials 1-to-1 to the contact hours of the instructor (as there is support from different sources). To be aligned with best practice standards, one is tempted to consider the following schema for large courses (cf. the illustration on top of this page):

- The lectures are given by an instructor who is supported by the role of a "Lecture Focal Point" (LFP). Together they coordinate and supervise the exercises and tutorial sessions and enable the interns in giving tutorial classes.
- The LFP takes responsibility for online related activities (like MUMIE, Piazza, ...) as well as for the course related administration (like IT infrastructure, attendance lists, student capacity building (master solutions, extra tutorials, ...), Kaizen statistics and performance diagnosis, ...). In physics and chemistry the LFP also supports and supervises lab work.
- The LFP tutors about 2 of the of the sometimes parallel tutorials (student groups of up to 24 in the best case) in order to be close to the students needs and requirements. The number of tutorials depends on the class size and the number of available resources.
- As everywhere imposed a certain teaching qualification is required for conducting autonomous teaching, thus the interns are supervised and guided by the instructor and the LFP. The interns tutor 2-3 of the sometimes parallel tutorials.

Respecting the workload and actual teaching times (spend in front of the class, individually with students (e.g. during office hours, ...) or by enabling the lectures through student-centred administrative activities (online support, administrative support, supervision and enabling of interns, ...), the department supports the following system of "balanced contact hours" (BCH) as a measurement for the teaching hours:

- Tiny courses (less than 24 students): these courses can be given by one single instructor without support, the BCHs are thus the contact hours in class as described by the syllabus, i.e. the same number as the students have.

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- Small courses (above 24 students and up to 2-3 tutorials): these courses can be given by one single instructor with some support for corrections and administrative activities (these can be handled by a department pool), the BCHs are thus the contact hours in class as described by the syllabus for the lectures plus the contact hours in class as described by the syllabus for the tutorials times the number of tutorials.
- Mid-sized courses (above 24 students and with several tutorials supported by interns): these courses are given by one single instructor with a dedicated intern and with some support for corrections and administrative activities (these can be handled by a department pool), the BCHs are thus the contact hours in class as described by the syllabus for the lectures plus the contact hours in class as described by the syllabus for the tutorials times the number of tutorials that are actually given solely by the instructor (this excludes the tutorials where the instructor acts as a supervisor for the interns) plus a combination of office hours and coordination efforts with the supporting interns (usually 2 hours depending on the class size).
- Large courses (above 80 students were basically all tutorials are supported by interns): these courses are given by one single instructor with a dedicated LFP (as outlined above) and several dedicated interns. The BCHs of the instructor are thus the contact hours in class as described by the syllabus for the lectures plus the contact hours in class as described by the syllabus for the tutorials times the number of tutorials that are actually given solely by the instructor (this excludes the tutorials where the instructor or LFP acts as a supervisor for the interns) plus a combination of office hours and coordination efforts with the supporting interns (usually 4 hours depending on the class size and the number of interns). The BCHs of the LFP are in alignment of the role as outlined above thus the contact hours in class as described by the syllabus for the tutorials times the number of tutorials that are actually given solely by the instructor (this excludes the tutorials where the instructor or LFP acts as a supervisor for the interns) plus a combination of office hours and coordination efforts with the supporting interns (usually 2 hours depending on the class size and the number of interns) plus the efforts undertaken for online related activities (usually 2 hours) as well as for the course related administration (usually 2 hours).

As office hours may be shared for several parallel courses they should be carefully taken into consideration for the computation of the BCH.



Dr. Gärtner giving a talk at the Faculty of Science

Services of MAS for the University

Although, usual at leading universities the time and amount of work spent on diversified administrative matters that affect the smooth running of the university should not stay unmentioned:

The members of the Department of Mathematics and Science served as chairs and active members in several hiring committees, chaired the strategy committee of the Department of Applied Geosciences and held active roles in the Operational Finance, Human Resources and Infrastructure committees.

We served in the recruitment of Interns, are continuously updating the webpages and GUtech MyPortal sites for the Departments of Applied Geosciences and Mathematics and Science.

We had and have leading roles in the blended learning activities at GUtech and provide the Chemistry and Physics Laboratory for the foundation program, including the budget planning and resource allocation.

We continuously organize student events and mentor students for several programs not only during their BSc thesis phases. In particular, we served in the Faculty Mentored Undergraduate Research Award Program (FURAP) committee to select and encourage autonomous research projects of our students.

Reports for the accreditation of several programs were as well provided as invigilation duties and presentations at the orientation days of the programs for Computer Science, Engineering and Applied GeoSciences.

Finally, we have the leading role in compiling a research survey based on inputs of GUtech as a whole for The Research Council of Oman.

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Accreditation of the AGEO BSc Study Program in 2015

MICHAELA BERNECKER

The AGEO BSc program received a pre-accreditation for the start of GUtech in 2008/2009. The program was modified and adapted during the last 6 years until the re-accreditation in 2015. Some minor changes currently made were related to the internal structure, module size, position in the timeline and prerequisites. The ratio of contact hours to self study and of lectures to practical lab sessions were balanced based on practical teaching experience over the years.

A focus on Petroleum Geology PGEO, Hydrogeology HGEO and Mineral Resources Geology MGEO was planned from the beginning for the AGEO BSc Program as tailor-made for the job market in Oman by the team of RWTH Aachen professors. Petroleum Geology was up to now the dominant specification, but with the recent employment of Prof. Ekkehard Holzbecher (Hydrogeology) and Prof. Wilfried Bauer (Mineral Resources Geology) we started already to strengthen the two other fields of Geosciences.

With an increasing number of students expected in the future we will offer a specification in all three fields for the BSc students on the project courses as BSc project, internship project, team project and field projects. Implementation is partly done with BSc and Internship projects already.

Two team project electives in PGEO and HGEO will be offered as selected by student interest in winter semester 2015/16 and an additional MGEO team project will be offered in winter semester 2016/17. The three electives in field projects (Excursion III) are planned for winter semester 2016/17.

Parallel to the modifications in the BSc program with the goal to strengthening HGEO and MGEO, the AGEO professors suggested an Integrated MSc Program named Applied Geosciences AGEO with specifications in PGEO, HGEO and MGEO. The new MSc should replace the existing PGEO MSc program in the future. The integration is based on the concept that AGEO topics, relevant for the economic and environmental future of Oman, will be in the focus of the final year of the BSc studies. The focus on Petroleum, Water and Mineral Resources will be carried forward into an integrated Master Program. This will enable us to target additional groups of potential students from Oman and the wider region and also the rising number of our own graduates from AGEO.

Geo-Engineering courses are planned to be established in 2016/17 with the electives Petroleum Engineering, Hydro Engineering and Mining Engineering on undergraduate level, similar to that in the Integrated AGEO MSc.



An internship at a research institution or a company in Oman or abroad is an important part of the study program and gives the BSc students an insight in their future work and an individual opportunity for training on the job. In the Academic Year 2014/15 the 12 final year AGEO BSc students and graduates in 2015 did internships in

- 1) PDO Exploration (Samira Al-Balushi: Hydrogeology, Bushra Al-Quraishi and Shahla Al-Mahrooqi: Sedimentology; Saleh Al-Ismaïl: Conventional Oil team; Maryam Al-Balushi: Khulud Unconventional Oil team and Muzna Al-Zidjali: Petrophysics);
- 2) Other companies in Oman (Noof Al-Hinai: Geo Resources Company and Saleem Al-Shukairi: Petrogas);
- 3) Research institutions and companies outside Oman (Ahmed Al-Taan: Wintershall Norge and FAU Erlangen, Germany; Saif Bawany: Stockholm University, Sweden; Amira Al-Saifi and Maryam Al-Naamani: Helmholtz Centre for Environmental Research UFZ, Germany).

Five of the AGEO graduates went for post-graduate study to UK (University of Manchester, Derby and Harington Watt Edinburgh).

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Tamayouz: Race for Excellence

AHMED AL-SALMI, BERNHARD HEIM
& FLORIAN RUPP

Every enterprise has to face the challenge of reflecting its decisions and scrutinize the path it is taking. As a young university GUtech still has the thrilling vibe of start-up and the eagerness to adjust even business units if required. Spring 2015 it was time to re-examine the GUtech Foundation program and re-align it to best practices observed in the last years of operation. Together with the General Manager of Foundation a team from the Department of Mathematics & Science strategically supported by members of GUtech's Rectorate and operationally supported by the Mathematics & Science teachers from Foundations took on the race for excellence: Tamayouz. After the Tamayouz project had successfully proposed a streamlined way of teaching Mathematics in Foundation this approach was assimilated by Oman Education Services and GUtech to transform its complete Foundation program into the new "GUbridge" operations unit affecting over half of GUtech's teaching staff and a third of its students.

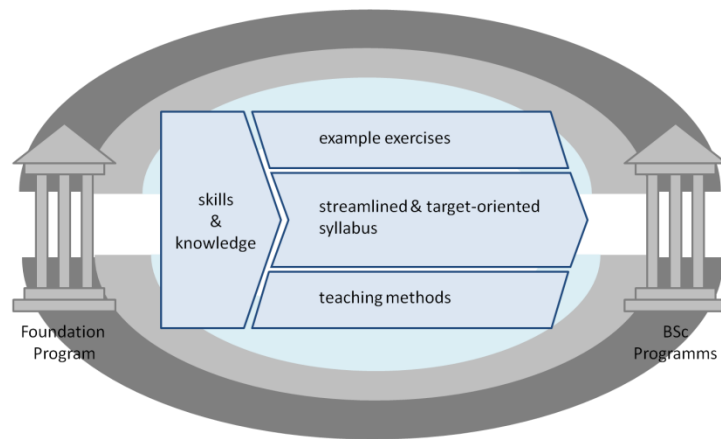
Since its beginning the highly qualified members of the Foundation program served enthusiastically as the bridge between schools in the Sultanate of Oman and the demands of an internationally competitive higher education in the BSc programs. Changing external and internal demands made it necessary to formalize and improve the teaching methods used so far in Foundation.

It is clear that every change has to begin by analyzing the demands: what are the skill and knowledge sets students need to know in the BSc programs and which skills do they already possess from their schooling. Foundation thus is, loosely speaking, filling this gap. Based on a comprehensive study from German universities the team agreed to use this "COSH" document as the line from which the knowledge gap of the students may be measured and that should be achieved at the end of the Foundation year(s). As a knowledge provider the Foundation program now has to answer three questions to facilitate the transition from school to BSc programs:

- (1) How can the COSH level be tested and how can it be continuously assured that the transition is taking place with the required speed?
- (2) How can we rise weaker students to the expected level? (this obviously needs to be connected and fixed in a syllabus), and
- (3) How can the topics be most efficiently and effectively be taught?



The Tamayouz core-team (Sausan Al-Riyami, Ahmed Al-Salmi, Bernhard Heim and Florian Rupp) at work in their think tank at More Café in the wave.



Combined efforts will lead to an efficient and effective entry to GUtech's BSc programs. These efforts are grouped into four essential pillars

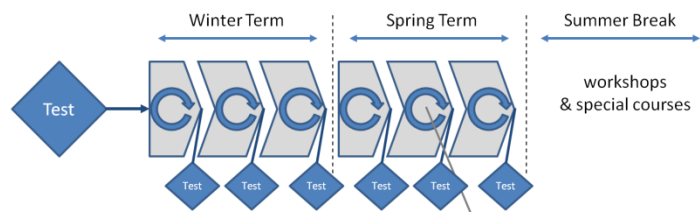
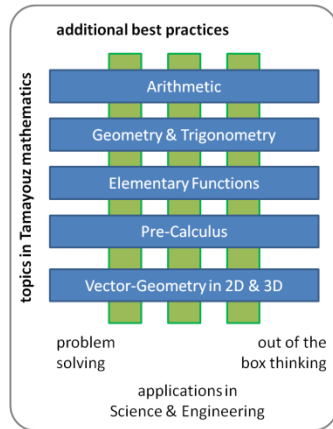
1. **Skills & knowledge:** What are the students expected to know?
2. **Example Exercises:** How can we test this?
3. **Syllabus:** How can we rise weaker students to the expected level? e.g. Advanced mathematics, Standard mathematics, and Study skills (what else is required?)
4. **Teaching Method:** How do we have to teach?

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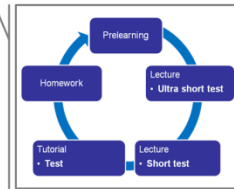


- experience of the team members
- degree program demands
- COSH catalogue
- OMB* as electronic support for the implementation



New features:

- Cybernetic teaching techniques & kaizen learning will be implemented as instant feedback-loop mechanisms to optimize learning (incl. e-learning)
- Intensive mentoring of the students will lead to at least 50% improvement compared to the entry test
- Quality assurance by BSc M&S
- Classes are assembled based on the entry test scores (increasing homogeneity in the classes)



International best practice considerations led to a streamlined distribution of the Mathematics topics that were next arranged in a modular way and to be taught by means of student centered cybernetic teaching techniques based on Kaizen learning.

In a first step international best practices led to a restructuring of the topics to be taught in Foundation mathematics:

- **Arithmetic** without calculators (although being somehow strange, mathematics exams at the BSc level are without calculators so the students need to get familiar again to elementary operations, like dividing 18 by 6),
- **Geometry & Trigonometry** (most if not all statements in Mathematics and Physics can and should be motivated by geometric analogies so the students need to refresh their base of examples such that it later on can be accessed),
- **Elementary Functions** (like linear functions, quadratic functions, polynomials, Sine and Cosine are typical examples in lectures so the students need to know how to evaluate them and in particular sketch their graphs),
- **Pre-Calculus** (although revised (on a theoretical level) in the first year of the BSc programs a solid basis of methods and techniques in differentiation and integration is highly recommended, the speed of the BSc lectures does not compensate deficiencies in computing, structural and theoretic concepts beyond calculus are in the focus of BSc mathematics), and
- **Vector-Geometry in 2D & 3D** (are the foundation for many examples in lectures so the students need to be very familiar with these topics).

These topics will be blended with problem solving skills, out of the box thinking examples and exercises as well as with applications in Science and Engineering. In view of the student's success in learning it is essential to link the topics to interesting examples and exercises that deal with the future career or current extra-curricular knowledge reality of the students.

The structure of the Foundation courses is changed as well: instead of one course with a mid-term and a final exam, the courses are module based with the goal to achieve the demanded learning outcomes in each of the topic categories. These leads to shorter "mini"-courses that can be taken in a modular way by the students. For instance, a student who has in a placement test shown excellent knowledge in "Geometry & Trigonometry" but lacks "Pre-Calculus" will have the option to attend just the "Pre-Calculus" mini-course (and those that are necessary such that he scores good enough in all required topics). There will not be the need to take classes that repeat topics the students are already good in.

Breaking-up the course structure accounts for further benefits for the students: regular tests after each of the mini-courses ensure timely feedback on the learning progress. Moreover new teaching methods, like the student centered cybernetic teaching approach will be put in place.

The logo of the Activity Report displays the positively invariant manifold of the famous Lorenz attractor. In 1963 Edward Lorenz designed a simple 3-dimensional model for convections and weather formation in the atmosphere. To his great astonishment the solutions of this system turned out to capture a great sensitivity on the chosen initial data, two trajectories starting nearby ended at certain simulation times at completely different spots. This behavior together with the strange shape of the attractor coined the term "butterfly effect" which means that a change as light as the flap of a butterfly of the initial data may have drastic results in the longer run. The peculiar nature of the long time dynamics, their swirling into the attractor gave rise to the study of chaotic systems. In particular, the geometry exhibited by the Lorenz attractor itself is that of a fractal object with a Hausdorff dimension of about 2.06.

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This approach is derived from the paradigm of kaizen learning recently developed by Heim and Rupp (see list of publications). It allows to realize instant feedback-loop mechanism to optimize learning by bringing Kolb's learning cycle to the classroom:

- Prelearning at home (e.g. some easy exercises that prepare the new topics),
- Lecture with ultra short tests (introduction of new topics and anchoring of core concepts),
- Tutorials (intensive exercise sessions that recap the core concepts, correction of given homework assignments and prepare for the homework assignments), and finally
- Homework Assignments (application of the core concepts and active problem solving).

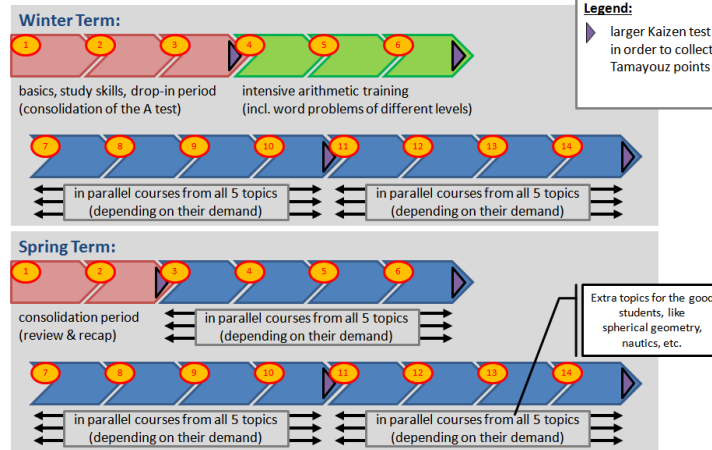
This approach is compatible with existing methods- of blended and e-learning. Together with an intensive mentoring program this will lead to an at least 50% improvement compared to the placement test at the entry to the Foundation program.

Additionally and in order to facilitate the cybernetic feedback loops a completely new class structure of mathematics at Foundation programs will be implemented. In order to mimic BSc courses and thus better prepare students for academic live the mini-courses are delivered in a combination of lectures and exercises sessions. The lectures will deal with the delivery of new topics whereas the tutorials are student centered and will be held in small groups ideally not exceeding 20 students per teacher (a class size assumed to be optimal in language courses as well). In particular, if required this system is scaled easily as the lectures have just the size of the lecture hall as a limit and additional tutorials are easy to organize thus avoiding the immense overhead of coordinating several smaller groups (of about 25-30 students and where the same topics are discussed in parallel).

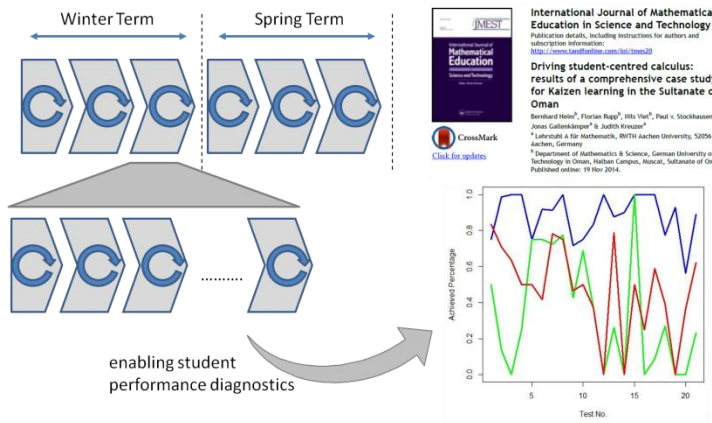
Finally, quality control of the Foundation mathematics activities will be ensured by the BSc mathematics & science programs as they are the "customers" of the Foundation program.

J. Gallenkämper, B. Heim, J. Kreuzer, F. Rupp, P. v. Stockhausen & N. Viet (2015): *Kaizen Teaching and the Learning Habits of Engineering Students in a Freshman Mathematics Course*, Central European Journal of Operations Research, first published online: 02/ 09/ 2015, doi: 10.1007/s10100-015-0416-5.

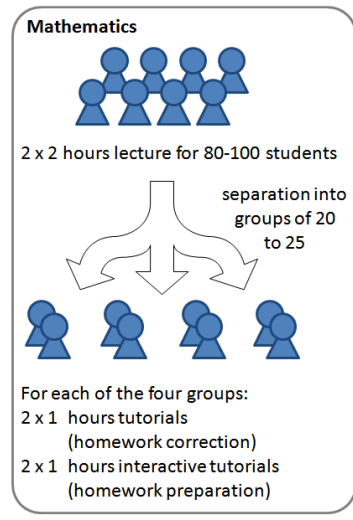
B. Heim, F. Rupp, N. Viet P. v. Stockhausen, J. Gallenkämper & J. Kreuzer (2015): *Driving Student-Centred Calculus: Results of a Comprehensive Case Study for Teaching in the Sultanate of Oman*, International Journal of Mathematical Education in Science and Technology, 46 (3), pp. 354-369.



Overview (from the topics perspective) of the new mathematics semesters with consolidation and individual study phases.



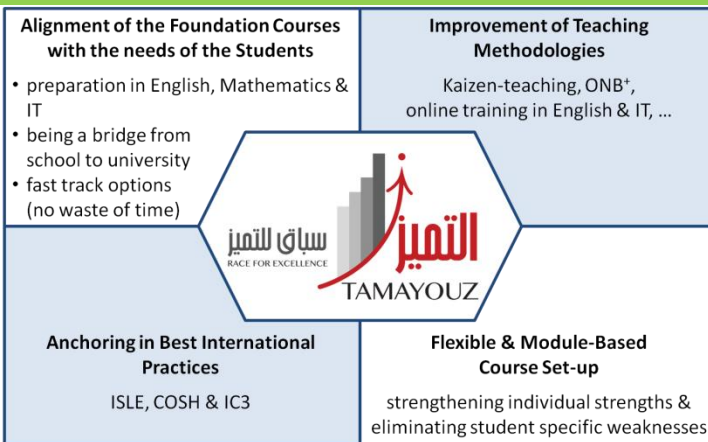
Once established the paradigm of Kaizen learning enables to track the performance of students and identify areas where more efforts have to be invested.



To simulate the lectures in the BSc programs a similar separation between lectures and exercise groups will be provided with a focus on student centered teaching.

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The results of project Tamayouz in a nutshell.

The change of the Foundation mathematics courses and its expected benefits were such promising that the streamlining approach of the Tamayouz team was requested by Oman Education Services and the Rectorate of GUtech to be applied to the whole of Foundation. As proposed by the Rector the thus transformed new operational organization became the name "GUbride" to clearer state its essential role between schools and the BSc programs.

In a nutshell the four result fields of Tamayouz and driving blocks of GUbridge are

- **Alignment of the courses with respect to the actual needs of the students** (English, Mathematics & IT are key, fast track options are possible, but quality is determining the track of a student – there is no such thing as free riding),
- **Anchoring in best practices** (ISLE for English, COSH for Mathematics, and IC3 for IT),
- **Best and state of the art teaching methodologies and tools** (Kaizen teaching, online training in Mathematics (ONB+) and the languages & IT), and
- **Flexible and module based course set-up** (in order to strength the student's individual strengths and eliminating their specific weaknesses).

The in-house consulting project Tamayouz was carried out during the last two months of the lecture time of the spring semester 2015. We would like to thank the Board of Oman Education Services, the Rectorate of GUtech, supporters from the Sultan Qaboos University and the Ministries of Education and Higher Education as well as the Foundation Mathematics team for their continuous support and encouragement during this dense and work-loaded period.

Supervised External PhD- & MSc-Theses

Though not having in particular a own PhD-program, we supported the following external students (incl. MSc theses):

- Professor Dr. Elena Berdysheva supervised
 - Katharina Baumann (since 2014): *Operators of Bernstein-Durrmeyer Type with Weights*, PhD Thesis, University of Wuppertal/ GUtech
- Professor Dr. Michaela Bernecker supervised
 - Caroline Hofmann (2015): *Microfacies and Paleontology of Early Eocene Limestones in Central Oman*, MSc Thesis, Friedrich-Alexander-University Erlangen
- Professor Dr. Bernhard Heim supervised
 - Judith Kreuzer (2011-2014): *Borchers Lifts and Maass Lifts on the Paramodular Group of Level 3*, PhD Thesis, RWTH Aachen/ GUtech
 - Till Dieckmann (until 2015): *Pullback Theory for Functions of Lattice-Index with Applications on Jacobi- and Modular Forms*, PhD Thesis, RWTH Aachen
 - Jonas Gallenkämper (since 2013): *Hecke Theory for the Orthogonal Group*, PhD Thesis, RWTH Aachen/ Gutech
 - Stephan Bless (since 2015): *The Maass Space*, PhD Thesis, RWTH Aachen
- Professor Dr. Ekkehard Holzbecher supervised
 - Sandra Oelmann (2015): *Development and application of a modelling approach for distributed karst aquifer characterization and groundwater residence time derivation*, PhD Thesis, Georg-August Univ. Göttingen
 - Manuel Cánovas Vidal (2014): *Dimensionless Characterization and numerical simulation of benchmark scenarios (Bénard, Yusa and Elder) on flow and transport geothermal processes*, PhD Thesis, Technical University of Cartagena
 - Hannes Räuschel (2014): *Optimierung mitteltiefer Erdwärmesonden im Zechsteinsalz durch numerische Modellierung*, MSc Thesis, Georg-August University Göttingen

Activity Report

Department of Applied Geosciences
Departments of Mathematics & Science

Achievements in Research

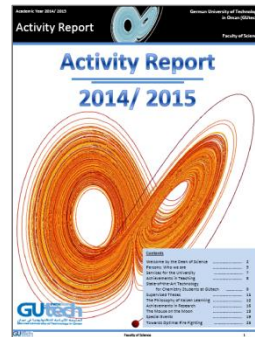
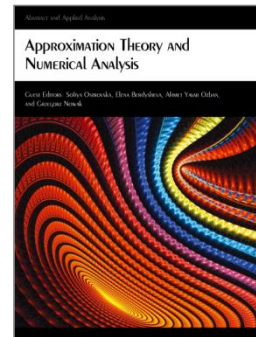
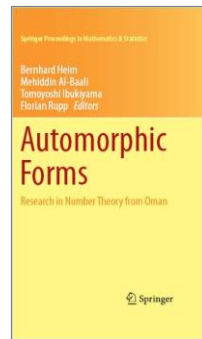
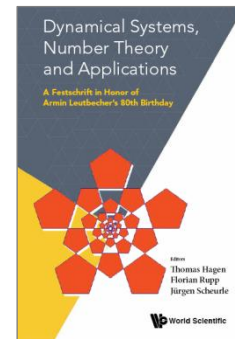
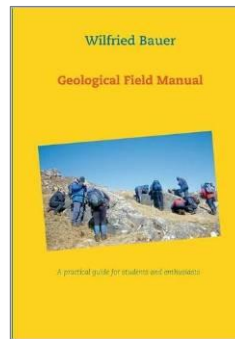
In 2014 and 2015 a number of books and articles could be published by us (1/ 1/ 2014 until 20/ 10/ 2015):

Books, Anthologies & Special Issues:

1. W. Bauer (2015): Geological Field Manual, A practical guide for students and enthusiasts, BoD.
2. Th. Hagen, F. Rupp & J. Scheurle (Eds., 2016): Dynamical Systems, Number Theory and Applications: A Festschrift in Honor of Armin Leutbecher's 80th Birthday, Word Scientific.
3. B. Heim, M. Al-Baali, T. Ibukiyama & F. Rupp (Eds., 2014): Automorphic Forms - Research in Number Theory from Oman, Springer Proceedings in Mathematics & Statistics (Vol. 115), Springer-Verlag.
4. S. Ostrovska, E. Berdysheva, A. Y. Ozban & G. Nowak (Eds., 2014): Special Issue "Approximation Theory and Numerical Analysis" of Abstract and Applied Analysis, Volume 2014.
5. B. Heim & F. Rupp (Eds., 2014): Activity Report of the Department of Mathematics & Science, GUtech, Muscat.

Journal Articles:

1. E.E. Berdysheva & E. Al-Aidarous: *Szasz-Mirakjan-Durrmeyer and Baskakov-Durrmeyer operators with respect to arbitrary measure*, Jaen Journal on Approximation, in press.
2. H. Dizer, B. Brackmann, M. Azizur Rahman, R. Szewzyk, C. Sprenger, E. Holzbecher & J.M. Lopez-Pila (2015): *Virus removal vs. subsurface water velocity during slow sand filtration*, J. of Water and Health, 13(2), pp. 371-382.
3. T. Duret, P. Agard, P. Yamato, C. Ducassou, E.B. Burov, & T.V. Gerya (2015): *Thermo-mechanical modelling of the obduction process based on the Oman ophiolite case*, Gondwana Research, available online 3 March 2015, doi:10.1016/j.gr.2015.02.002
4. J. Gallenkämper, B. Heim & A. Krieg: *The Maass Space and Hecke Operators*, submitted.
5. J. Gallenkämper, B. Heim, J. Kreuzer, F. Rupp, P. v. Stockhausen & N. Viet (2015): *Kaizen Teaching and the Learning Habits of Engineering Students in a Freshman Mathematics Course*, Central European Journal of Operations Research, first published online: 02/ 09/ 2015, doi: 10.1007/s10100-015-0416-5.
6. B. Heim & P. Garret (2015): *Hecke Duality of Ikeda lifts*. *Journal of Number Theory*, Journal of Number Theory, 146, pp. 171-186.



7. B. Heim & A. Murase (2015): *A Characterization of Holomorphic Borchers Lifts by Symmetries*, International Mathematics Research Notices 2015, doi: 10.1093/imrn/rnv021.
8. M. Jakubowicz, B. Berkowski, M. López Correa, E. Jarochovska, M. Joachimski & Z. Belka (2015): *Stable isotope signatures of Middle Paleozoic ahermatypic rugose corals – deciphering vital effects, alteration patterns, and palaeoecological implications*, PLOSone, doi: 10.1371/journal.pone.0136289.
9. F. Rupp & J. Scheurle (2015): *The Dynamics of the Jellyfish Joyride: Mathematical Discussion of the Causes to Blooming*, Math. Methods in the Applied Sciences, doi: 10.1002/mma.3347
10. F. Rupp (2015): *Static & Rigid Rotor Configurations of Three Classical 12-6-Lennard-Jones Particles, Few Body Systems*, 56(2), pp. 81-105.
11. M. Taviani, F. Franchi, L. Angeletti, A.M. Correggiari, M. López Correa, V. Maselli, C. Mazzoli & J. Peckmann (2015): *Biotrital carbonates on the Adriatic continental shelf imprinted by oxidation of seeping hydrocarbons*, Marine and Petroleum Geology (online 03/2015). doi:10.1016/j.marpetgeo.2015.03.015.
12. J. Titschack, D. Baum, R. De Pol-Holz, M. López Correa, N. Forster, S. Flögel, D. Hebbeln & A. Freiwald (2015): *Aggradation and carbonate accumulation of Holocene Norwegian cold-water coral reefs*, Sedimentology (online 03/2015). doi:10.1111/sed.12206.

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13. N. Al Habsi, M. Al Shukailli, S. Al Tooqi, S.N. Ehrenberg & M. Bernecker (2014): *Lithofacies, diagenesis and reservoir quality of Upper Shu'aiba reservoirs in northwestern Oman*, Georabia 19/4, 145-182, Gulf Petrolink, Bahrain.
14. E. E. Berdysheva & B.-Z. Li (2014), *On L^p -convergence of Bernstein-Durrmeyer operators with respect to arbitrary measure*, Publ. Inst. Math., Nouv. Sér., in press.
15. E. E. Berdysheva (2014), *Bernstein-Durrmeyer operators with respect to arbitrary measure, II: pointwise convergence*, J. Math. Anal. Appl. 418 (2014), 734-752.
16. T. Flå, F. Rupp & C. Woywod (2014): *Bifurcation Patterns in Generalized Models for the Dynamics of Normal and Leukaemic Stem Cells with Signaling*, Math. Methods in the Applied Sciences, doi: 10.1002/mma.3345.
17. F. Gazeau, S. Alliouane, C. Bock, L. Bramanti, M. López Correa, M. Gentile, T. Hirse, H.-O. Pörtner & P. Ziveri (2014): *Impact of ocean acidification and warming on the Mediterranean mussel (Mytilus galloprovincialis)*, Frontiers in Marine Science 1, Article 62, 1-12 (Open Access), doi: 10.3389/fmars.2014.00062.
18. B. Heim, F. Rupp, N. Viet P. v. Stockhausen, J. Gallenkämper & J. Kreuzer (2015): *Driving Student-Centred Calculus: Results of a Comprehensive Case Study for Teaching in the Sultanate of Oman*, International Journal of Mathematical Education in Science and Technology, 46 (3), pp. 354-369.
19. E. Holzbecher & P. Oberdorfer (2014): *Rock deformation due to geothermal heat production – a modelling study*, Europ. Oil & Gas Magazine, 40 (1), pp. 25-26.
20. Y. Jin, E. Holzbecher & M. Sauter (2014): *A novel modeling approach using arbitrary Lagrangian-Eulerian (ALE) method for the flow simulation in unconfined aquifers*, Computers & Geosciences, 62, pp. 88-94.
21. S. Ohmagari, T. Hanada, Y. Katamune, S. Al-Riyami & T. Yoshitake (2014): *Carrier Transport and Photodetection in Heterojunction Photodiodes Comprising n-Type Silicon and p-Type Ultrananocrystalline Diamond/ Hydrogenated Amorphous Carbon Composite Films*. Jpn. J. Appl. Phys. 53 050307.
3. E. E. Berdysheva & H. Berens (2014): *On a discrete Turán problem for l_1 radial functions*, in press, in G. Schmeisser & A. Zayed (Eds., 2014): *New Perspectives on Approximation and Sampling Theory - Festschrift in honor of Paul Butzer's 85th birthday*, Birkhaeuser.
4. M. Bernecker (2014): *Paleogene Carbonates of Oman: Lithofacies and Stratigraphy*. In: Rocha, R., Pais, J., Kullberg, J.C., Finney, S. (Eds.): *STRATI 2013 At the Cutting Edge of Stratigraphy*. Series Geology 71-74, Springer, Heidelberg.
5. C. Riesinger, T. Neckel, F. Rupp, A. Parra Hinojosa & H.-J. Bungartz (2014): *GPU Optimization of Pseudo Random Number Generators for Random Ordinary Differential Equations*, Procedia Computer Science, Proceedings of the International Conference of Computational Science 2014 (Cairns, AUS), Volume 29, pp. 172 – 183.

Conference Publications & Technical Reports:

1. M. Bernecker (Ed., 2015): *12th International Symposium on Fossil Cnidaria and Porifera 2015 GUtech*, Abstract Volume, GUtech Geoscience Conference Publication 2, Muscat.
2. M. Bernecker, A. Baud & O. Weidlich (Eds., 2015): *Permian and Triassic Coral Sponge Limestones in the Oman Mountains*, 12 ISFCP Pre-Conference Field Workshop, GUtech Geoscience Conference Publication 2, Muscat.
3. M. Bernecker & O. Weidlich (2015): *Platform and reefal limestones of the Permian Saiq and the Triassic Misfah Formation in the central Hajar Mountains*, 12 ISFCP Pre-conference FT 2 Guide-book, Muscat.
4. A.P. Jesus (2015): *Provenance analysis of stone cannonballs recovered from a XVI century Portuguese East Indiaman shipwreck in Oman – preliminary report*, Technical scientific report to Blue Water Recoveries Ltd, 11pp.
5. F. Mattern, A. Scharf, M. Bernecker, D. Moreatis & B. Pracejus (2015): *Geological Fieldtrip to Al Khoud Area*, 12 ISFCP Conference Field Guide-book FT 3, Muscat.
6. E. Holzbecher (2014): *Energy pile simulation – an application of THM-modeling*, COMSOL2014, Cambridge (UK)
7. E. Holzbecher & H. Rauschel (2014): *Heat transfer in borehole heat exchangers from laminar to turbulent conditions*, COMSOL2014, Cambridge (UK)

Articles in Refereed Proceedings & Anthologies:

1. E.E. Berdysheva: *Operators of Durrmeyer type with respect to arbitrary measure*, In: Springer Proceedings in Mathematics & Statistics, in press
2. B. Heim (2015): *A New Type of Functional Equations of Euler Products*, In: Th. Hagen, F. Rupp & J. Scheurle (Eds., 2016): *Dynamical Systems, Number Theory and Applications: A Festschrift in Honor of Armin Leutbecher's 80th Birthday*, Word Scientific, in press.

Activity Report

Department of Applied Geosciences
Departments of Mathematics & Science



(left) AGEO BSc students received the grant notification letters by the Rector Prof. Dr.-Ing. Michael Modigell in the atrium of GUtech. (right) Discussion of the second mover advantage at the workshop “Economics of Conflict”.

Research Grants & Scholarships

Scholarships for AGEO students

AGEO Semester 6 students received partial scholarships to participate in the International Carbonate Course at FAU Erlangen in February 2015. This opportunity is given to high performing students from GUtech every year by Prof. Dr. Michaela Bernecker from FAU University.

Conference/ Workshop Grants

- Michaela Bernecker: TRC-Grant to conduct the conference “12th International Symposium on Fossil Cnidaria and Porifera”
- Florian Rupp: TRC-Grant to conduct the workshop “Economics of Conflict” (additionally supported by the Deanship of the Sultan Qaboos University, the “Research Center Indian Ocean”, as well as by the Accedo Publishing House) with Co-Scientific Organizer Bernhard Heim

TRC Open Research Grant

“Computer-Based Analysis of the Stochastic Stability of Mechanic Structures Driven by White and Colored Noise”

Principal Investigator: Prof. Dr. Florian Rupp (GUtech)
Co-Principal Investigators: Prof. Dr. Bernhard Heim (GUtech) and Prof. Dr. Mohammed Al-Lawati (Sultan Qaboos University)

The project “Computer-Based Analysis of the Stochastic Stability of Mechanic Structures Driven by White and Colored Noise” brings two streams of cutting edge research together

and pursues the algorithmic construction of stochastic Lyapunov-functions and their randomized basins of attraction by means of radial basis functions and sums of square decomposition. Prone to natural catastrophes like earthquakes and tropical storms the citizens of the Sultanate of Oman are well aware of what systems subject to noise are and how desirable detection of stable situations are for their safety and protection of their properties. From a mathematical point of view the last decades witnessed two remarkable developments taking place in parallel: on the one side powerful techniques have been investigated for the analytic study of white and colored noise driven systems, like Itô’s calculus, Fokker-Planck and approximate Fokker-Planck equations, and to detect the stochastic stability of equilibrium solutions in terms of path-wise concepts, stochastic Lyapunov-functions or the notions of pull-back attractors. On the other hand numerical studies of deterministic systems and the construction of Lyapunov-functions by means of radial basis algorithms (numerical approximation problems) or sum of square decomposition (algebraic and semi-linear optimization methods) lead to powerful insights into the local deterministic dynamics as well as to valuable estimates for the basins of attraction. Now, it is time to unite these two strains.

The grant was received at the 25th of January 2015 and the project began at the 1st of April 2015.

Further TRC Open Research Grants are in the ramp-up phase or submitted and we will give detailed information and a concise status update in the next Activity Report where (hopefully) sufficient success can be documented.

Activity Report



Teaching at Math & Science

During the academic year 2014/ 15 the members of the department gave 22 courses for about 1245 students altogether (counted by student and course, i.e. the actual effort) across four lines of study programs:

Winter Term 2014/ 15:

- Mathematics I for Engineering, Computer Science & Logistics (lectures, consultation hours, corrected homework assignments, exams, quizzes, e-learning with MUMIE, and exercises for about 150 students)
- Special Topics or Mathematics I for Computer Science (lectures, consultation hours, corrected homework assignments, exams, quizzes, and exercises for about 10 students)
- Special Topics or Mathematics I for Logistics (consultation hours and exercises for about 30 students)
- Physics I for Engineering (lectures, consultation hours, corrected homework assignments, exams, quizzes, lab experiments, and exercises for about 110 students)
- Chemistry I for Engineering (lectures, consultation hours, corrected homework assignments, exams, quizzes, lab experiments, and exercises for about 110 students)
- Chemistry for Applied Geosciences (lectures, consultation hours, corrected homework assignments, exams, quizzes, lab experiments, and exercises for about 40 students)
- Mathematics III for Engineering (lectures, consultation hours, corrected homework assignments, exams, quizzes, and exercises for about 100 students)
- Mathematics for Earth Scientists I (lectures, consultation hours, corrected homework assignments, exams, quizzes, and exercises for about 40 students)
- Mathematics for Earth Scientists II (lectures, consultation hours, corrected homework assignments, exams, quizzes, and exercises for about 15 students)
- Numerical Computation for Computer Science (lectures, consultation hours, corrected homework assignments, exams, quizzes, computer labs with MATLAB, exercises and research projects for about 10 students)
- Microeconomics and Game Theory (The Art of Agent-Based Modeling) for Logistics (lectures, consultation hours, corrected homework assignments, interactive computer simulations and labs and exercises for about 30 students)

Remark:

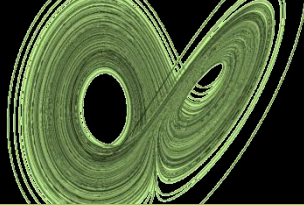
- The lecture “Logic and Discrete Structure for Computer Science” (winter term 2014/ 15) was shared with the Department of Computer Science (Prof. Dr. Rudolf Fleischer)

Spring Term 2015:

- Mathematics II for Engineering & Computer Science (lectures, consultation hours, corrected homework assignments, exams, quizzes, e-learning with MUMIE, interactive online elements based on the Q&A platform piazza, and exercises for about 150 students)
- Special Topics or Mathematics II for Computer Science (lectures, consultation hours, corrected homework assignments, exams, quizzes, and exercises for about 10 students)
- Special Topics or Mathematics II for Logistics (consultation hours and exercises for about 30 students)
- Physics II for Engineering (lectures, consultation hours, corrected homework assignments, exams, quizzes, lab experiments, and exercises for about 110 students)
- Physics for Applied Geosciences (lectures, consultation hours, corrected homework assignments, exams, quizzes, lab experiments, and exercises for about 40 students)
- Chemistry II for Engineering (lectures, consultation hours, corrected homework assignments, exams, quizzes, lab experiments, and exercises for about 110 students)
- Mathematics IV for Engineering (lectures, consultation hours, corrected homework assignments, exams, quizzes, computer labs with MATLAB, and exercises for about 100 students)
- Simulation Techniques for Engineering (lectures, consultation hours, corrected homework assignments, exams, quizzes, computer labs with SciLab & Xcos, interactive online elements based on the Q&A platform piazza, and exercises for about 35 students)
- Logic & Discrete Structures for Computer Science (lectures, consultation hours, corrected homework assignments, exams, quizzes, set-up & maintenance of a course home page, and exercises for about 10 students)
- Probability for Computer Science (lectures, consultation hours, corrected homework assignments, exams, quizzes, set-up & maintenance of a course home page, and exercises for about 5 students)
- Interpretation of Data and Critical Thinking for Applied Geosciences & Logistics (lectures, consultation hours, corrected homework assignments, exams, quizzes, and exercises for about 70 students)

Compared to the academic year 2013/ 14 (cf. last years Activity Report of the Department of Mathematics & Science) this means an increase by 7 courses and a doubling of the cumulative student numbers (i.e. the actual efforts).

Activity Report



Teaching at AGEO

Over the reporting period, AGEO delivered 50 courses to 88 students. One student finally dropped-out in WS.

Winter Term 2014/ 15

AGEO 1 40 students

- Planet Earth
- Rocks and Minerals
- Geological Mapping I
- Geological Field work
- Geosciences Seminar

AGEO 3 20 students

- Structural Geology
- Sedimentology
- Water Cycle I
- Surface Processes and Soils
- Palaeontology
- Geological Field Methods
- Excursions I to Salah

AGEO 5 16 students

- Geological Evolution of Oman
- Geohazards
- Introduction to GIS
- Rock Microstructures - Petrology
- Remote Sensing and Image Analysis
- Quantitative Field Methods
- Vadose and Phreatic Zone
- Communication and Presentation
- Excursions II to Spain

AGEO 7 12 students

- Mineral Exploration
- Applied Geophysics
- Petroleum Exploration
- Geological Visualisation
- Geomechanics in Hydrocarbon Geology
- Hydrogeological Field Methods
- Team project
- Excursions III Huqf Mapping Course

Spring Term 2015

AGEO 2 40 students

- Earth History
- Geol. Mapping II
- Microscopy
- Laboratory Methods
- Communication Skills

AGEO 4 20 students

- Geochemistry
- Geophysics
- Geodynamics and Tectonics
- Introduction to Mineral Resources
- Introduction to Petroleum Geology
- Water Cycle II
- Scientific Reading and Writing

AGEO 6 15 students

- Petrophysics, and Log Evaluation
- Applied Structural Geology
- Applied Sedimentology
- Hydraulic Test
- Groundwater flow
- Hydrogeochemistry
- Mineralogy
- Project Management

AGEO 8 12 students

- Internship
- Bachelor's Thesis
- BSc Colloquium

(right) The AGEO final year BSc students on Rig 72 during an Internship oilfield visit to Fahud.

PGEO Courses

Over the reporting period, PGEO delivered 8 courses to 10 students. Two of the courses were delivered by the resident professor, the other by fly-ins. Two students dropped-out at the end of SS 2015.

Winter Term 2014/ 15:

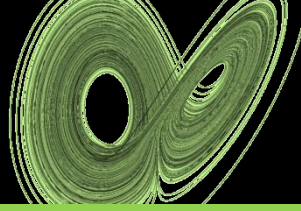
- Seismic interpretation: extensive course of 6 ECTS, using the advanced "Petrel" software.
- The Petroleum geochemistry course to understand the origin and quality of hydrocarbons encountered in the subsurface.
- The Basin Geodynamics an Modelling course discussed sedimentary basin evolution, and prediction of hydrocarbon occurrences by using 3D modelling software PetroMod.
- The well-log analysis course revolves around petrophysics, for assessing hydrocarbon occurrences in wells based on wireline logs.

Spring Term 2015: The MSc students entered the phase of advanced courses in that semester.

- Reservoir Engineering: The flow behaviour of 3-phase fluids in the subsurface is the subject of this course.
- The great uncertainty in any sub-surface data requires good understanding of statistics, and thus a course on geostatistics had been inserted into the curriculum.
- The Pressures and Seal course deals with the intricate relationship between the complex subsurface pressure/stress field and the behaviour of rocks.
- The Prospect Analysis course integrates many of the technical subjects discussed in preceding courses, with the aim to quantify risk and uncertainty in finding an oil/gas field.
- During the summer break students went to Dorset in the UK, to participate in GUtech's Petroleum Systems Field course (see detailed article).



Activity Report



Department of Applied Geosciences
Departments of Mathematics & Science

Field Reports

CELINE DUCASSOU

AGEO Field Education in Oman

The main aim of the field courses is to familiarize the students with the Geology of Oman. In 2014-15, the focus of the field education was on the main features of the Geology of the Oman Mountains to the students:

- in Wadi Bani Awf, the students were shown the evidence of the opening of the Tethys Ocean 250 Myrs ago and the different sediments deposited on the Arabian Platform before the obduction of the Samail ophiolite;
- in Wadi Al Abyad, the students explored a cross-section through the largest and best-preserved ophiolite in the World, the Samail Ophiolite, which was obducted 90 Myrs ago;
- in As Sifah and Qantab, studied the impressive eclogites from As Sifah. These rocks have been dragged in the subduction zone and came back to the surface towards the end of the obduction. In Qantab, the students were shown the sediments deposited on the ophiolite after its emplacement on the Arabian Platform.

In addition, during a one-week excursion, the students had the opportunity, for the first time, to discover the geology of the Dhofar and Huqf areas.

Leaving from Muscat, we stopped in Wadi Mu'aydin to study the deep-marine sediments deposited on the margin of the Arabian Platform (Hawasina Basin) and emplaced on top of the Arabian Platform during the obduction. Then, moving south, we visited the Adam foothills to complete our cross-section of the Oman Mountains, and the Salt domes from the Ghaba Basin. These impressive structural features are also very important in the formation of Oil and Gas resources in Oman.

During the 2 days spent in the Dhofar area, the students had the opportunity to study (i) the Mirbat metamorphic basement for which they observed the field relationships between several types of intrusions, and (ii) its sedimentary cover (from Proterozoic to Miocene) affected by several phases of deformation.

On the way from Salalah to Duqm, we drove through the oil fields of the South Oman Salt Basin (Marmul, Nimr). In the Duqm area, the students were shown the evolution of the Huqf-Haushi High through different outcrops including the Proterozoic sedimentary cover unconformably overlain by Cretaceous deposits, and the Eocene sedimentation in the Duqm Rock Garden.



AGEO BSc Semester 4 students during the Salalah field course.

AGEO Field Education in Spain

For the fifth time since the inception of the BSc program, the AGEO department successfully organized an excursion to Spain with the 6th semester students. This excursion was held in Aliaga (Teruel Province, Aragon). During 10 days, the students were working on one of the most classical exercises in Geosciences: Geological Mapping. They were divided in groups of 2 and given an area to study. Every day, they collected data on the field and had to combine the knowledge they acquired during their studies in different topics, in order to provide a geological map and a cross-section of their mapping area; then to reconstitute the geological history of the area from their observations.

The field area is located in the Geological Park of Aliaga and its surroundings. This area is particularly well exposed and provides nicely preserved fossils, sedimentary structures and interesting structural features (faults and folds). It is a very famous place for this kind of exercise and several Universities in Europe are organizing every year their Geological Mapping courses in Aliaga.

For the Omani students, this excursion was also the opportunity to discover and adapt to a different culture and environment. They stayed together in small apartments and had to organize their meals by themselves. In the small village of Aliaga, very few people are able to speak English, but the students managed somehow to communicate with them.

Activity Report



Department of Applied Geosciences
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Most of the students graduating in the AGEO BSc in GUtech are pursuing their studies abroad, mainly in Europe where they will be exposed to such a cultural (and climatic) experience. Moreover geologists often work in a multi-cultural environment; such an experience is therefore beneficial for them, and often appreciated by their employers.



AGEO BSc Semester 6 students during the field course in Aliaga, Spain for geological mapping.

Master of Petroleum Geosciences

WIEKERT VISSER

The Master program in Petroleum Geosciences (MSc PGEO) saw an exciting start of the academic year with the first cohort of MSc students receiving their degree. It has been a real milestone in the development of GUtech to deliver its first Master of Science degree holders. The four thesis reports covered a wide variety of subjects: a highly specialized Quantitative Seismic modelling project, a fully integrated exploration project on a data set from Northern Oman, development of a novel technique to upscale wire-line log data from a tight-gas field, and a first attempt to create 1D basin models for Oman's north eastern province. The projects used a wide array of modern oil industry technologies, broke some new ground, and delivered results that were useful for the various supporting oil companies in the country (several successful wells were drilled based on the work by our MSc students!).



PGEO MSc-students and staff at the type locality of the Kimmeridge Clay Formation petroleum source rocks.

The current cohort of 9 MSc students have entered the phase of advanced courses. Oil fields usually produce three different fluids: oil, gas, and water in ever changing mixtures. The flow behaviour of 3-phase fluids in the subsurface was taught by reservoir engineering specialist.

The great uncertainty in any sub-surface data requires good understanding of statistics, and thus a course on geostatistics had been inserted into the curriculum, and a specialist from the field delivered the course.

The intricate relationship between the complex subsurface pressure / stress field and the behaviour of rocks was one of the advanced courses offered by PGEO this year. Students learned to assess the effectiveness of a specific sealing unit for an oil/gas field. Also the subject has great relevance also for evaluating the so-called unconventional resources, because students gain understanding of fracturing of rocks due to subsurface pressure.

The Prospect Analysis course which PGEO offered this year for the second time, integrates many of the technical subjects discussed in preceding courses, with the aim to quantify risk and uncertainty in finding an oil/gas field.

During the summer break students went to Dorset in the UK, to participate in GUtech's Petroleum Systems Field course.

This excursion is the twin of the Prospect Analysis course, in that the objective is to assess the chance of finding an oil/gas accumulation, but now based on field observations. The Devon-Dorset coastal area is world famous for teaching petroleum geology, and one cannot avoid coming across Academics or Industry geoscientists studying the outcrops. The field trip also offers great experience in team work, and in experiencing geology from a region other than Oman. The presence of the largest onshore oil field of Europe in the field work region is the "icing on the cake". Students had to work as a team and presented their observations at the end of the trip.

Activity Report

Department of Applied Geosciences
Departments of Mathematics & Science

E-Learning in Chemistry

CONCEPCION MENDOZA

Increasing number of students who need to learn Chemistry in many different ways and at different time, limitations on resources (like time, budget, staff, etc) to teach them and a university committed to quality education. To meet these emerging teaching and learning needs, an open-source solution is needed.

For the study of Chemistry at GUtech, a blended learning program is in use: e-learning technology combined with the traditional face-to-face learning methods (lecture presentation, pen and board work, classroom discussion, and wet laboratory) in campus classes. With the hope, that e-learning tools can be a method to improve the process of delivering course materials and of connecting to the students.

E-learning is the use of technology to learn anywhere and anytime. One of my e-learning tools a learning management system, where my prepared teaching resources are made available online to students; from any computer, smart phone, tab or other mobile devices that has internet access. Announcement, calendar of activities, e-mails, and other functions are available. It also allowed me to create differentiated learning opportunities for my students, allowing for a more individualized approach to student learning. Evaluation tools like an interactive and online in-class activities/self-tests are delivered and allowed students to participate in the learning process at a specified time and a location that meet the student's requirement. Students complete these in-class activities over the web, and receive instantaneous feedback as to the correctness of their responses. While the teacher (I), gets also an instant reporting regarding student progression, tracking attainment, recognizing achievements and an e-portfolio. With this technology, I get rid of some problems on marking papers.

Aside from the e-learning solutions, students are introduced to other web-based references (like textbooks online resources: Chemistry by Chang). This web-resouce has a self-assessment site; very helpful for students on their self-revision on Chemistry concepts prior for an exam.

These examples of e-learning tools have allowed me to be a facilitator of learning, and to provide a framework for face-to-face and online interaction that may happen both in and outside of the classroom. With this framework, my students and I come up with a collaborative experience of online interaction, sharing of ideas and a common understanding of the online information.

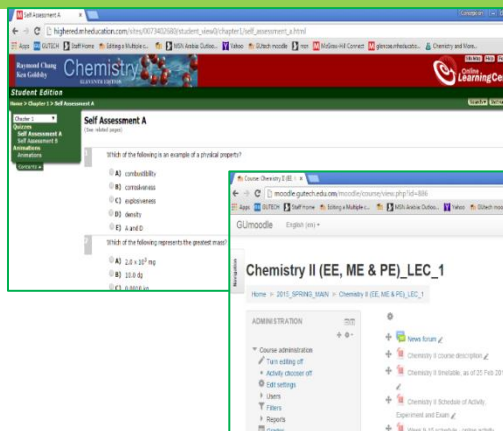


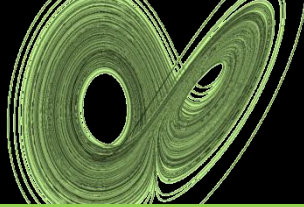
Figure 1: Screenshots of the home pages of some E-learning tools and Chang's Chemistry Online Center, that gives a 24/7 access to Chemistry resources with a promised 24/7 connectivity.



Figure 2: Accessing a Chemistry online-activity using any mobile apparatus at different places where students learn with classmates (or alone) for a better understanding of the concept.

Activity Report

Department of Applied Geosciences
Departments of Mathematics & Science



What are the best aspects of the course? "Online questions"

"Online activities where students depend on the internet and slides given or the information taught in class."

"The activities are both enjoyable and extremely helpful to show a student where he or she stands in terms of progression."



"practice questions in the online resource are very good"

"online activities must be done along with a partner"

Figure 3: Students generally appreciated Chemistry e-learning, as reflected in their comments during the chemistry course evaluation in 2014-2015.

For my Chemistry students, the understanding of chemistry can be enhanced anywhere and anytime through the use of technology or e-learning. Students also developed other important skills while on e-learning, like: computer skills, self-motivation and self-reliance, self-disciplined and able to follow written directions, active participation and collaboration with peers for a deeper understanding, willingness to complete assignments on due time, take time to study, and address difficulties with teacher as soon the need arises.

E-learning tools have provided me new opportunities to explore a blended teaching approach to teaching in a student centered environment. Blended learning can provide the convenience, speed, cost effectiveness of e-learning with the personal touch of traditional learning towards the attainment of a better and quality education with the university's changing needs.



Figure 4: Further interactive teaching methods include the use of tablets in exercise groups or lectures such that students can immediately solve certain questions given to the class (see male student in the front). Of course, like the use of the Aachen App (see "Special Activities"), this way of engaging students is particularly useful an necessary for large lectures where one cannot just call a student easily to the blackboard.

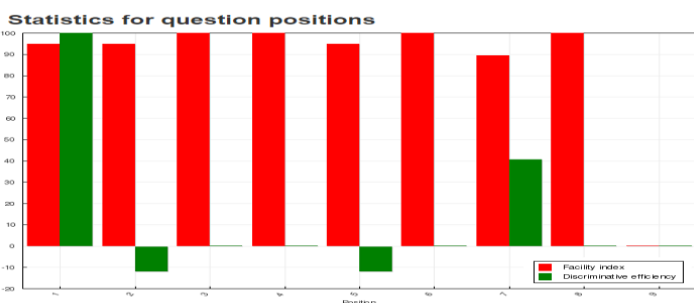


Figure 5 (left): Keeping track of students' progress and performance; Online statistics offers feedback to teacher and to the student, indicating topics of difficulty that may need more time and work to improve student's understanding.

Activity Report



The Ibn Al-Haytham Teaching Awards

Based on the common understanding that excellent teaching belongs to outstanding achievements a university offers to their students, the Faculty of Science of the German University of Technology endows the

Ibn Al-Haytham Teaching Awards

to exceptional personalities in teaching in the Sciences (1st of January 2015). With this award the Faculty of Science acknowledges that it is not technology but individual personalities and their engaging spirits that constitute any achievements in teaching at a university level.

- (1) The price is named in honor of the Arabian polymath Abu Ali Al-Ḥasan Ibn Al-Ḥasan Ibn Al-Haytham (965 – 1040), who made significant contributions to the principles of optics, astronomy, mathematics, meteorology, visual perception and the scientific method. Ibn Al-Hytham is considered the father of Islamic Sciences.
- (2) The award will be bestowed upon one or more personalities at the start of each semester for their achievements in the prior semester.
- (3) An award commission discusses suitable candidates based on their merits shown in their courses, evaluations, publications or teaching related events for the public. The commission is convoked and suspended by the Dean of Science. In case of a tie the vote of the chair of the commission decides. In case there are no suitable candidates the commission will not allocate the award.
- (4) The award commission consists of four voting members: the head of the Department of Applied Geosciences, the head of the Department of Mathematics and Science (or their representatives) as well as one representative of the students and one of the universities quality assurance unit, both of whom are invited by the chair of the commission. The chair of the commission rotates between the two heads every semester, starting with the head of the Department of Applied Geosciences as chair of the commission.



- (5) Personalities who received the award are not entitled to be allocated to the award for the next two years following the semester for which they received the award.
- (6) The commission presents their results to the Dean of Science who delivers the awards. As the Dean of Science is democratically elected by the members of the Faculty of Science, the Dean of Science has the power of veto.

Activity Report



Department of Applied Geosciences
Departments of Mathematics & Science

Special Events

New Phone App used for teaching at GUtech “Steering Student-Teacher Interaction to a New Level”

A team of internationally recognized professors and enthusiastic lecturers of the Faculty of Science at the German University of Technology in Oman (GUtech) have tested a classroom mobile phone app called ‘RWTH Aachen App’ with over 200 GUtech students at the start of the academic term recently. This app that was developed by a team of Computer Scientists and Engineers at GUtech’s parent-university, RWTH Aachen University. “The app allows us to receive immediate feedback from the students, which is extremely important in courses attended by hundreds of students. This new and very handy app steers the classroom interaction to a new level and allows, in its sphere of applicability, for tailored answers optimized to the very needs of the students to understand a topic,” explained Prof. Dr. Bernhard Heim, Dean of the Faculty of Science at GUtech. These blended learning activities are a part of project between GUtech and the RWTH Aachen, initiated by Prof. Dr. Modigell, rector of GUtech, Prof. Dr. Nacken, Prof. Dr. Krieg (RWTH Aachen) funded by the DAAD.

The ‘Aachen App’ transforms the lecture hall into a quiz show without corrupting the academic integrity of the lecture. In such a way simple multiple choice questions can be addressed to the auditorium and the students, who can vote anonymously on their mobile devices. “We realized that this app increases the return rate as the students do not experience any fear if they give wrong answers. Moreover, it’s a lot of fun,” said Prof. Dr. Florian Rupp, who teaches two mathematics classes “Math I” and “Math III” along with Prof. Bernhard Heim. Furthermore, the course “Rocks & Minerals” given by Prof. Dr. Michaela Bernecker of the Department of Applied Geosciences applies this new App as an effective way of modern communication. “I think this is the first time we are not blamed when we use our smart phones during the lecture,” one of the students commented, while adding: “It is also great that we are now able to write short messages to the professor to tell him that we need more explanations without disturbing the others”.

Once the question is closed a histogram of the answers is displayed to the students and the correct answers can be discussed as well as the remaining choices. “The real charm of this student-teacher interaction is that we the professors and lecturers can exactly see the number of students who think that an answer is correct. Usually there is a huge mass of undecided students who are now more motivated to vouch for their opinion in the anonymity of the cloud. In particular we can explain in depth the misconception of many students and

not the usual “please raise your hands” approach, having to balance the expositions,” said Prof. Dr. Bernhard

“The large classes we are facing in modern technical universities somehow alienate us from our students”, Prof. Bernhard starts to mention another benefit of the app: “the new app now enables us to focus on the individual student. Think of a short calculation you do as a student in a course of over 100 participants and you want to discuss your solution with the teacher or the class. Now, you take a photo with your smart phone which is immediately uploaded and if interesting for all can be spontaneously displayed via a projector and is discussed in a flash”.

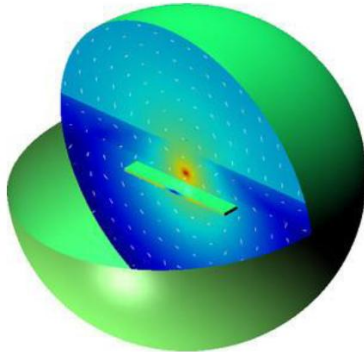
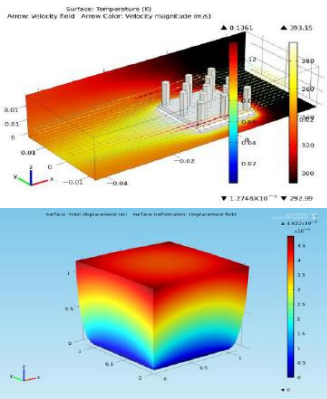
The Art of Science Tour

The Faculty of Science was proud to host the “Art of Science Tour 2014” of the European Association of Geoscientists & Engineers (EAGE). The event took place at GUtech at the 21st of October 2014. The presenter was Prof. Dr. Roel Sneider, Keck Foundation Endowed Chair of Basic Exploration Science at the Colorado School of Mines, Fellow of the American Geophysical Union and Honorary Member of the Society of Exploration Geophysicists. Besides his achievements in Science Prof. Dr. Roel Sneider is an enthusiastic teacher. At his stay with the Faculty of Science, he will lecture on the skills necessary for being an effective researcher, and thus make the implicit knowledge that is accumulated over a lifespan accessible to our students.



GUtech students applying the Aachen App during a lecture. The polls are ready for immediate discussion and evaluation.

Activity Report



Illustrating the capabilities of modern software packages for modeling and scientific computing.

Finite Element Modeling Using COMSOL Multiphysics Workshop

Due to the continuous efforts of Prof. Dr. Ekkehard Holzbecher a 1-day workshop on the modeling and simulation capabilities of the software COMSOL could be conducted at GUtech on the 29th of April 2015.

This workshop day began with a walk-through of the fundamental modeling steps in COMSOL Multiphysics, where the attendees had the chance to set up and solve a simulation through a hands-on exercise. Like other highly advanced products the simulation software environment facilitates all steps in the modeling process – defining the geometry, material, specifying the physics, meshing, solving, and then visualizing the results. In particular, here the model set-up is quick, thanks to a number of predefined physics interfaces for applications ranging from fluid flow and heat transfer to structural mechanics. Material properties, source terms and boundary conditions can all be arbitrary functions of the dependent variables. “This makes these commercial software packages so powerful for groundwater simulations” explains Prof. Ekkehard who is the main investigator in the project “Towards a flood-resilient Omani society: improved tools for flood management”, funded by The Research Council (TRC).

Science Day

May 24, 2015
9:30 AM - 4:00 PM

Please come and join the fun with us!

9:30 A.M. 4th floor lobby, in front of Department of Math and Science

- A Welcome: by Prof. B. Heim, Dean of Faculty of Science
- Opening Hands-on Demo: by students with the University Rectorate

10:00 A.M. – 4:00 PM. Simultaneous Presentations
(Exhibits, Hands-on Lab, Posters, Games and more)

- AGEO: Minerals and Fossils (R&M lab 418)
Microscopy (Micro lab 419)
Oil and Porosity (room 431)
- Chemistry: Chemistry Laboratory (room 514S)
Part I - Chemistry Activities (10:00 AM – 12:00 noon)
Part II - Chemistry Activities (12:00 noon – 2:00 PM)
- Math: Games on Statistics (room 431, 1:00 – 2:30 PM)
Poster & 3D exhibits (Math and Science Office, 4th floor)
- Physics: Exhibits at Physics Laboratory (room 434 S)

Light Snacks @ Science (3:00 - 4:00 PM, 4th floor – Salalah Wing)



Poster of the 1st Science Day at GUtech (top) organized by the Faculty of Science and some impressions of the activities in particular related to Chemistry and performed by students with the support of the Rectorate (bottom left) or in groups in front and in the Chemistry lab (bottom right) that took place during this event.



Activity Report

Department of Applied Geosciences
Departments of Mathematics & Science



Science Day held at GUtech

To raise interest and awareness in Sciences, the Faculty of Science at the German University of Technology in Oman (GUtech) has organized a Science Day for its freshmen and Foundation Year students at the GUtech Halban Campus recently. Around 300 students and staff members actively participated in the one day event. "Science is fun and interesting and has always been a challenge for the brightest minds," said Prof. Dr. Bernhard Heim, Dean of the Faculty of Science.

At the Science Day several experiments from Chemistry and Physics were combined with hands on lectures on Applied Geosciences. "We wanted to inspire the students and to enjoy sciences. We started with an open demonstration on solid dry ice with experiments with the members of the Rectorate" said Prof. Dr. Concepcion Mendoza, Chemistry professor at GUtech, who was the main organizer of this event. "The sublimation process or the conversion of solid carbon dioxide to gaseous carbon dioxide without passing through the liquid state was demonstrated through different fun activities with bubbles, balloons and popsicle making," she added.

Other experiments like the appearing ink. "If you write on paper with lemon juice followed by brushing the whole paper with iodine solution, a visible white writing appears while the rest of the paper turns violet." Physics experiments included solar cells and hydro-dynamics.

In Applied Geosciences (AGEO) the students learnt more about our planet earth. Several Professors of the department gave presentations on oil and gas, ground water modelling, rock forming, mountain building and mineral resources. "How can be oil created from a source rock? How to manage the groundwater in different aquifers? How are the Oman Mountains formed? How can we examine rocks under the microscope? How to explore ore deposits containing iron, copper and chromium in Oman? All this was demonstrated and explained by experiments in the labs", said Prof. Dr. Michaela Bernecker, Head of AGEO Department. "Our BSc students were actively involved in teaching basics on minerals and fossils, showcasing geophysics projects and telling about their future life as geoscientists."

"Due to the success of the event we are planning to conduct the science day on a regular basis", said Prof. Dr. Bernhard Heim.

Activity Report

Department of Applied Geosciences
Departments of Mathematics & Science



Who is Al-Biruni?

Abu al-Rayhan Muhammad bin Ahmad al-Biruni, born in 973 in Khwarezm, and passed away at 1048 in Ghazni, Afghanistan, known as Al-Biruni in English, was a Persian Muslim mathematician, astronomer, geographer, physicist, and philosopher. His native language was Persian but he spoke Arabic too. In Khwarezm Al-Biruni studied Islamic history, theology, grammar, mathematics, astronomy, medicine, physics and other sciences. He was best known for his work in mathematics, astronomy, physics and geography. He was also famous as an ethnologist where he wrote an encyclopedic work about the history of India including religions, geology, geography, mathematics and sciences. He was inspired by the studies of Indian scholars about the shape of earth and started to explore and further develop the concept of proving that earth has an elliptical shape using mathematics and astronomy.

History

Al-Biruni was inspired by the arguments offered by Indian scholars who believed earth must be ellipsoid shape, with yet to be discovered continent at earth's south pole, and earth's rotation around the sun is the only way to fully explain the difference in daylight hours by latitude, seasons and earth's relative positions with moon and stars. Certainly by the age of seventeen al-Biruni was engaged in serious scientific work for instance:

- 1- he described the variation in the motion of the sun with respect to the earthly observer in mathematical language that modern historians of science have construed as among the earliest references to mathematical functional relationships.
- 2- Nearly five of 140 books known to have been written by Biruni were devoted to astronomy, mathematics, and related subjects like mathematical geography.
- 3- in the course of a discussion devoted to the trigonometric functions used in astronomy, he defined the rational number π as the result of division of two other numbers (the circumference of a circle and the diameter), whereas his predecessors, including the Greek authors, had defined it as a geometric ratio.
- 4- in his book "Sims al-Asma' al-Jawami'at" he concentrated mainly on the applications of spherical trigonometry in astronomy and provided a detailed classification of spherical triangles and their solutions.

In his book "Kitab al-Fihrist al-Maqalat fi Asrar al-Yaqut" he developed the familiar trigonometric definitions further and applied them to such religious practices as determining times of prayer and finding the direction of Mecca.

Applications

Astronomy
Invented a new theory to extract the amount of known circumference of the Earth at the base of the al-Biruni Western scientists.

Physics
The experiments to calculate the specific weight in eighteen element.
The explanations and applications of some phenomena related to pressure and fluid balance.

Geography
The collection of a number of geographical facts and especially with respect to the sea.
Know that there swaths in the north, the sun never sets in the summer.
Also know that in the south of the equator in Africa swaths where the winter while the summer in the north.
He said rotation of the Earth on its axis and already the Galileo and Copernicus.
Al-Biruni invented a cone device to measure the specific weight of metals and precious stones, which is a measure of the intensity of the oldest method, it has succeeded in reaching a specific weight of eighteen compound.

GUTech
Al Khwarizmi

Who is Al Khwarizmi

Algebra

Algebra is a branch of mathematics that deals with the study of mathematical symbols and the rules for manipulating these symbols. It is a generalization of arithmetic and elementary algebra. Algebraic symbols represent numbers and quantities that can be added, subtracted, multiplied, and divided. It is used to solve equations and to study the properties of numbers and functions.

Algebraic Equations

$$2x + 5 = 11$$

$$x^2 - 4 = 0$$

$$x^2 + 3x + 2 = 0$$

$$x^2 - 5x + 6 = 0$$

$$x^2 + 1 = 0$$


Activity Report



Seismic Experiments in Oman

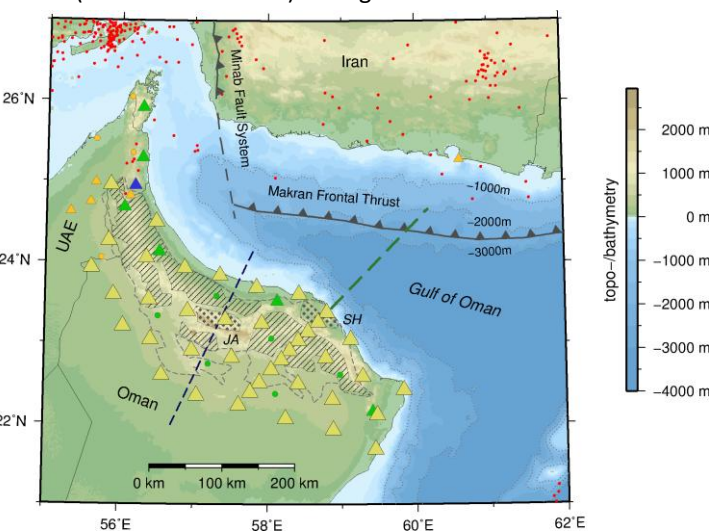
CELINE DUCASSOU

The AGEO Department is participating to a seismic experiment across northern Oman together with the Earthquake Monitoring Center and the Department of Earth Sciences at Sultan Qaboos University and international cooperation partners Christian-Albrechts-Universität zu Kiel (Germany) and UPMC Paris VI (France). During this experiment, seismometers record the seismic waves that are generated by earthquakes from all around the world and propagate through the interior of the Earth and along its surface. These seismic waves will provide information on the internal properties of the subsurface beneath the Oman Mountains and its surroundings.

In October 2013, 40 broadband seismometers were installed across the entire mountain belt (yellow triangles on the figure below). Five GUtech students participated to this first step: Bushra Al Quraishi and Shahla Al Mahrooqi participated to the site survey and Khalda Al Barwani, Yasmeen Al Shaqsi and Jokha Al Thanawi participated to the deployment of the seismic stations.

This year again, 2 GUtech students (Muzna Al Zidjali and Ali Al Hajri) were involved in the project as field assistants during the service of the seismic stations. They were supporting our geophysicist colleagues on the field while they were checking the stations and collecting the data.

In addition, the 6th semester students had the opportunity to visit one of the seismometers installed next to Barka (Al Namman School) during the Winter Semester.



Topography/bathymetry and seismic stations in the Gulf of Oman. Broadband (triangles) and short-period (circles) seismometers from the COOL project (yellow), Oman Seismic Network (green), Dubai Seismic Network (orange), GSN station UOSS (blue), offshore seismic profile from the O:NLAP project (dashed green), seismic profile from Al-Lazki et al. (2002) (dashed black) and earthquakes with magnitude >4,5 since 1990 (red dots, data from NEIC/USGS).

The Oman Drilling Project in 2015

ANA JESUS

The Oman Drilling Project is an internationally participated and funded project, which aims at performing scientific drilling in the Oman Samail Ophiolite. Prof. Dr. Peter Kelemen (Arthur D. Storke Professor and Chair, Dept. of Earth & Environmental Sciences, Lamont-Doherty Earth Observatory of Columbia University), is the Principal Investigator together with other subscribed principal investigators. The proposal was approved and partially financed by the International Drilling Project (ICDP), the kindred mission of the International Oceanic Drilling Project (IODP), which provides logistical, operational and financial support for scientific research drilling in the continental crust. Successful proposals to ICDP privilege sites of exceptional geological relevance as is the Sumail Ophiolite in Oman. Other partners/sponsors of the project include: the Deep Carbon Observatory-DCO (funded by the Alfred Sloan Foundation, USA), NASA "Rock-Powered Life" Astrobiology Institute (USA), the National Science Foundation- NSF (USA), the German Research Foundation- DFG and the International Ocean Drilling Project - IODP. Pending funding proposals were submitted to the Natural Environment Research Council - NERC (UK) and to Norwegian Science agencies. The main objectives of the project are, in order of increasing temperature and geological age (op cit Palisade workshop documentation, 2010):

- Explore the present-day, subsurface microbial ecosystem, with relevance to the origin of life on this and other planets.
- Quantify ongoing weathering processes that consume H₂O, and CO₂, which produce hydrocarbons and cause volume changes that lead to reaction-driven cracking.
- Measure the transfer of carbon, H₂O and other components from subducting sediments into the overlying mantle section of the ophiolite during emplacement.
- Determine the depth, nature and extent of hydrothermal alteration of the oceanic crust and shallow mantle near the spreading ridge that formed the ophiolite.
- Answer long-standing questions about the processes that form oceanic crust.
- Constrain mantle upwelling and melting beneath mid-ocean ridges.

Drilling is hoped to start in late 2015/early 2016 and to continue in the autumn/winter of the subsequent two years. On-site activities will include geophysical logging, fluid sampling, hydrological measurements and microbiological sampling. Preliminary observation and testing will be carried out by scientific Biology teams at Sultan Qaboos University in Oman.

Activity Report



Following basic core labelling and curation, detailed core description, instrumental scanning, and sampling will take place at the IODP drill ship, RV JOIDES Resolution which will be stationed at Cape Town (RSA). Coring activities aboard the JOIDES Resolution will occur in an internship framework, supervised and coordinated by many highly experienced international scientists.

The Executive Committee of the DCO meets on a semester basis and given its recent partnership with the Oman Drilling Project, the 2015 winter meeting was held at Muscat. This allowed for a series of field visits to the geological sites of interest in the project, as well as logistics meetings between the representatives of the Project, DCO and ICDP with Omani authorities. AGEO representatives participated in all of these activities summarised below.

- a) The fieldtrips were led by Prof. Dr. Peter Kelemen and focused on locations that enable a better understating of the project's overarching questions, including several sites that are planned to be drilled.
 - **The field trip to Wadi Fins** (27 January) consisted of a descend into to the wadi bed to observe peridotite outcrops displaying abundant effects of hydraulic fracturing with complex calcite-serpentine veins developed as a result of carbonation from hydrosphere/atmosphere interaction. A conspicuous unconformity that separates the peridotite from the overlying thick Eocene-Miocene limestone sequences was also observed.
 - **The Field trip to Samail-Nizwa-Ibra area** (28 and 29 January) focused on the observation of travertine terraces and related carbonate veins in peridotite in several localities related with the recent (< 50,000 years) to ongoing carbonation of the peridotites. Testimonies of ancient of carbonation were observed at listvainite outcrops which are thought to have developed along main thrust planes and above as a result of hydrothermally induced circulation during the obduction of the ophiolite. Additionally, several key outcrops with classic ophiolite features were visited, including the Moho Transition Zone and the lower crustal layered gabbro sequence.
- b) **Executive committee Deep Carbon Observatory (DCO) meeting** (30-31 January 2015). GUtech representatives were invited to attend part of the meeting of the DCO executive committee. This included several communications regarding general overviews of the DCO program, the ICDP Scientific Drilling and the Oman Drilling Project in particular.



AGEO BSc students and staff explored a cross-section through the largest and best-preserved ophiolite in the World, the Samail Ophiolite.



View of Wadi Fins bed showing hydraulically fractured, calcite-veined peridotite visited during Executive Committee of the DCO field trip.

- c) **Logistics meeting between** project members and Omani authorities (1 February 2015). The meeting was hosted by DCO and ICDP representatives and was convened by Prof. Dr. Peter Kelemen. Besides of GUtech, the following Omani institutions were represented: the Research Council of Oman, the Ministries of Environment and Climate Affairs and of Regional Municipalities and Water Resources, Sultan Qaboos University, the Oman Water Society and the Public Authority for Mining. The meeting aimed at discussing the objectives and operational details of the Oman Drilling Project as well as its extended scientific and societal benefits for Oman.

Activity Report



Department of Applied Geosciences
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International Conference on Fossil Corals at GUtech

An international conference addressing research topics on fossil corals throughout Earth History, from Paleozoic to recent times, took place at the German University of Technology in Oman (GUtech) from 5th to 15th of February 2015 at GUtech Halban Campus. The conference is sponsored by The Research Council (TRC) and Carmeuse limestone company, Belgium, Springer Publishing House and the Geological Society of Oman (GSO). Around 60 scientists from Belgium, Germany, Poland, France, Italy, UK, Japan, Russia, Iran, Usbekistan, Tadjikistan, China and Australia participated in the conference. The previous conference was held in Belgium.

The 12th International Symposium on Fossil Cnidaria and Porifera focussed on corals and sponges through time and space, during reef crisis in earth history, bio-mineralization, coral growth, biostrome forming and reef building from a micro- to macro scale. The participants of the conference consider how the marine ecosystems are influenced by several triggering mechanisms like global and regional tectonics, increased carbon dioxide concentrations, loss of oxygen in the oceans, carbon dioxide poisoning or rapid global warming. Their discoveries help us to actively respond in an optimal way to current global concerns including sustainable use of natural resources, biodiversity response to global warming and keeping our planet environmentally sustainable. Moreover, it is important to study coral and sponge limestone, since fossil reefs can be potential petroleum reservoirs. During several time slices in Earth History a variety of different reef building fauna and flora evolved. The organisms produced carbonate by biomineralisation and formed stratigraphically and geographically extended geo-bodies, which are preserved until today and act as reservoirs due to their special physical properties.

As part of the conference, a number of field excursions offered the researchers opportunities to visit the magnificent geological outcrops for example in Al Khoud, Jabal Al Akhdar and in the Huqf. Those excursions will provide unparalleled access to the unique fossil Cnidaria and Porifera limestone locations in the Sultanate for scientific discussion and exchange of ideas. The modern coral reefs of the Gulf of Oman offered the possibility for geologists and biologists to apply an interdisciplinary approach of comparison with the fossil counterparts deposited on the Arabian shelf during Earth History. Students from GUtech and SQU participated in the conference and a special student session will be organized.

The study of such fossil reef limestone allows us to interpret this potential reservoir rocks with significant primary framework porosity and permeability for water and hydrocarbons like oil and gas and to understand the heterogeneities in carbonate reservoirs.



The Permian coral limestone (here as tiles in the Sahab hotel) on Saiq plateau Jabal Akhdar was presented by Prof. Dr. Michaela Bernecker, the main conference organizer and current president of IAFCP, during the pre-conference field workshop.

GUtech Applied Geosciences Students and Lecturer Received Awards During the International Fossil Coral Conference

During a poster competition held during the International Conference on Fossil Corals and Sponges, three students of the Department of Applied Geosciences (AGEO) were awarded by international scientists for their posters entitled "Fossil Corals of Oman".

"Until today sea corals are important for marine wildlife. Many animals nest there," said the winning team. The three 5th semester Applied Geosciences students, mentioned that they choose the topic and researched the area. Many corals in Oman were formed around 203 years ago until recently, when Oman and the Arabian Shelf was covered with water. "Corals have evolved through time," said Ahlam Al Jabri, AGEO student. The corals named Rugose and Tabulate were important reef builders in shallow waters. "Corals like warm conditions," said Sabra Al Shaqsi, AGEO student at GUtech.

"We took photos of the fossils, that were collected in different areas in Oman such as Musandam, Al Batinah region, Al Huqf and Jebel Al Akhdar" said Sabra Al Shaqsi. The students were glad being involved in the International Conference. "We are honoured that the scientists are here at GUtech. We would be interested in learning more about the corals, discover them during field-trips and be part of research project," said Sabra Al Shaqsi.

Activity Report

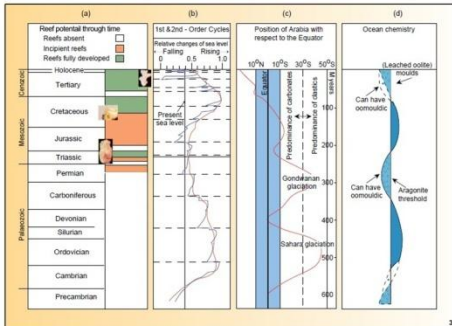
Department of Applied Geosciences
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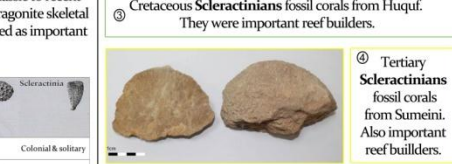
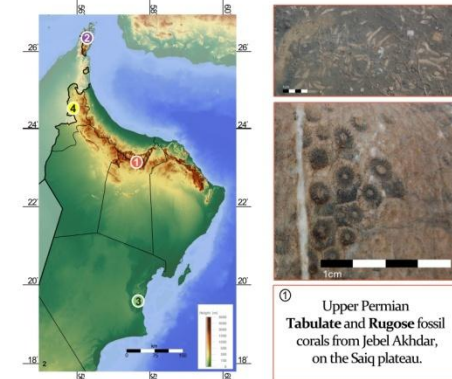
Fossil Corals of Oman

Al Jabry, A. Al Shaqsi, S. & Al Tuqi, R.

Introduction Corals have come and gone throughout geological history. In Oman corals were present from Upper Permian to recent times. Corals developed during warm temperature 23 - 29°C and require very saline water. They were important reef builders during Upper Triassic, Cretaceous to recent time, when Oman was between 25°N and S of the equator.



The presence of well-developed coral reef facies (a) is linked to sea level fluctuations (b). Movement of Arabia relative to the equator through time (c) is also controlling the development of coral reefs. The development of ooids is controlled by seawater chemistry (d). The chemical changes influenced the relative stability of calcite and aragonite cements and dissolution of ooids.²

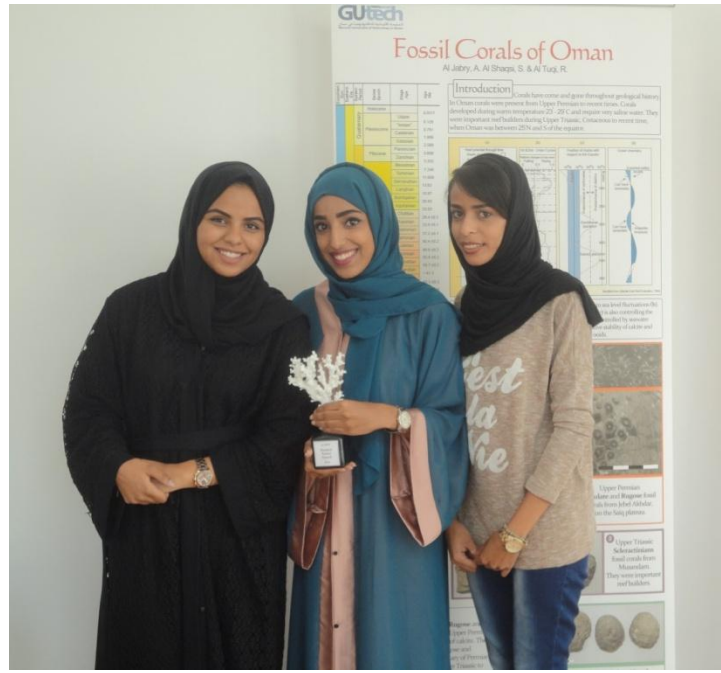


Discussion

Corals have evolved through time. **Rugose** and **Tabulate** were present during the Upper Permian, they had a skeleton that was made of calcite. Then there was a major extinction of Rugose and Tabulate corals between the boundary of Permian and Triassic. After that during Upper Triassic to recent times corals have evolved to form aragonite skeletal **Scleractinians**, they were considered as important reef builders.¹

Feature ¹	Rugosa	Tabulata	Scleractinia
Growth mode	Colonial & solitary	Colonial	Colonial & solitary
Tabulae	Usual	Well developed	Absent
Skeletal material	Calcite	Calcite	Aragonite
Suitability	Poor	Poor	Good with basal plate
Range	Ordovician to Permian	Ordovician to Permian	Triassic to Recent

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The AGEO students (from left to right) Ahlam Al Jabri, Sabra Al Shaqsi and Reem Al Tuqi received an award for the best poster "Corals of Oman". Their poster "Fossil Corals of Oman" is displayed on the left hand side.



AGEO Lecturer Matthias Lopez-Corra receiving an interdisciplinary coral researcher award.

Activity Report

Department of Applied Geosciences
Departments of Mathematics & Science



The opening ceremony (left) of the international workshop “Economics of Conflict” at the SQU Conference Center started with a welcome addresses of Her Highness Dr. Muna Fahad and of the Rector of GUtech Prof. Dr.-Ing. Michael Modigell. At the right a group photo of the members of both the organizing and scientific committee at the end of the closing ceremony at GUtech.

International Workshop “Economics of Conflict” and Foundation of the Muscat hub of the Center for Conflict Resolution (CCR)

Supported by The Research Council of Oman (TRC) and initiated and organized by Leon Goldsmith from the Sultan Qaboos University (SQU), Martin Leroch from the Johannes Gutenberg-University Mainz, and Florian Rupp (GUtech) the three day international workshop “Economics of Conflict” took place at the QSU and GUtech from the 31st of March until the 1st of April 2015.

Conflict is typically associated with inefficiencies, both in the time of its occurrence and its aftermath. From an economic point of view, it is thus of interest to understand the drivers and consequences of conflict to avoid costly conflicts and how to design effective institutions to settle conflicts.

The question what drives conflict, both from a macro- and a microeconomic perspective, is currently one of the topics debated in the community. While, for instance, it appears to be consensus that disputes over access to economic resources like land or oil may cause an outbreak of violence, factors favoring or triggering episodes of conflict, such as possibly ethnic diversity, need to be better understood. Ultimately, it also remains to be clarified how groups manage to overcome the public good problem associated with engaging in group conflicts – i.e. why people stand to fight for their fellows, if they suffer from the possibility of getting injured, whilst their individual effect on the outcome of the conflict appears marginal.

Consequently this workshop brought together scholars addressing all three core questions: 1. What drives conflict? 2. What are the consequences of conflict?, and 3. How can institutions be designed to effectively settle conflict?

To foster further international activities the board of directors of the Center of Conflict Resolution (CCR), represented by Prof. Dr. Manfred Holler, congratulated the founding members of the Muscat CCR hub: Ahmed Al-Salmi (GUtech, Tamayouz), Leon Goldsmith (SQU, College of Economics and Political Science), Bernhard Heim (GUtech, Department of Mathematics and Science), Michael Jansen (Research Center Indian Ocean), Florian Rupp (GUtech, Department of Mathematics and Science), Houchang Hassan Yari (SQU, College of Economics and Political Science), and Mahmut Cuneyt Yenigun (SQU, College of Economics and Political Science).

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