

Module Catalogue

for

[Marine Geosciences]
[MSc], [1-Fach Master]

Effective [01.10.2019]

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key: ca. 14 sessions / semester (incl. exams) taken as basis for calculation of workload

Modules

Module Name:	Module Code
Coastal Geology	mageoMaCCG-01a
Module Coordinator	
Prof. Dr. Christian Winter, Phone: +49-(0)431.8802881, E-mail: christian.winter@ifg.uni-kiel.de	
Organizer	
Institute of Geosciences	
Faculty	
Faculty of Mathematics and Natural Sciences	
Examination Office	
Examination office of Geosciences	

Status¹ (C / CE / O)	C
ECTS Credits	5
Evaluation	graded
Duration	1 semester
Frequency	Every year, winter semester
Workload per ECTS Credit	30 hours
Total Workload	150 hours
Contact Time	70 hours
Independent Study	80 hours

Teaching Language	English
Entry Requirements as Stated in the Examination Regulations	None
Recommended Requirements*	

Module Course(s)			
Course Type	Course Name	Compulsory/ compulsory elective/ optional	Credit hours
Lecture	Shallow water processes	C	2
Practical exercise	Coastal Systems (SH/Sylt)	C	2
Seminar	Sea Level Change	C	1
Further Information on the Course(s)*		Class size: 20	
Prerequisites for Admission to the Examination(s)*		Attendance at the field exercise and seminar, accepted field report and seminar talk	

Examination(s)				
Examination Name	Type of Examination	Evaluation	Compulsory/ compulsory elective/ optional	Weighting²

¹ Status of whole module (compulsory, compulsory elective, optional)

² Weighting within the module

Coastal Geology	Written	Graded	C	100
Further Information on the Examination(s)*		One written examination for all courses, successful participation at field exercise and seminar is pre-requisite		

Short Summary*
The goal of this module is to develop process based understanding of drivers and transport physics that lead to the typical geomorphological development and geological built up of coasts. The module combines a lecture, seminar, and field work.
Course Content
This lecture will introduce the geomorphology and governing processes of coastal morphodynamics covering all different coastal typed from the tropics to high latitudes. Typical settings are explored hands on during a field exercise to the North Sea coast of Schleswig Holstein, especially Sylt Island. Students develop their own approaches.
Learning Outcomes
After completion of the course the students will be able to describe hydrodynamic and transport processes as well as global and local sea level issues. They are able to apply their knowledge of experienced sites on other sites. The students will be able to explain how the combination of geological/sedimentological prerequisites and process-interactions lead to the formation of different coasts. They also are able to analyse climate change and sea level change as main future driving forces and apply their knowledge on possible future challenges.
Reading List
Brown et al., 2005. Waves, tides, and shallow water processes (Univ. Press). Masselink et al. 2011. Introduction to Coastal Processes & Geomorphology. Routledge Church et al., Understanding sea-level-rise and variability. Wiley Davidson-Arnott, R., 2010. Introduction to Coastal Processes and Geomorphology, Cambridge University Press
Additional Information*
None
Application of module
Marine Geosciences MSc Applied Geosciences MSc

Module Name	Module Code
Marine Biogeochemistry	mageoMaCBG-01a
Module Coordinator	
Prof. Dr. Klaus Wallmann (Phone: +49-(0)431-6002287, E-mail: kwallmann@geomar.de)	
Organizer	
Institute of Geosciences	
Faculty	
Faculty of Mathematics and Natural Sciences	
Examination Office	
Examination office of Geosciences	

Status³ (C / CE / O)	C
ECTS Credits	5 ECTS
Evaluation	graded
Duration	1 semester
Frequency	Every year, winter semester
Workload per ECTS Credit	30 hours
Total Workload	150 hours
Contact Time	56 hours
Independent Study	94 hours

Teaching Language	English
Entry Requirements as Stated in the Examination Regulations	none
Recommended Requirements*	

Module Course(s)			
Course Type	Course Name	Compulsory/ compulsory elective/ optional	Credit hours
Lecture 1	Pelagic Biogeochemistry	Compulsory	2
Lecture 2	Benthic Biogeochemistry	Compulsory	2
Further Information on the Course(s)*		Class size: 40 students	
Prerequisites for Admission to the Examination(s)*			

Examination(s)				
Examination Name	Type of Examination	Evaluation	Compulsory/ compulsory elective/ optional	Weighting⁴
	written exam	Graded	Compulsory	100%

³ Status of whole module (compulsory, compulsory elective, optional)

⁴ Weighting within the module

Further Information on the Examination(s)*	
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Short Summary*
Course Content
This module will provide a broad overview on biogeochemical cycles in the ocean and in marine sediments. These include the cycles of carbon, oxygen, nitrogen, phosphorus, manganese, iron, sulphur and methane. Modelling approaches such as box models and 1-D transport-reaction models will be explained and explored using simple apps (CDF files).
Learning Outcomes
The students are able to describe biogeochemical cycles in the global ocean and marine sediments. as well as modelling approaches. They are able to use central models and simple apps for modelling biogeochemical cycles.
Reading List
Lecture notes and apps will be distributed via OLAT.
Additional Information*
Application of module
Marine Geosciences MSc

Module Name	Module Code
Marine petrology, geodynamics and ore deposits	mageo MaCMP-01a
Module Coordinator	
Prof. Dr. R. Bousquet (Phone: +49-(0)431-880-2888, E-mail: romain.bousquet@ifg.uni-kiel.de)	
Organizer	
Institute of Geosciences	
Faculty	
Faculty of Mathematics and Natural Sciences	
Examination Office	
Examination office of Geosciences	

Status⁵ (C / CE / O)	C
ECTS Credits	5
Evaluation	graded
Duration	1 semester
Frequency	Every year WS
Workload per ECTS Credit	30 hours
Total Workload	150 hours
Contact Time	70 hours
Independent Study	80 hours

Teaching Language	English
Entry Requirements as Stated in the Examination Regulations	
Recommended Requirements*	Bachelor courses in petrology/geodynamics

Module Course(s)			
Course Type	Course Name	Compulsory/ compulsory elective/ optional	Credit hours
Lecture	Petrology & geodynamics	Compulsory	2
Lecture	Marine mineral resources	Compulsory	2
Practical Exercise	Geodynamics & ore deposits	Compulsory	1
Further Information on the Course(s)*			
Prerequisites for Admission to the Examination(s)*		Successful passed exercises	

Examination(s)				
Examination Name	Type of Examination	Evaluation	Compulsory/ compulsory elective/ optional	Weighting⁶
	written exam	graded	compulsory	100%

⁵ Status of whole module (compulsory, compulsory elective, optional)

⁶ Weighting within the module

Further Information on the Examination(s)*				

Short Summary*

This module will provide a broad overview on the petrology and geodynamics of the seafloor and their relationships with marine mineral and ore resources.

Course Content

This module will focus on the formation and evolution of the oceanic lithosphere in the context of global geodynamics. Emphasis will be placed on the relationships between plate tectonics and magmatic, metamorphic and hydrothermal processes: Understanding the influence of plate tectonics on melting processes, the rifting dynamics, the heat flow variations, ...
 Formation of marine resources in association with volcanic, sedimentary and hydrothermal processes at the sea floor. Characterization of volcanic deposits and their eruption and transport mechanisms.
 We will examine the formation, geological setting, and evolution of deep-sea mineral occurrences as well as their resource potential and environmental impacts of possible mining activities

Learning Outcomes

Students have an in-depth understanding of the ocean floor’s formation and evolution so they are able to analyse hydrothermal fluids, solve thermodynamic modeling exercises and explain their role in the whole Earth System and its importance in future mineral/ ore resources.
 The students are able to explain the basic geological background of the variability of marine mineral resources and how this relates to global demands to mine them for a future secure metal supply and for achieving the UN sustainable development goals.

Reading List

Humphris, S., Zierenberg, R., Mullineaux, L., and Thomson, R. (1995) Seafloor Hydrothermal Systems: Physical, Chemical, Biological, and Geological Interactions American Geophysical Union, Geophysical Monograph Series 91
 Frisch, W., Meschede, M., Blakey, R. (2011) Plate Tectonics - Continental Drift and Mountain Building. Springer, Berlin-Heidelberg
 P.E. Halbach, V. Tunnicliffe, and J.R. Hein: Energy and mass transfer in marine hydrothermal systems. Dahlem University Press, Berlin.
 Geochemistry of Hydrothermal Ore Deposits, 3rd Edition. Hubert Lloyd Barnes (Editor). ISBN: 978-0-471-57144-5. Hardcover. 992 pages. June 1997
 Hekinian, R., Sea Floor Exploration: Scientific Adventures Diving into the Abyss (2014), Springer, SBN 978-3-319-03203-0
 Harff, J., Meschede, M., Petersen, S. and Thiede, J., eds. (2016) Encyclopedia of Marine Geosciences. Encyclopedia of Earth Sciences Series Springer, Dordrecht, XXXIII, 961 pp. ISBN 978-94-007-6237-4.
 Ridley J., 2013, Ore deposit Geology, Cambridge University Press
 Kesler S. E., Somon A.C., 2015, Mineral resources, economics and the environment, Cambridge University Press

Publications:

Hein, J.R., et al., (2013) Deep-ocean mineral deposits as a source of critical metals for high- and green-technology applications: Comparison with land-based resources. Ore Geology Reviews 51, 1–14. doi:10.1016/j.oregeorev.2012.12.001
 Petersen, S., et al. (2016) News from the seabed – Geological characteristics and resource potential of deep-sea mineral resources. Marine Policy 70, 175–187. doi:10.1016/j.marpol.2016.03.012
 Rona, P.A. (2003) Resources of the sea floor. Science 299, 673–674

Additional Information*

Will be placed on OLAT

Application of module

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Module Name	Module Code
Submarine Mapping	mageoMaCSM-01a
Module Coordinator	
Prof. Dr. Sebastian Krastel, Phone: +49-(0)431-8803914, E-mail: sebastian.krastel@ifg.uni-kiel.de	
Organizer	
Institute of Geosciences	
Faculty	
Faculty of Mathematics and Natural Sciences	
Examination Office	
Examination office of Geosciences	

Status⁷ (C / CE / O)	C
ECTS Credits	5 ECTS
Evaluation	graded
Duration	1 semester
Frequency	Every year, winter semester
Workload per ECTS Credit	30 hours
Total Workload	150 hours
Contact Time	56 hours
Independent Study	94 hours

Teaching Language	English
Entry Requirements as Stated in the Examination Regulations	none
Recommended Requirements*	

Module Course(s)			
Course Type	Course Name	Compulsory/ compulsory elective/ optional	Credit hours
Lecture	Submarine Mapping (Lectures)	Compulsory	2
Exercises	Submarine Mapping (Exercises)	Compulsory	2
Further Information on the Course(s)*		Class size: 40 students (lecture), 30 students (exercises)	
Prerequisites for Admission to the Examination(s)*			

⁷ Status of whole module (compulsory, compulsory elective, optional)

Examination(s)				
Examination Name	Type of Examination	Evaluation	Compulsory/ compulsory elective/ optional	Weighting ⁸
	Oral examination	Graded	Compulsory	100%
Further Information on the Examination(s)*				

Short Summary*
The lecture will introduce acoustic methods for mapping the ocean floor and the internal structure of marine sediments. Principles of submarine mapping as well as the interpretation of acoustic data will be discussed.
Course Content
The module starts with an introduction to different mapping techniques (bathymetric, side scan sonar and seismic systems). Strengths and weaknesses of the methods will be discussed. This knowledge will be used to interpret acoustic data set. Special focus will be on the integrated interpretation of acoustic data sets collected with different tools. Software for visualizing and interpretation of acoustic data will be introduced.
Learning Outcomes
The students are able to describe basic methods for mapping the sea floor including bathymetric, side scan sonar und seismic measurements. The students can visualize and interpret acoustic data of the sea floor. They are aware about advantages and disadvantages of submarine mapping tools.
Reading List
Marine Geophysics, E. J. W. Jones, Wiley Sound Images of the Ocean, P. Wille, Springer Submarine Geomorphology, A. Micalef et al, Springer
Additional Information*
Application of module
Marine Geosciences MSc

⁸ Weighting within the module

Module Name	Module Code
Paleoceanography	mageoMaCPO-01a
Module Coordinator	
Prof. Dr. Martin Frank (Phone: +49-(0)431-6002218, E-mail: mfrank@geomar.de)	
Organizer	
Institute of Geosciences	
Faculty	
Faculty of Mathematics and Natural Sciences	
Examination Office	
Examination office of Geosciences	

Status⁹ (C / CE / O)	C
ECTS Credits	5 ECTS
Evaluation	graded
Duration	1 semester
Frequency	Every year, winter semester
Workload per ECTS Credit	30 hours
Total Workload	150 hours
Contact Time	56 hours
Independent Study	94 hours

Teaching Language	English
Entry Requirements as Stated in the Examination Regulations	none
Recommended Requirements*	

Module Course(s)			
Course Type	Course Name	Compulsory/ compulsory elective/ optional	Credit hours
Lecture	Chemical Paleoceanography	Compulsory	2
Lecture	Marine isotope systems	Compulsory	2
Further Information on the Course(s)*		Class size: 20 students	
Prerequisites for Admission to the Examination(s)*			

Examination(s)				
Examination Name	Type of Examination	Evaluation	Compulsory/ compulsory elective/ optional	Weighting¹⁰
	Written Exam	Graded	Compulsory	100%
Further Information on the Examination(s)*				

⁹ Status of whole module (compulsory, compulsory elective, optional)

¹⁰ Weighting within the module

Short Summary*
Course Content
Distribution and depositional environment of chemical sediments through Earth's history and proxies archived in them to reconstruct past environmental conditions. Knowledge of state of the art chemical analytical techniques and approaches applied to extract isotopic proxy information from marine samples including waters, corals, foraminifera, sediments, etc.
Learning Outcomes
Students are able to describe processes and interaction of marine environmental and biogeochemical systems. They are able to analyse the factors controlling their changes in Earth's history based on proxy information.
Reading List
will be announced during lectures and G. Faure, Principles of Isotope Geology A.P. Dickin, Radiogenic Isotope Geology
Additional Information*
Application of module
Marine Geosciences MSc

Module Name	Module Code
Introduction to Climate Sciences	mageoMaCCS-01a
Module Coordinator	
Prof. Dr. Birgit Schneider (Phone: +49-(0)431-8803254, E-mail: birgit.schneider@ifg.uni-kiel.de)	
Organizer	
Institute of Geosciences	
Faculty	
Faculty of Mathematics and Natural Sciences	
Examination Office	
Examination office of Geosciences	

Status¹¹ (C / CE / O)	C
ECTS Credits	5 ECTS
Evaluation	graded
Duration	1 semester
Frequency	Every year, winter semester
Workload per ECTS Credit	30 hours
Total Workload	150 hours
Contact Time	42 hours
Independent Study	108 hours

Teaching Language	English
Entry Requirements as Stated in the Examination Regulations	none
Recommended Requirements*	

Module Course(s)			
Course Type	Course Name	Compulsory/ compulsory elective/ optional	Credit hours
Lecture	Introduction to Climate Sciences (Lectures)	Compulsory	2
Practical Exercises	Introduction to Climate Sciences (Exercises)	Compulsory	1
Further Information on the Course(s)*		Class size: 20 students	
Prerequisites for Admission to the Examination(s)*		50 % of the exercises correct	

Examination(s)				
Examination Name	Type of Examination	Evaluation	Compulsory/ compulsory elective/ optional	Weighting¹²
	written exam	Graded	Compulsory	100%

¹¹ Status of whole module (compulsory, compulsory elective, optional)

¹² Weighting within the module

Further Information on the Examination(s)*				

Short Summary*
Course Content
Physical and (biogeo-) chemical basics of atmosphere and ocean in terms of composition, state, statics, thermodynamics, radiation, dynamics, as well as atmosphere-ocean interaction.
Learning Outcomes
Students know the fundamental laws to describe and quantify the physical and (biogeo-) chemical state of atmosphere and oceans as components of the climate system.
Reading List
Wallace, J.M. and P.V. Hobbs (2006): Atmospheric Science. Elsevier, Oxford. Salby, M.L. (2012): Physics of the Atmosphere and Climate. Cambridge University Press.
Additional Information*
Application of module
Marine Geosciences MSc

Module Name:	Module Code
Measuring techniques in shallow water	mageoMaCMT-01a
Module Coordinator	
Dr. Klaus Schwarzer, Phone: +49-(0)431.8801188, E-mail: klaus.schwarzer@ifg.uni-kiel.de	
Organizer	
Institute of Geosciences	
Faculty	
Faculty of Mathematics and Natural Sciences	
Examination Office	
Examination office of Geosciences	

Status¹³ (C / CE / O)	C
ECTS Credits	5 ECTS
Evaluation	graded
Duration	1 semester
Frequency	Every year, summer semester
Workload per ECTS Credit	30 hours
Total Workload	150 hours
Contact Time	70 hours
Independent Study	80 hours

Teaching Language	English
Entry Requirements as Stated in the Examination Regulations	None
Recommended Requirements*	

Module Course(s)			
Course Type	Course Name	Compulsory/ compulsory elective/ optional	Credit hours
Seminar	Measuring techniques in shallow water	Compulsory	1
Practical exercise	Exercise (5-days cruise)	Compulsory	4
Further Information on the Course(s)*		Class size: 18	
Prerequisites for Admission to the Examination(s)*			

Examination(s)				
Examination Name	Type of Examination	Evaluation	Compulsory/ compulsory elective/ optional	Weighting¹⁴
Measuring techniques in shallow water: report	report	Graded	Compulsory	100%

¹³ Status of whole module (compulsory, compulsory elective, optional)

¹⁴ Weighting within the module

Further Information on the Examination(s)*				

Short Summary*

The goal of this module is to introduce students to the application of different basic measuring and sampling techniques which are state of the art in marine research. This will be done during a 5 days expedition with a research vessel.

Course Content

This course includes all different hydroacoustic mapping techniques (Multibeam for bathymetry, Side-Scan Sonar for sediment properties, Subbottom profilers for geological built up of the seafloor). Techniques to study hydrodynamic parameters are ADCP and CTD, which will be applied. Sampling techniques will be done by different grab sampler and coring devices (gravity and vibro-corer). Visual observation will be done with video techniques. Besides the application of the different measuring and sampling techniques, data and sampled material which is collected will be treated on board. Students will be supervised in writing reports as the are common for assessment studies. A pre-cruise seminar is included. Students have to give a presentation to topics which are related to the subsequent cruise.

Learning Outcomes

The students are able to describe and use basic methods for the investigation of the seafloor, especially tools for different kind of environmental impact assessments in marine environments, requirements by national and international regulations (Habitat mapping, offshore constructions like windparks, extraction of mineral resources, sediment transport studies, installation of pipelines, etc.)

Reading List

Harris, P.T., Baker, E.K., 2012. Seafloor Geomorphology and Benthic Habitat. GeoHab Atlas of Seafloor Geomorphic Features and Benthic Habitats, 900 p.
 Lurton, X., (2002). An Introduction to underwater Acoustics – principles and Application, 347 S. (Springer).
 Todd, B.J., Greene, H.G., 2007. Mapping the seafloor for Habitat Characterization, Geological Association of Canada, GAC SI 47, 519 pp.

Additional Information*

None

Application of module

Marine Geosciences MSc

Module Name:	Module Code
Field Exercises: Introduction to integrated marine sciences (cruise)	mageoMaCFEM-01a
Module Coordinator	
Dr. Ralph Schneider, Phone: +49-(0)4318801457, E-mail: ralph.schneider@ifg.uni-kiel.de	
Organizer	
Institute of Geosciences	
Faculty	
Faculty of Mathematics and Natural Sciences	
Examination Office	
Examination office of Geosciences	

Status¹⁵ (C / CE / O)	CE
ECTS Credits	5 ECTS
Evaluation	graded
Duration	1 semester
Frequency	Every year
Workload per ECTS Credit	30 hours
Total Workload	150 hours
Contact Time	70 hours
Independent Study	80 hours

Teaching Language	English
Entry Requirements as Stated in the Examination Regulations	None
Recommended Requirements*	

Module Course(s)			
Course Type	Course Name	Compulsory/ compulsory elective/ optional	Credit hours
Practical exercise	Introduction to integrated marine sciences (cruise)	Compulsory	4
Seminar	Introduction to integrated marine sciences (pre and post cruise seminar)	Compulsory	1
Further Information on the Course(s)*		Class size: 15 consists of a preparatory seminar (1 day), 3 day cruise (Baltic Sea) and a postcruise seminar with a compulsory oral presentation by each students (graded) associated seminar and exercises	
Prerequisites for Admission to the Examination(s)*			

¹⁵ Status of whole module (compulsory, compulsory elective, optional)

Examination(s)				
Examination Name	Type of Examination	Evaluation	Compulsory/ compulsory elective/ optional	Weighting ¹⁶
Integrated marine sciences	Oral presentation	Graded	C	100%
Further Information on the Examination(s)*				

Short Summary*
The goal of this module is to introduce students to fieldwork relevant in marine geoscience. The cruise will build upon the measuring techniques from the compulsory module mageoMaCMT-01a. New methods will be introduced, focusing e.g. on geochemical analyses (e.g. trace elements, pore water chemistry) or optical imaging. Furthermore, data will be explored using specific software, e.g. ODV.
Course Content
<p>Integrated marine sciences (cruise):</p> <p>This course includes a variety of techniques from different marine disciplines, such as, but not limited to</p> <ul style="list-style-type: none"> -water sampling using CTD and subsequent analyses of the water (e.g. SSS, SST, pH, O₂, trace elements, DIC) -taking sediment cores (Rumohr) -analyses of marine sediments (microfossils and trace elements, porewater chemistry with respect to early diagenesis) -optical imaging (towed cameras, ROVs, AUVs). <p>Besides the application of the different measuring and sampling techniques, data and sampled material which is collected will be processed.</p>
Learning Outcomes
<p>Integrated marine sciences (cruise):</p> <p>The students are able to apply basic methods for the investigation of the water column and the seafloor. The methods introduced during this course are actively used in the field as part of multidisciplinary research efforts for science and governmental monitoring efforts.</p>
Reading List
<p>Integrated marine sciences (cruise):</p> <p>Durden et al. "PERSPECTIVES IN VISUAL IMAGING FOR MARINE BIOLOGY AND ECOLOGY: FROM ACQUISITION TO UNDERSTANDING" <i>Oceanography and Marine Biology: An Annual Review</i>, 2016, 54, 1-72</p> <p>Broecker & Peng: <i>Tracers in the Sea</i></p> <p>Schulz & Zabel: <i>Marine Geochemistry</i></p>
Additional Information*
Integrated marine sciences (cruise): every year, summer semester
Application of module
Marine Geosciences MSc

¹⁶ Weighting within the module

Module Name:	Module Code
Petrological Field Exercises	mageoMaCFEP-01a
Module Coordinator	
Dr. Romain Bousquet (Phone: +49-(0)431-880-2888, E-mail: romain.bousquet@ifg.uni-kiel.de)	
Organizer	
Institute of Geosciences	
Faculty	
Faculty of Mathematics and Natural Sciences	
Examination Office	
Examination office of Geosciences	

Status¹⁷ (C / CE / O)	CE
ECTS Credits	5 ECTS
Evaluation	graded
Duration	1 semester
Frequency	Every year
Workload per ECTS Credit	30 hours
Total Workload	150 hours
Contact Time	70 hours
Independent Study	80 hours

Teaching Language	English
Entry Requirements as Stated in the Examination Regulations	None
Recommended Requirements*	

Module Course(s)			
Course Type	Course Name	Compulsory/ compulsory elective/ optional	Credit hours
Practical exercise	Petrological field exercises	Compulsory	5
Further Information on the Course(s)*		Class size: 15 Petrological field exercises: 12 days of field exercise with associated seminar and exercises	
Prerequisites for Admission to the Examination(s)*			

¹⁷ Status of whole module (compulsory, compulsory elective, optional)

Examination(s)				
Examination Name	Type of Examination	Evaluation	Compulsory/ compulsory elective/ optional	Weighting¹⁸
Petrological field exercise	report	graded	C	100%
Further Information on the Examination(s)*				

Short Summary*
The goal of this module is to introduce students to petrological and regional geological field exercises with a marine focus
Course Content
12 days of field exercise in a topic relevant area (e.g., ophiolite complex, rifts, or past marine sedimentary systems) with associated seminar and exercises to prepare the field work. The students can apply the knowledge and skills acquired in the course of their studies in the field and obtain detailed documentation and evaluation of the geological results in a report.
Learning Outcomes
Petrological or Regional field exercises: The students are able to independently analyze and create cartographic representations of petrological, lithological, sedimentological, and structural data. Furthermore, they are able to collect and understand data in the field through improved field mapping skills.
Reading List
will be placed on OLAT
Additional Information*
depending on the destination (i.e., weather) winter or summer semester
Application of module
Marine Geosciences MSc

¹⁸ Weighting within the module

Module Name	Module Code
Paleobiology	mageoMaCPB-01a
Module Coordinator	
Prof. Dr. Wolfgang Kuhnt (Phone: +49-(0)431-8802924, E-mail: wolfgang.kuhnt@ifg.uni-kiel.de)	
Organizer	
Institute of Geosciences	
Faculty	
Faculty of Mathematics and Natural Sciences	
Examination Office	
Examination office of Geosciences	

Status¹⁹ (C / CE / O)	C
ECTS Credits	5
Evaluation	graded
Duration	1 semester
Frequency	every summer semester
Workload per ECTS Credit	30 hours
Total Workload	150 hours
Contact Time	70 hours
Independent Study	80 hours

Teaching Language	English
Entry Requirements as Stated in the Examination Regulations	none
Recommended Requirements*	

Module Course(s)			
Course Type	Course Name	Compulsory/ compulsory elective/ optional	Credit hours
Lecture	Evolution of marine biota	compulsory	1
Practical exercises	Practical studies of marine biota	compulsory	3
Seminar	Fundamental questions in paleobiology	compulsory	1
Further Information on the Course(s)*		Class size: 30 students	

¹⁹ Status of whole module (compulsory, compulsory elective, optional)

Prerequisites for Admission to the Examination(s)*	
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Examination(s)				
Examination Name	Type of Examination	Evaluation	Compulsory/ compulsory elective/ optional	Weighting²⁰
Paleobiology: Laboratory Report	Report	ungraded	compulsory	50%
Paleobiology: Written Exam	Written Exam	graded	compulsory	50%
Further Information on the Examination(s)*		The examination is divided into 2 parts (Teilprüfungen): Part 1: Laboratory Report Part 2: Written Exam		

Short Summary*
Course Content
Paleobiology and evolution of selected groups of marine organisms (i.e. foraminifera, corals). Practical exercises of classification, taxonomy and paleoenvironmental interpretation of assemblage composition. Introduction to taphonomy and biogeochemistry of important marine fossil groups.
Learning Outcomes
Through the practical exercises students are able to identify and describe the systematics and evolution of selected marine organism groups. This knowledge is further deepened through a lecture and seminar series, enabling students to interpret environmental and biostratigraphic information of fossil assemblages.
Reading List
Briggs&Crowther: Paleobiology-a synthesis, Blackwell
Cowen: History of Life, Wiley-Blackwell
Additional Information*
Application of module
Marine Geosciences MSc

²⁰ Weighting within the module

Module Name:	Module Code
Sustainability	mageoMaCSus-01a
Module Coordinator	
Dr. Nina Keul, Phone: +49-(0)431 880 3253, E-mail: nina.keul@ifg.uni-kiel.de	
Organizer	
Institute of Geosciences	
Faculty	
Faculty of Mathematics and Natural Sciences	
Examination Office	
Examination office of Geosciences	

Status²¹ (C / CE / O)	C
ECTS Credits	5 ECTS
Evaluation	graded
Duration	1 semester
Frequency	Every year, summer semester
Workload per ECTS Credit	30 hours
Total Workload	150 hours
Contact Time	56 hours
Independent Study	94 hours

Teaching Language	English
Entry Requirements as Stated in the Examination Regulations	None
Recommended Requirements*	

Module Course(s)			
Course Type	Course Name	Compulsory/ compulsory elective/ optional	Credit hours
Lecture	Introduction to Ocean Sustainability	Compulsory	2
Seminar	Ocean Sustainability (Seminar)	Compulsory	2

²¹ Status of whole module (compulsory, compulsory elective, optional)

Further Information on the Course(s)*	Class size: 60		
Prerequisites for Admission to the Examination(s)*			

Examination(s)				
Examination Name	Type of Examination	Evaluation	Compulsory/ compulsory elective/ optional	Weighting²²
	Oral presentation	Graded	Compulsory	100%
Further Information on the Examination(s)*				

Short Summary*
The key to future ocean sustainability lies in understanding the ocean and treating it as an integrated system with diverse social and natural interactions. Therefore we target students from all three marine Master programmes at Kiel University: Marine Geosciences, Climate Physics and Biological Oceanography.
Course Content
The module will concentrate on integrated research areas that focus on the grand challenges faced in attaining ocean sustainability. Students will attend a lecture (Ringvorlesung) where the members of the Cluster of Excellence "Future Ocean" will present current topics on ocean sustainability centering around Ocean Food, Ocean Floor Resources, Ocean Pollutants, Ocean Disasters, Ocean Stewardship, and Ocean Narratives. Students will further explore these topics within a seminar, where they will present sustainability topics close to their own area of expertise to the fellow students from the other Master programmes.
Learning Outcomes
Students are able to describe the basic concepts of ocean sustainability. Furthermore, students will be familiar with innovative and solution-orientated opportunities for sustainability policy that reduces ocean pressures, enhance resilience and safeguards human prosperity derived from the ocean. Using this knowledge, students will be able to analyse sustainability related topics in an interdisciplinary setting, developing an important skill not only for academic careers, but also for engagement with societal actors and knowledge holders outside academia.
Reading List
Course contents and further reading will be specified for each course upon the topics identified according to the student preferences. All course material will be uploaded on OLAT.
Additional Information*
None
Application of module
Marine Geosciences MSc, Biological Oceanography MSc, Climate Physics MSc

²² Weighting within the module

Module Name:	Module Code
Marine Paleoenvironment	mageoMaCMPE-01a
Module Coordinator	
Dr. Ralph Schneider, Phone: +49-(0)4318801457, E-mail: ralph.schneider@ifg.uni-kiel.de	
Organizer	
Institute of Geosciences	
Faculty	
Faculty of Mathematics and Natural Sciences	
Examination Office	
Examination office of Geosciences	

Status²³ (C / CE / O)	C
ECTS Credits	5 ECTS
Evaluation	graded
Duration	1 semester
Frequency	Every year, winter semester
Workload per ECTS Credit	30 hours
Total Workload	150 hours
Contact Time	70 hours
Independent Study	80 hours

Teaching Language	English
Entry Requirements as Stated in the Examination Regulations	None
Recommended Requirements*	

Module Course(s)			
Course Type	Course Name	Compulsory/ compulsory elective/ optional	Credit hours
Lecture	The Oceans Role in Climate	Compulsory	1
Practical exercise	Quantitative Proxies	Compulsory	2
Practical exercise	Ocean-Continent-Atmosphere Interactions	Compulsory	2
Further Information on the Course(s)*		Class size: 30	
Prerequisites for Admission to the Examination(s)*			

Examination(s)				
Examination Name	Type of Examination	Evaluation	Compulsory/ compulsory elective/ optional	Weighting²⁴
Report: Marine Paleoenvironment	Report	Graded	Compulsory	100%

²³ Status of whole module (compulsory, compulsory elective, optional)

²⁴ Weighting within the module

Further Information on the Examination(s)*				

Short Summary*
Course Content
Feedback mechanisms between Ocean, Continents and Atmosphere in the Earth's Climate System. Introduction to climatically relevant biogeochemical and physical processes on time scales from decades to million years.
Learning Outcomes
Students are able to describe the complex interaction of physical and biogeochemical processes in the Earth's Climate System.
Reading List
actual research articles will be provided and placed on OLAT.
Additional Information*
None
Application of module
Marine Geosciences MSc

Module Name:	Module Code
Project Work Marine Geosciences	mageoMaCPW-01a
Module Coordinator	
Dr. Ralph Schneider, Phone: +49-(0)4318801457, E-mail: ralph.schneider@ifg.uni-kiel.de	
Organizer	
Institute of Geosciences	
Faculty	
Faculty of Mathematics and Natural Sciences	
Examination Office	
Examination office of Geosciences	

Status²⁵ (C / CE / O)	C
ECTS Credits	10 ECTS
Evaluation	non graded
Duration	1 semester
Frequency	Every semester, summer and winter semester
Workload per ECTS Credit	30 hours
Total Workload	300 hours
Contact Time	140 hours
Independent Study	160 hours

Teaching Language	English
Entry Requirements as Stated in the Examination Regulations	None
Recommended Requirements*	

Module Course(s)			
Course Type	Course Name	Compulsory/ compulsory elective/ optional	Credit hours
Seminar	Research Seminar Marine Geosciences	Compulsory	2
Practical exercise	Work Project Marine Geosciences	Compulsory	8
Further Information on the Course(s)*			
Prerequisites for Admission to the Examination(s)*			

Examination(s)				
Examination Name	Type of Examination	Evaluation	Compulsory/ compulsory elective/ optional	Weighting²⁶
	Report	graded	Compulsory	100%

²⁵ Status of whole module (compulsory, compulsory elective, optional)

²⁶ Weighting within the module

Further Information on the Examination(s)*				

Short Summary*
Course Content
Application of marine geoscientific working methods, report writing and presentation of own project data. The project work usually lasts 4 - 6 weeks.
Learning Outcomes
Students are able to acquire and validate independently analytical data . Furthermore, students are able to write and present scientific concepts.
Reading List
Actual research articles will be provided in the seminar. Laboratory protocols and manuals are made accessible for project work.
Additional Information*
None
Application of module
Marine Geosciences MSc

Module Name:	Module Code
Masterthesis	mageoMaCMTh-01a
Module Coordinator	
Dr. Ralph Schneider, Phone: +49-(0)4318801457, E-mail: ralph.schneider@ifg.uni-kiel.de	
Organizer	
Institute of Geosciences	
Faculty	
Faculty of Mathematics and Natural Sciences	
Examination Office	
Examination office of Geosciences	

Status²⁷ (C / CE / O)	C
ECTS Credits	28 ECTS
Evaluation	graded
Duration	1 semester
Frequency	Every year, summer and winter semester
Workload per ECTS Credit	30 hours
Total Workload	840 hours
Contact Time	400 hours
Independent Study	440 hours

Teaching Language	English
Entry Requirements as Stated in the Examination Regulations	None
Recommended Requirements*	

Module Course(s)			
Course Type	Course Name	Compulsory/ compulsory elective/ optional	Credit hours
	Masterthesis	Compulsory	6 months
Further Information on the Course(s)*			
Prerequisites for Admission to the Examination(s)*			

Examination(s)				
Examination Name	Type of Examination	Evaluation	Compulsory/ compulsory elective/ optional	Weighting²⁸
Masterthesis	Masterthesis	Graded	Compulsory	100%

²⁷ Status of whole module (compulsory, compulsory elective, optional)

²⁸ Weighting within the module

Further Information on the Examination(s)*	
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Short Summary*
Course Content
Preparation of an independent research thesis.
Learning Outcomes
The Students will acquire profound and specific knowledge on the topic of the Master's thesis and the surrounding scientific area in the respective focus area. Furthermore students are familiar with techniques for developing a written scientific presentation. They are able to develop a concept for their research work and can structure and execute their work in the lab and on their thesis . Students can integrate the knowledge acquired through their studies into the data interpretation of their theses. Students can develop further research approaches based on their achievements so far.
Reading List
Actual research articles depending on topic shall be collected by the student
Additional Information*
None
Application of module
Marine Geosciences MSc

Module Name:	Module Code
Masterthesis Seminar	mageoMaCMTS-01a
Module Coordinator	
Dr. Ralph Schneider, Phone: +49-(0)4318801457, E-mail: ralph.schneider@ifg.uni-kiel.de	
Organizer	
Institute of Geosciences	
Faculty	
Faculty of Mathematics and Natural Sciences	
Examination Office	
Examination office of Geosciences	

Status²⁹ (C / CE / O)	C
ECTS Credits	2 ECTS
Evaluation	graded
Duration	1 semester
Frequency	Every year, summer and winter semester
Workload per ECTS Credit	30 hours
Total Workload	60 hours
Contact Time	28 hours
Independent Study	32hours

Teaching Language	English
Entry Requirements as Stated in the Examination Regulations	None
Recommended Requirements*	

Module Course(s)			
Course Type	Course Name	Compulsory/ compulsory elective/ optional	Credit hours
Seminar	Masterthesis Seminar	Compulsory	2
Further Information on the Course(s)*			
Prerequisites for Admission to the Examination(s)*			

Examination(s)				
Examination Name	Type of Examination	Evaluation	Compulsory/ compulsory elective/ optional	Weighting³⁰
Masterthesis Seminar	Oral presentation	Graded	Compulsory	100%

²⁹ Status of whole module (compulsory, compulsory elective, optional)

³⁰ Weighting within the module

Further Information on the Examination(s)*				

Short Summary*
Course Content
Oral presentation of an independent research thesis.
Learning Outcomes
Students are able to present and discuss their own work critically on the background of current scientific knowledge and can put it into relation to its social and scientific impact. Furthermore, they can present their results and reasoning according to the rules of Good Scientific Practice.
Reading List
Actual research articles depending on topic shall be collected by the student
Additional Information*
None
Application of module
Marine Geosciences MSc

Module Name	Module Code
Applied Paleobiology	mageoMaCEAP-01a
Module Coordinator	
Prof. Dr. Wolfgang Kuhnt (Phone: +49-(0)431-8802924, E-mail: wolfgang.kuhnt@ifg.uni-kiel.de)	
Organizer	
Institute of Geosciences	
Faculty	
Faculty of Mathematics and Natural Sciences	
Examination Office	
Examination office of Geosciences	

Status³¹ (C / CE / O)	CE
ECTS Credits	5
Evaluation	graded
Duration	1 semester
Frequency	every summer semester
Workload per ECTS Credit	30 hours
Total Workload	150 hours
Contact Time	70 hours
Independent Study	80 hours

Teaching Language	English
Entry Requirements as Stated in the Examination Regulations	
Recommended Requirements*	

Module Course(s)			
Course Type	Course Name	Compulsory/ compulsory elective/ optional	Credit hours
Lecture	Microfossils as proxies for climate and environment and Quantitative Micropaleontology	Compulsory	2
Practical exercise	Saltmarsh foraminifers in Schleswig Holstein as proxies for sealevel fluctuations	Compulsory	3
Further Information on the Course(s)*		Class size: 30 students	
Prerequisites for Admission to the Examination(s)*			

³¹ Status of whole module (compulsory, compulsory elective, optional)

Examination(s)				
Examination Name	Type of Examination	Evaluation	Compulsory/ compulsory elective/ optional	Weighting³²
Field report	Report	ungraded	C	50%
Lecture exam	Written Exam	graded	C	50%
Further Information on the Examination(s)*		The examination is divided into 2 parts (Teilprüfungen): Part 1: Field Report Part 2: Written Exam		

Short Summary*
Course Content
Application of marine microfossils in paleoceanography, paleoclimate and paleoenvironmental research focusing on seawater temperature, salinity, productivity and sea-level reconstructions. Introduction to micropaleontological field and laboratory methods including quantitative applications such as statistical analysis of assemblage composition and transfer functions. Introduction to microfossils as isotope and geochemical tracers. Selected case studies to the application of microfossils as environmental indicators.
Learning Outcomes
Students are able to use marine microfossils as proxies for climate and environment, using quantitative methods such as statistical analysis of assemblage composition, transfer functions and isotope and geochemical signals in microfossil shells. The field course will enable the student to observe, describe and sample marine sediments, skills that can be applied on ship expeditions and for ecological studies in coastal areas.
Reading List
Scott, D. B., Medioli, F. S. & Schafer, C. T. 2001. Monitoring in Coastal Environments Using Foraminifera and Thecamoebian Indicators.
Additional Information*
Application of module
Marine Geosciences MSc

³² Weighting within the module

Module Name	Module Code
Coastal Processes and Engineering	magoMaCECG2-01a
Module Coordinator	
Prof. Dr. Christian Winter, Phone: +49-(0)431.8802881, E-mail: christian.winter@ifg.uni-kiel.de	
Organizer	
Institute of Geosciences	
Faculty	
Faculty of Mathematics and Natural Sciences	
Examination Office	
Examination office of Geosciences	

Status³³ (C / CE / O)	CE
ECTS Credits	5
Evaluation	graded
Duration	1 semester
Frequency	Winter Semester only
Workload per ECTS Credit	30 hours
Total Workload	150 hours
Contact Time	70 hours
Independent Study	80 hours

Teaching Language	Englisch
Entry Requirements as Stated in the Examination Regulations	
Recommended Requirements*	

Module Course(s)			
Course Type	Course Name	Compulsory/ compulsory elective/ optional	Credit hours
Lecture	Coastal Engineering	CE	2
Practical Exercise	Sediment Flume	CE	2
Seminar	Modelling of coastal processes	CE	1
Further Information on the Course(s)*	Class size: 30 students		
Prerequisites for Admission to the Examination(s)*	Attendance at the laboratory course and seminar		

Examination(s)				
Examination Name	Type of Examination	Evaluation	Compulsory/ compulsory elective/ optional	Weighting³⁴
Coastal Processes and Engineering	Written Exam	graded	C	100%

³³ Status of whole module (compulsory, compulsory elective, optional)

³⁴ Weighting within the module

Further Information on the Examination(s)*	One written examination for all courses
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Short Summary*
<p>The goal of this module is a process based understanding of coastal morphodynamics with a focus on coastal engineering.</p> <p>The module combines a lecture, laboratory work, and numerical modelling exercises. After completion of the course the students shall have achieved knowledge on hydrodynamic and transport processes, they shall have experienced sedimentary processes in hands-on experiments in laboratory a flume. They shall have learned to apply and discuss numerical models for the simulation of shallow water systems.</p>
Course Content
<p>A lecture will introduce processes and coastal engineering measures. In a sedimentary flume experiments will be carried out and discussed. Modelling concepts are introduced and experienced by the students by own programming of simple transport models and application of state-of-the-art numerical modelling systems.</p>
Learning Outcomes
<p>Based on process based knowledge and experience students are capable of a critical discussion of coastal engineering measures and numerical models. Furthermore, they are able to analyse the main sedimentological processes in laboratory scale.</p>
Reading List
<p>Reeve, D. et al. (2012) Coastal Engineering. Spon Press</p> <p>Eurotop manual (online www.overtopping-manual.com)</p> <p>Cooper & Pilkey (2012) Pitfalls of Shoreline Stabilisation. Springer</p> <p>Masselink et al. 2011 Introduction to Coastal Processes & Geomorphology. Routledge</p>
Additional Information*
None
Application of module
Master Marine Geosciences

Module Name	Module Code
Paleoclimate Modelling	mageoMaCEPM-01a
Module Coordinator	
Prof. Dr. Birgit Schneider (Phone: +49-(0)431-8803254, E-mail: birgit.schneider @ifg.uni-kiel.de)	
Organizer	
Institute of Geosciences	
Faculty	
Faculty of Mathematics and Natural Sciences	
Examination Office	
Examination office of Geosciences	

Status³⁵ (C / CE / O)	CE
ECTS Credits	5 ECTS
Evaluation	graded
Duration	1 semester
Frequency	Every year, summer semester
Workload per ECTS Credit	30 hours
Total Workload	150 hours
Contact Time	56 hours
Independent Study	94 hours

Teaching Language	English
Entry Requirements as Stated in the Examination Regulations	Introduction to Climate Sciences (mageoMaCCS-01a)
Recommended Requirements*	

Module Course(s)			
Course Type	Course Name	Compulsory/ compulsory elective/ optional	Credit hours
Lecture	Paleoclimate Modelling (Lecture)	Compulsory	2
Practical Exercises	Applied Programming Techniques (Practical Exercise)	Compulsory	2
Further Information on the Course(s)*	Class size: 20 students		
Prerequisites for Admission to the Examination(s)*			

Examination(s)				
Examination Name	Type of Examination	Evaluation	Compulsory/ compulsory elective/ optional	Weighting³⁶
	Report	Graded	Compulsory	100%

³⁵ Status of whole module (compulsory, compulsory elective, optional)

³⁶ Weighting within the module

Further Information on the Examination(s)*				

Short Summary*
Course Content
Numerical methods in Earth Sciences (Atmosphere, Ocean) and their application. Design, set-up, validation and analysis of climate model simulations. Basic skills in Unix/Linux, CDO, ferret, Latex to analyse and visualize model results and to prepare print-ready manuscripts.
Learning Outcomes
Students are able to use numerical methods to quantitatively describe atmospheric and oceanic flow. Through hands-on practical exercises they are able to use basic computer tools to analyse/visualize output from state-of-the-art climate models.
Reading List
Ruddiman, W. (2013): Earth's Climate: Past and Future. WH Freeman.
Mc Guffie, K. and A. Henderson-Sellers (2005): A Climate Modelling Primer. John Wiley & Sons.
Additional Information*
Students can participate in the additional module "Earth system Lab" in the following semester (also CE)
Application of module
Marine Geosciences MSc

Module Name	Module Code
Earth System Lab	mageoMaCEESL-01a
Module Coordinator	
Prof. Dr. Birgit Schneider (Phone: +49-(0)431-8803254, E-mail: birgit.schneider@ifg.uni-kiel.de)	
Organizer	
Institute of Geosciences	
Faculty	
Faculty of Mathematics and Natural Sciences	
Examination Office	
Examination office of Geosciences	

Status³⁷ (C / CE / O)	CE
ECTS Credits	5 ECTS
Evaluation	graded
Duration	1 semester
Frequency	Every year, winter semester
Workload per ECTS Credit	30 hours
Total Workload	150 hours
Contact Time	56 hours
Independent Study	94 hours

Teaching Language	English
Entry Requirements as Stated in the Examination Regulations	Paleoclimate Modelling (mageoMaCEPM-01a)
Recommended Requirements*	

Module Course(s)			
Course Type	Course Name	Compulsory/ compulsory elective/ optional	Credit hours
Lecture	Concepts of Earth System Modelling (Lecture)	Compulsory	1
Practical Exercises	Earth System Dynamics (Practical Exercise)	Compulsory	3
Further Information on the Course(s)*		Class size: 20 students	
Prerequisites for Admission to the Examination(s)*			

³⁷ Status of whole module (compulsory, compulsory elective, optional)

Examination(s)				
Examination Name	Type of Examination	Evaluation	Compulsory/ compulsory elective/ optional	Weighting ³⁸
	Report	Graded	Compulsory	100%
Further Information on the Examination(s)*				

Short Summary*
Course Content
Concepts of modelling the links between the different components of the climate system, with a special focus on element cycling in the ocean (water column). Advanced use of Unix/Linux, CDO, ferret, Latex to analyse and visualize model results and to prepare print-ready manuscripts.
Learning Outcomes
Students are able to explain the connections and interactions between the different components of the climate system and their time scales of interaction. They are able to analyse results from numerical models of ocean circulation and marine biogeochemical cycles with a focus on element cycling in the ocean with relevance to global climate, carbon cycle and ocean (de)oxygenation.
Reading List
Ruddiman, W. (2013): Earth's Climate: Past and Future. WH Freeman. Sarmiento, J. and N. Gruber (2013): Ocean Biogeochemical Dynamics. Princeton University Press.
Additional Information*
Application of module
Marine Geosciences MSc

³⁸ Weighting within the module

Module Name:	Module Code
Current Topics in Marine Biogeosciences	mageoMaCECT-01a
Module Coordinator	
Dr. Nina Keul, Phone: +49-(0)431 880 3253, E-mail: nina.keul@ifg.uni-kiel.de	
Organizer	
Institute of Geosciences	
Faculty	
Faculty of Mathematics and Geosciences	
Examination Office	
Examination office of Geosciences	

Status³⁹ (C / CE / O)	CE
ECTS Credits	5 ECTS
Evaluation	graded
Duration	1 semester
Frequency	Every year, summer semester
Workload per ECTS Credit	30 hours
Total Workload	150 hours
Contact Time	56 hours
Independent Study	94 hours

Teaching Language	English
Entry Requirements as Stated in the Examination Regulations	None
Recommended Requirements*	

Module Course(s)			
Course Type	Course Name	Compulsory/ compulsory elective/ optional	Credit hours
Lecture	Marine Biogeosciences (Lecture)	Compulsory	2
Seminar	Marine Biogeosciences (Seminar)	Compulsory	2
Further Information on the Course(s)*		Class size: 20	
Prerequisites for Admission to the Examination(s)*			

Examination(s)				
Examination Name	Type of Examination	Evaluation	Compulsory/ compulsory elective/ optional	Weighting⁴⁰
	Oral presentation	Graded	Compulsory	100%

³⁹ Status of whole module (compulsory, compulsory elective, optional)

⁴⁰ Weighting within the module

Further Information on the Examination(s)*	
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Short Summary*

The objective of the module is to cut across the boundaries of established sciences and give students an interdisciplinary view of interactions between biological, chemical, and physical processes in the ocean.

Course Content

On-going research in marine biogeosciences will be presented in lectures and critically discussed in a student seminar series.

Topics will be from a broad area of marine sciences, including oceanic regimes and interaction between physical and biological systems, physical and biological response to global change, biomineralization biogeochemistry and palaeogeobiology, including origin and evolution of life, evolution of the biosphere, sedimentary records, and the development and use of proxies.

This module serves two purposes: In the lectures students will be taught the basics of marine biogeosciences and physical oceanography. In the seminars, students will work on current research topics in these fields, including recent developments and novel scientific concepts

Learning Outcomes

On successful completion of this module, students will be able to describe the interactions between the biological, chemical, and physical processes in the ocean.

They will be aware of the present and projected future impacts of human activities on marine ecosystems and biogeochemistry. The seminar series will provide students with the opportunity to get an insight and critically evaluate on-going research topics through participation in scientific discussions. Students can select their own research questions, formulate testable hypotheses, and learn about state of the art methodologies. By experiencing the interdisciplinary nature of marine biogeosciences, students will develop the ability to place results in a specific area into the larger context of understanding the role of ocean physics and biogeochemistry in the earth system.

Reading List

Relevant literature will be provided during the module and uploaded on OLAT.

Additional Information*

None

Application of module

Marine Geosciences MSc, Biological Oceanography MSc, Climate Physics MSc

Module Name	Module Code
Marine Igneous Geochemistry	mageoMaCEMIG-01a
Module Coordinator	
Prof. Dr. Kaj Hoernle (Phone: +49-(0)431-6002642, E-mail: khoernle@geomar.de)	
Organizer	
Institute of Geosciences	
Faculty	
Faculty of Mathematics and Natural Sciences	
Examination Office	
Examination office of Geosciences	

Status⁴¹ (C / CE / O)	CE
ECTS Credits	5 ECTS
Evaluation	graded
Duration	1 semester
Frequency	Every year, summer semester
Workload per ECTS Credit	30 hours
Total Workload	150 hours
Contact Time	70 hours
Independent Study	80 hours

Teaching Language	English
Entry Requirements as Stated in the Examination Regulations	none
Recommended Requirements*	

Module Course(s)			
Course Type	Course Name	Compulsory/ compulsory elective/ optional	Credit hours
Lecture (J. Geldmacher & K. Hoernle)	Isotope geochemistry and geochronology of marine magmatic systems	Compulsory	2
Seminar (K. Hoernle & J. Geldmacher)	Key papers and current topics in igneous geochemistry	Compulsory	3
Further Information on the Course(s)*		Class size: 15 students	
Prerequisites for Admission to the Examination(s)*		Lecture: none; Seminar: one presentation.	

⁴¹ Status of whole module (compulsory, compulsory elective, optional)

Examination(s)				
Examination Name	Type of Examination	Evaluation	Compulsory/ compulsory elective/ optional	Weighting⁴²
Marine Igneous Geochemistry: Oral presentation	Oral presentation	Graded	Compulsory	100%
Further Information on the Examination(s)*		Oral presentation including participation in discussion (50%). Tested competence: Applying knowledge of igneous geochemistry (including isotope systems) in understanding, presenting, evaluating and discussing respective publications in that field.		

Short Summary*
Course Content
<p>This module will provide a broad overview on general principles and applications of igneous geochemistry, in particular radiogenic isotope geochemistry, including the use of the Rb-Sr, Sm-Nd, U-Th-Pb, Lu-Hf, He, O and other isotope systems for identifying magma sources, geodynamic settings and age dating.</p> <p>In the seminar, the participants will learn how to professionally present a scientific topic/question (related to the module title) to a larger audience and to discuss the presented content. The focus of the respective seminar will be discussed with participants at the beginning of each semester.</p>
Learning Outcomes
<p>Students will be able to apply the basic applications of igneous geochemistry (and in particular the use of radiogenic isotopes for identifying magma sources and geochronology) to marine igneous systems. The seminar enables participants to professionally present a scientific topic/question (related to igneous geochemistry) to a larger audience and how to answer difficult questions about the presented content.</p>
Reading List
<p><u>Lecture:</u> G. Faure (1986) Principles of Isotope Geology, Wiley</p> <p><u>Seminar:</u> During the first session, the seminar content will be discussed among the participants. Accordingly, specific reference information will be provided to all participants.</p>
Additional Information*
Application of module
<p>Marine Geosciences MSc Applied Geosciences MSc Geosciences MSc</p>

⁴² Weighting within the module

Module Name	Module Code
Analytical Geochemistry	mageoMaCEAG-01a
Module Coordinator	
Dieter Garbe-Schönberg (Phone: +49-(0)431-880-2872, E-mail: dieter.garbe-schoenberg@ifg.uni-kiel.de)	
Organizer	
Institute of Geosciences	
Faculty	
Faculty of Mathematics and Natural Sciences	
Examination Office	
Examination office of Geosciences	

Status⁴³ (C / CE / O)	CE
ECTS Credits	5
Evaluation	ungraded
Duration	1 semester
Frequency	yearly every winter semester (block course)
Workload per ECTS Credit	30 hours
Total Workload	150 hours
Contact Time	56 hours
Independent Study	94 hours

Teaching Language	English
Entry Requirements as Stated in the Examination Regulations	
Recommended Requirements*	

Module Course(s)			
Course Type	Course Name	Compulsory/ compulsory elective/ optional	Credit hours
Lecture	Analytical Geochemistry	Compulsory	2 SWS
Exercise	Instrumental analytical Methods	Compulsory	2 SWS
Further Information on the Course(s)*		Class size: 8 students	
Prerequisites for Admission to the Examination(s)*			

Examination(s)				
Examination Name	Type of Examination	Evaluation	Compulsory/ compulsory elective/ optional	Weighting⁴⁴

⁴³ Status of whole module (compulsory, compulsory elective, optional)

⁴⁴ Weighting within the module

Report	Report	non graded	Compulsory	100%
Further Information on the Examination(s)*				

Short Summary*

Samples taken during previous practical field work (ship-based or land-based) shall be analyzed with hands-on experience by analytical methods that are available in-house. Quality of generated data shall be evaluated and chemical data interpreted in the context of a defined scientific problem. Bulk analytical techniques are used for whole rock and porewater chemistry. Micro-analytical techniques are increasingly used for deciphering in-situ chemical archives in (bio-) minerals (foraminifera, pteropods, algae, shells, corals, otoliths, teeth etc.), speleothems, laminated sediments, rock-forming minerals etc. for reconstructing past environmental conditions during their formation. This module introduces into fundamentals of operation of widely used, and on-site available, analytical techniques: LA-ICP-MS, ICP-OES, EPMA, Raman spectrometry, SEM, XRF etc. and discusses their strengths and pitfalls with hands-on experience in the labs. A focus will be on basic principles of analytical quality assessment and statistical data evaluation including chemical imaging.

Course Content

Introduction to analytical chemistry, analytical quality control, principles of XRF-based techniques, atomic spectrometry, mass spectrometry, laser ablation; instrument optimization; sample preparation; analytical data processing and calibration strategies; principles of electron beam microprobe and scanning electron microscopy, EDAX, ZAF correction and data processing; calculation of mineral formulae; Raman microprobe; molecular and isotopic characterization and interpretation of organic matter composition

Learning Outcomes

Students will be able to describe principles of (micro-)analytical chemistry, instrument operation and optimization, sample preparation as well as to critically evaluate analytical data. Furthermore, students will be able to analyse rock samples, (bio-) minerals, sediment cores, marine porewater, organic matter composition in the biogeosphere for application in past environment reconstruction.

Reading List

Bertin, E. P., 1984. Principles and Practice of X-ray Spectrometric Analysis. Plenum Press, New York.
 Jenkins, R. et al., 1995. Quantitative X-ray Spectrometry. Marcel Dekker, Inc., New York.
 Potts, P. J., 2003. Handbook of Rock Analysis. Viridian Publishing. ISBN 0-9544891-3-6
 Montaser, A, 1998, Inductively-Coupled-Plasma-Mass-Spectrometry. – Wiley-VCH
 Sylvester, P., 2001. Laser-Ablation ICP-MS in the Earth Sciences
 Grasshoff, K. 2007. Methods of Seawater Analysis. 3rd edition. Wiley VCH
 Killops and Killops – Introduction to Organic Geochemistry
 Peters, Walters and Moldowan – The Biomarker Guide

Additional Information*

Application of module

Marine Geosciences MSc

Module Name	Module Code
Marine geospatial and environmental analyses using high resolution surveying techniques	mageoMaCSM2-01a
Module Coordinator	
Dr. Jens Schneider von Deimling (Phone: +49-(0)431-8805792, E-mail: jens.schneider@ifg.uni-kiel.de)	
Organizer	
Institute of Geosciences	
Faculty	
Faculty of Mathematics and Natural Sciences	
Examination Office	
Examination office of Geosciences	

Status⁴⁵ (C / CE / O)	CE
ECTS Credits	5 ECTS
Evaluation	graded
Duration	1 semester
Frequency	Every year, winter semester
Workload per ECTS Credit	30 hours
Total Workload	150 hours
Contact Time	56 hours
Independent Study	94 hours

Teaching Language	English
Entry Requirements as Stated in the Examination Regulations	-
Recommended Requirements*	Submarine Mapping I

Module Course(s)			
Course Type	Course Name	Compulsory/ compulsory elective/ optional	Credit hours
Lecture	Marine geospatial and environmental analyses using high resolution surveying techniques (Lectures)	CE	2
Exercises	Marine geospatial and environmental analyses using high resolution surveying techniques (Exercises)	CE	2

⁴⁵ Status of whole module (compulsory, compulsory elective, optional)

Further Information on the Course(s)*	Class size: 40 students (lecture), 30 students (exercises)
Prerequisites for Admission to the Examination(s)*	

Examination(s)				
Examination Name	Type of Examination	Evaluation	Compulsory/ compulsory elective/ optional	Weighting⁴⁶
	Oral examination	Graded	Compulsory	100%
Further Information on the Examination(s)*				

Short Summary*

The module offers comprehensive knowledge about high resolution seafloor mapping such as multibeam echosounding, and airborne bathymetric measurements (LiDAR). The module highlights the arising topic of environmental marine monitoring and has a focus on shallow coastal waters. The module covers theory and offers practical exercises using case study data mainly from the Baltic Sea. The lecture also introduces into acoustic seabed classification techniques, general and specific habitat mapping approaches, and highlights seabed mapping under the control of geological and biological activity.

Course Content

The module offers an overview of high resolution surveying techniques with focus on shallow coastal waters. Geo-bio acoustic properties of the water column and the seabed will be introduced by evaluating multibeam echosounder case study data. Optic methods in shallow water like laser bathymetric measurements will complement the module. Marine flora and fauna will be discussed as an important factor in regard to opto-acoustic interaction and seabed mapping and classification. Geo-spatial and backscatter analyses will be accomplished and state-of-the-art methods for seafloor classification and habitat characterization will be introduced. The module will also present dedicated case studies from commercial near- and offshore applications like cable detection, pipeline monitoring, mammal protection, and boulder detection. Real-world technical skills and environmental understanding relevant for submarine mapping shall be examined by dedicated exercises. Furthermore software for processing, visualizing, classification, and interpretation of acoustic (multibeam) and optical (LiDAR) data will be introduced.

Learning Outcomes

The students are able to apply high resolution mapping techniques especially in shallow coastal settings. This includes knowledge of highly accurate positioning techniques. Students will gain knowledge about various habitats in the Baltic Sea and are able to estimate assets and pitfalls in regard to corresponding surveying and classification. The students can visualize and interpret acoustic data of the seabed surface and the water column. They are aware about advantages and disadvantages of acoustical and optical submarine mapping tools.

Reading List

Harris, P. T., & Baker, E. K. (Eds.). (2011). Seafloor geomorphology as benthic habitat. Elsevier.
http://www.mdpi.com/journal/geosciences/special_issues/marine_geomorphometry
https://www.gebco.net/data_and_products/gebco_cook_book/

Additional Information*

Application of module

Marine Geosciences MSc
 Geophysik MSc

⁴⁶ Weighting within the module

Module Name	Module Code
Paleobiogeochemistry	mageoMaCPBG-01a
Module Coordinator	
Prof. Dr. Lorenz Schwark (Phone: +49-(0)431-880-2850, E-mail: lorenz.schwark@ifg.uni-kiel.de)	
Organizer	
Institute of Geosciences	
Faculty	
Faculty of Mathematics and Natural Sciences	
Examination Office	
Examination office of Geosciences	

Status⁴⁷ (C / CE / O)	CE
ECTS Credits	5 ECTS
Evaluation	graded
Duration	1 semester
Frequency	Every year, winter semester
Workload per ECTS Credit	30 hours
Total Workload	150 hours
Contact Time	56 hours
Independent Study	94 hours

Teaching Language	English
Entry Requirements as Stated in the Examination Regulations	none
Recommended Requirements*	

Module Course(s)			
Course Type	Course Name	Compulsory/ compulsory elective/ optional	Credit hours
Lecture	Paleobiochemistry Lecture	Compulsory elective	2
Practical Exercise	Paleobiochemistry Practical Exercise	Compulsory elective	1
Seminar	Paleobiochemistry Seminar	Compulsory elective	1
Further Information on the Course(s)*		Class size: 20 students	
Prerequisites for Admission to the Examination(s)*			

⁴⁷ Status of whole module (compulsory, compulsory elective, optional)

Examination(s)				
Examination Name	Type of Examination	Evaluation	Compulsory/ compulsory elective/ optional	Weighting⁴⁸
	Written Exam	Graded	Compulsory	100%
Further Information on the Examination(s)*				

Short Summary*
Course Content
Biomolecules of recent marine/limnic /terrestrial organisms in dependence of chemotaxonomy, evolution and adaption to environmental conditions. Distribution pathways of biomolecules in the biogeosphere. Diagenetic transformation of biomolecules in the geosphere in dependence of environmental conditions of preservation. Reconstruction of paleo-ecosystems through deep time based on molecular and isotopic proxies. Causes of past environmental perturbations and their role in evolution of the geosystem.
Learning Outcomes
Students are able to describe the production and composition of biomolecules in dependence of environmental control mechanisms. Furthermore, they are able to analyze the behavior of biomolecules in the geosphere and their use in reconstruction of past environments and environmental change.
Reading List
will be announced during lectures and Killops and Killops – Introduction to Organic Geochemistry Peters, Walters and Moldowan – The Biomarker Guide
Additional Information*
Application of module
Marine Geosciences MSc

⁴⁸ Weighting within the module

Module Name	Module Code
Petrological modelling	mageoMaCEPEM-01a
Module Coordinator	
Dr. Peter Appel (Phone: +49-(0)431-880-2900, E-mail: peter.appel@ifg.uni-kiel.de)	
Organizer	
Institute of Geosciences	
Faculty	
Faculty of Mathematics and Natural Sciences	
Examination Office	
Examination office of Geosciences	

Status⁴⁹ (C / CE / O)	CE
ECTS Credits	5
Evaluation	graded
Duration	1 semester
Frequency	Every year summer semester
Workload per ECTS Credit	30 hours
Total Workload	150 hours
Contact Time	56 hours
Independent Study	94 hours

Teaching Language	English
Entry Requirements as Stated in the Examination Regulations	
Recommended Requirements*	Bachelor courses in petrology/geodynamics

Module Course(s)			
Course Type	Course Name	Compulsory/ compulsory elective/ optional	Credit hours
Lecture	Petrogenesis	compulsory	2
Exercise	Modelling of metamorphic systems	compulsory	2
Further Information on the Course(s)*			
Prerequisites for Admission to the Examination(s)*			

Examination(s)

⁴⁹ Status of whole module (compulsory, compulsory elective, optional)

Examination Name	Type of Examination	Evaluation	Compulsory/ compulsory elective/ optional	Weighting ⁵⁰
Petrological modelling: report	report	graded	compulsory	100%
Further Information on the Examination(s)*				

Short Summary*
This module aims to introduce students to the understanding of rock-forming processes from microscopic observation to thermodynamic modelling
Course Content
Petrogenesis: Microscopy and petrological analysis of selected crustal and lithospheric rocks. Modelling of metamorphic systems: Thermodynamic calculations of metamorphic phase equilibria and the geodynamic and geophysical interpretation of P-T paths during the evolution of the oceanic lithosphere (from half space cooling model to subduction)
Learning Outcomes
Students are able to determine the pressure-temperature paths of tectonic units from microscopic structures and mineral chemical data of metamorphic rocks with the aid of thermodynamic calculations in order to enable petrological and geodynamic interpretations.
Reading List
Will be placed on OLAT
Additional Information*
Application of module
Marine Geosciences MSc

⁵⁰ Weighting within the module

Module Name	Module Code
New aspects of meteorology and oceanography: Carbon cycling in a changing climate	MNF-bioc-271
Module Coordinator	
Prof. Dr. Birgit Schneider (Phone: +49-(0)431-8803254, E-mail: birgit.schneider@ifg.uni-kiel.de)	
Organizer	
Institute of Biology	
Faculty	
Faculty of Mathematics and Natural Sciences	
Examination Office	
Examination office of Biology	

Status⁵¹ (C / CE / O)	CE
ECTS Credits	5
Evaluation	graded
Duration	1 semester
Frequency	Every year summer semester
Workload per ECTS Credit	30 hours
Total Workload	150 hours
Contact Time	56 hours
Independent Study	94 hours

Teaching Language	English
Entry Requirements as Stated in the Examination Regulations	
Recommended Requirements*	A bachelor's degree in a biological, geological, physical or Chemical discipline.

Module Course(s)			
Course Type	Course Name	Compulsory/ compulsory elective/ optional	Credit hours
Block course (Lecture/ Seminar/Exercise)	Carbon cycling in a changing climate (Lecture/ Seminar/Exercise)	compulsory	5

⁵¹ Status of whole module (compulsory, compulsory elective, optional)

Further Information on the Course(s)*			
Prerequisites for Admission to the Examination(s)*			

Examination(s)				
Examination Name	Type of Examination	Evaluation	Compulsory/ compulsory elective/ optional	Weighting⁵²
Carbon cycling in a changing Climate: oral presentation	Oral presentation	graded	compulsory	100%
Further Information on the Examination(s)*				

Short Summary*
This interdisciplinary seminar should give an introduction into the role of carbon (including the greenhouse gases CO ₂ and methane) in the climate-system
Course Content
This interdisciplinary seminar should give an introduction into the role of carbon (including the greenhouse gases CO ₂ and methane) in the climate-system, with a focus on the coupling of atmosphere, ocean and solid earth. The seminar will teach the basics of the earth's climate history, with an emphasis on the cycling of carbon through atmosphere, ocean, sediments and biosphere. Climate change issues will be discussed interactively with the students along the current IPCC assessment.
Learning Outcomes
The seminar is divided into interactive lectures connected to a student part with presentations and exercises. The student part includes studying and presenting recent articles on modern aspects of carbon in the climate-system. Within teams the students should learn to analyze and discuss scientific papers and IPCC chapters in more detail. Finally, a synthesis paper will be developed by all participants together.
Reading List
John Houghton, Global Warming: The Complete Briefing, Cambridge University Press Additional literature and lecture notes will be distributed.
Additional Information*
Formal subscription to this course via OLAT and participation in a planning meeting is mandatory; please check UnivIS for more information
Application of module
Master of Climate Physics, Master of Science in Biological Oceanography, Master of Science in Marine Geoscience

⁵² Weighting within the module

Zusätzlich können im Rahmen der "CAU-wide option" Module aus allen CAU Angeboten gewählt werden, solange sie die Schwerpunktsetzung der Studenten unterstützen, z.B.:

- Internationales Seerecht / Int. Law of the Sea (Int. SeeR) (020044) (Matz-Lück)
- International Environmental Law (020061) (Matz-Lück)
- Environmental Democracy (051031) (Ott)
- offers from the School of Sustainability, e.g.
- MNF-Geogr-201: Concepts of Sustainable Development and Environmental Management (taught in winter semester)
- VWL-EnRe-ReEc: Resource Economics
- AEF-EM009: Principles in Environmental Economics and Environmental Planning
- offers from the MSc Biological Oceanography, e.g.
- MNF-bioc-255: Mechanisms of biomineralization I
- MNF-bioc-365: Mechanisms of biomineralization II
- MNF-bioc-271: New aspects of meteorology and oceanography: Carbon cycling in a changing climate
- MNF-bioc-231: Current topics in Marine Biogeochemistry
- MNF-bioc-251: Biogeochemistry of Marine Sediments
- MNF-bioc-250: Element cycles in the ocean
- MNF-bioc-103: Introduction to Chemical Oceanography
- MNF-bioc-335: Fundamentals and Current Topics in Biogeochemical Modelling
- MNF-ozgr-151/ bioc-210: Introduction to Physical Oceanography

