

海洋地质学（OCE306）课程大纲

2022 秋季学期起	2
2019 春季学期 — 2021 春季学期	15

课程详述

COURSE SPECIFICATION

以下课程信息可能根据实际授课需要或在课程检讨之后产生变动。如对课程有任何疑问，请联系授课教师。

The course information as follows may be subject to change, either during the session because of unforeseen circumstances, or following review of the course at the end of the session. Queries about the course should be directed to the course instructor.

1.	课程名称 Course Title	海洋地质学 Marine Geology
2.	授课院系 Originating Department	海洋科学与工程系 Department of Ocean Science and Engineering
3.	课程编号 Course Code	OCE306
4.	课程学分 Credit Value	3
5.	课程类别 Course Type	专业核心课 Major Core Course 理论课（不含实践） Lectures（no lab course）
6.	授课学期 Semester	秋季学期 Fall
7.	授课语言 Teaching Language	双语授课 Bilingual teaching
8.	授课教师、所属学系、联系方式（如属团队授课，请列明其他授课教师） Instructor(s), Affiliation& Contact (For team teaching, please list all instructors)	姚炜琪 海洋科学与工程系 0755-88011405 Dr. Weiqi Yao, Department of Ocean Science and Engineering, 0755-88011405
9.	实验员/助教、所属学系、联系方式（请列出本课所有教辅人员） Tutor/TA(s), Contact (Please list all)	
10.	选课人数限额(可不填) Maximum Enrolment (Optional)	

11.	授课方式 Delivery Method	讲授 Lectures	习题/辅导/讨论 tutorials	实验/实习 Lab/Practical	其它(请具体注明) Other (Please specify)	总学时 Total
	学时数 Credit Hours	48				48

12.	先修课程、其它学习要求 Pre-requisites or Other Academic Requirements	OCE303 普通地质学 Physical Geology				
13.	后续课程、其它学习规划 Courses for which this course is a pre-requisite					
14.	其它要求修读本课程的学系 Cross-listing Dept.					

教学大纲及教学日历 SYLLABUS

15. 教学目标 Course Objectives

本课程为海洋科学本科生的专业核心课。本课程主要介绍海洋地质学的研究对象、研究内容、发展历程、调查研究方法及本学科所涉及的基本知识和基础理论，重点阐述海底地形地貌、大陆边缘与深海沉积、海底构造、古海洋学、海洋地质调查技术以及海洋灾害与预防。本课程为寻找海洋资源、建设海洋工程、预测和防治海洋地质灾害、保护海洋生态环境、维护国家海洋权益等方面提供科学依据。

This course is designed for all the undergraduate students major in Marine Sciences. This course introduces basic theories, contents, and objectives of marine geology. The major topics include morphology of the sea floor, marginal seas, paleoceanography, tectonics, and marine survey, etc. The course provides the scientific supports for surveying marine resources, marine engineering, marine geological disasters, protection of marine ecology, and etc.

16. 预达学习成果 Learning Outcomes

通过本课程学习，使学生了解海洋地质的基本原理及主要研究内容，让学生能够解释各种沉积类型的地质含义。

In this course, students will investigate theories and research scope of marine geology. They can interpret various kinds of geological depositions.

17. 课程内容及教学日历 (语言与授课语言一致, 例: 如授课语言以英文为主, 则课程内容介绍可以用英文; 如团队教学或模块教学, 教学日历须注明主讲人) Course Contents (in Parts/Chapters/Sections/Weeks. In consistency with instructional language. Please notify name of instructor for course section(s), if this is a team teaching or module course.)

Chapter One: Introduction (2 credit hours)

Questions:

1. What are the main drivers promoted the recent development of Marine Geology?
2. How many stages are there in the development history of Marine Geology? What are the main academic ideas in each stage?

Readings:

- Manten, A.A., 1964. The origin of marine geology. *Marine Geology* 2, 1-28.
- Deacon M, 1971. *Scientist and the Sea, 1650-1900: A study of Marine science*. London: Academic press.
- James P. Kennett, 1981. *Marine Geology, Introduction*.
- Manten, A.A., 1964. The origin of marine geology. *Marine Geology* 2, 1-28.

Chapter Two: Topography and Geomorphology of Seafloor (6 credit hours)

Questions:

1. List different tectonic units of sea floor and think about their characteristics.
2. What is the topographic and geomorphological character of continental shelf?
3. List the main geomorphological types of continental margins and their characteristics.
4. What is coastal? List the different types of them.

Readings:

- Fowler CMR, 1990. *The solid earth*, Cambridge: Cambridge University Press.
- Bird ECF, 1984. *Coasts*, 3rd edn, London: Blackwell.
- Burk CA and Drake CL(eds), 1974. *The Geology of Continental margins*. New York” Springer-Verlag.
- Trenhaile AS, 1997. *Coastal dynamics and landforms*. Oxford: Clarendon Press.
- Floyd PA (ed.), 1991. *Oceanic Basalts*. Glasgow: Blackie and Son.

Chapter Three: Structure of the Earth and Lithosphere of Seafloor (4 credit hours)

Questions:

1. What are the differences between continental lithosphere and Oceanic Lithosphere?
2. What is the structure and composition of the standard oceanic crust?
3. What are the differences between the continental crust and oceanic crust?
4. What is the scientific significance of the Heterogeneity of Asthenosphere?

Readings:

- Kump LR, Kasting JF, and Crane RC, 1999. *The Earth System*. London: prentice-hall.

Fowler CMR, 1990. The solid earth, Cambridge: Cambridge University Press.

James P. Kennett, 1981. Marine Geology, Introduction.

Chapter Four: Tectonics of Seafloor (6 credit hours)

Questions:

1. Are there any shortages of the theory of ocean floor spreading?
2. List the main tectonic structures of the ocean mid-ridge.
3. How many types of the Lithospheric plate boundary are there? What are the characteristics of them?
4. List the factors influence the quality of magmatic rock.
5. What is the subduction of plate? How does it happen?

Readings:

Moore EM and Twiss RJ, 1995. Tectonics, New York: WH Freeman.

Perfit MR and Davidson JP, 2000. Plate Tectonics and Volcanism. In: Sigurdson H (ed) Encyclopedia of Volcanoes. San Diego: Academic Press.

Solomon SC and Toomey DR, 1992. The structure of Mid-ocean Ridges. Annual review of Earth and Planetary Sciences 20: 329-364.

Nicolas A, 1990. The Mid-Ocean Ridge. Springer Verlag, Berlin.

Hey RN, Sinton JM, Duennebieer FK, 1989. Propagating rifts and spreading centers. In: Winterer EL, Hussong DM, and Decker RW (eds.) Decade of North American geology: The Eastern Pacific Ocean and Hawaii, PP161-176.

Price JF, 2001. Subduction, In: Ocean circulation and Climate: Observing and Modelling the Global Ocean, G. Siedler, J. Church and J. Gould (eds), Academic Press, pp. 357-371

Chapter Five: Sea-Level changes (4 credit hours)

Questions:

1. What are the characteristics of sea-level changes?
2. How did sea level change over geological time scales?
3. What are the causes of modern sea-level variations and how does it impact environments?

Readings:

Kominz M.A., Browning J.V., Miller K.G., Sugarman P.J., Mizintseva S. and Scotese C.R. (2008) Late Cretaceous to Miocene sea-level estimates from the New Jersey and Delaware coastal plain coreholes: an error analysis. Basin Research 20, 211–226.

Miller, K.G., Browning, J.V., Schmelz, W.J., Kopp, R.E., Mountain, G. S. and Wright, J.D. (2020) Cenozoic sea-level and cryospheric evolution from deep-sea geochemical and continental margin records. Sci. Adv. 6, eaaz1346.

Müller, R.D., Sdrolias, M., Gaina, C., Steinberger, B. and Heine, C. (2008) Long-Term Sea-Level Fluctuations Driven by Ocean Basin Dynamics. *Science* 319, 1357–1362.

Chapter Six: Factors of Marine Environment and Geology (4 credit hours)

Questions :

1. How do physical processes (sea waves, tides, and ocean currents) influence seafloor, and what are their roles in erosion, transportation, sedimentation, etc.?
2. How do chemical processes (pycnocline, halocline, CCD depth, etc.) influence seafloor?
3. How do biological processes affect seafloor sediments?

Readings :

- Pickard GL and Emery WJ, 1992. *Descriptive Physical Oceanography*, 5th edn. Oxford: Pergamon Press.
- Cartwright DE, 1999. *Tides-a Scientific History*, Cambridge: Cambridge university press.
- Summerhayes CP and Thorpe SA, 1996. *Oceanography-An Illustrated Guide*. London: Manson Publishing.
- Gill AE, 1982. *Atmosphere-Ocean Dynamics*, London: Academic Press.
- Lavrenov I, 2003. *Wind-Waves in Oceans: Dynamics and Numerical simulation*. New York: Springer.
- Covey C and Barron E, 1988. The role of Ocean heat transport in climatic change. *Earth- Science review*24: 429-445.
- Siedler G, Church J and Gould, 2001. *Ocean circulation and Climate*, London: Academic press.
- Simpson JE, 1997. *Gravity Currents*, 2nd Edn. Cambridge: Cambridge University Press.
- Emery WJ and Meincke J, 1986. Global water masses summary and review. *Oceanologica Acta* 9:383-391.

Chapter Seven: Sedimentation of Continental Margins and Deep Sea (8 credit hours)

Questions :

1. What is turbidity current deposition, contour current deposition and semi-deep sea deposition, and what are the main differences among them?
2. What are the main factors controlling deposition process in deep sea and coastal environments?
3. What are the distribution and characteristics of deep-sea sediments?

Readings :

- Davis RA, 1985. *Coastal sedimentary environments*. New York: Springer-verlag.
- Lisitzin AP, 1996. *Oceanic sedimentation, Lithology and Geochemistry*. Washington DC: American Geophysics Union.
- Miall AD, 1997. *The geology of Stratigraphic sequences*. Berlin: Springer-Verlag.
- Huh C-A and Kadko DC, 1992. Marine sediments and sedimentation process, In: Ivanovich M and Harmon RS (eds) . *Uranium Series Disequilibrium: applications to earth, Marine and Environmental Sciences* 2nd edn. PP. 460-486. Oxford: Oxford University Press.

Lisitzin AP, 1996. Oceanic sedimentation, lithology and Geochemistry, Washington, DC: American Geophysical Union.

Boyd R, Darlymple R, and Zaitlin BA, 1992. Classification of clastic coastal depositional environments. *Sedimentary geology* 80:139-150.

Peltier WR, 1998. Postglacial variations in the level of the sea: implication for climate dynamic and solid-earth geophysics, *Review in geophysics* 36:603-689.

Milliman JD and Farnsworth KL, 2002. *River runoff, Erosion and Delivery to the Coastal Ocean: A Global Analysis*. Oxford University Press.

Wunsch C and Ferrari R, 2004. Vertical Mixing, energy, and the general circulation of the oceans. *Annual reviews of Fluid Mechanics* 36: 281-314.

Chapter Eight: Paleoceanography (8 credit hours)

Questions:

1. List the main biological, physical and chemical proxies in the research of Paleoceanography, and understand the principles and applications of one of them which you are interested in.
2. List the main methods to build chronological sequence.
3. What are the main aspects that consist of the Paleoceanography environment and how to reconstruct them?
4. What is the formation progress of the West Pacific warm pool?
5. How did the Antarctic ice sheet form?
6. What did the ocean environments like during the glacial periods?

Readings:

Hillaire-Marcel C and de Vernal A, 2007. *Proxies in Late Cenozoic Palaeoceanography*, Amsterdam: Elsevier.

Gradstein F, Ogg J, and Smith AG, 2004. *A Geological Time scale*. Cambridge, UK: Cambridge University Press.

Broecker WS, 1991. The great ocean conveyor. *Oceanography* 4: 79-89.

Orsi A, Johnson G and Bullister J, 1999. Circulation, mixing, and production of Antarctic bottom water, *Progress in Oceanography* 43: 55-109.

Covey C and Barron E, 1988. The role of Ocean heat transport in climatic change. *Earth- Science review* 24: 429-445.

Rind D and Chandler M, 1991. Increased ocean Heat transports and warmer climate. *Journal of Geophysical Research* 96:7437-7461

Lisiecki LE and Raymo ME, 2005. A Pliocene-Pleistocene stack of 57 globally distributed benthic delta O-18 records. *Paleoceanography* 20:PA1003.

Wilson DS, 1993. Confirmation of the astronomical calibration of the magnetic polarity timescale from sea-floor spreading rate. *Nature* 364: 788-790.

Huber BT, Macleod KG, and Wing S, 1999. *Warm Climates in Earth History*, Cambridge, UK:

Cambridge University Press.

Zachos JC, Rohl U, Schellenberg SA, et al., 2005. Rapid acidification of the ocean during the Paleocene-Eocene Thermal Maximum, *Science* 308:1611-1615.

Zachos JC, Pagani M, Sloan L, et al., 2001. Trends, rhythms, and aberrations in Global climate 65 Ma to present, *Science* 292:686-694 .

Chapter Nine: Major International Marine Geological Research Programs (6 credit hours)

Questions:

1. How did ocean drilling programs (e.g. IODP, ODP, DSDP) contribute to the development of Marine Geology?
2. What is the main mission of InterRidge?
3. List the main technologies used in the research of Marine Geology, and understand their applications and shortages.

Readings:

Becker K and Davis EE, 2000. Plugging the seafloor with CORKs, *Oceanus* 42(1): 14-16

Cullen V, 1993/1994. 25 years of Ocean Drilling, *Oceans* 36 (4) .

Warne JE, Douglas GR, and Winterer EL, 1981. The Deep sea Drilling Project: A decade of progress, special publication 32, Tulsa, OK: Society of Economic Paleontologists and Mineralogists.

Hsu KJ, 1992. *Challenger at sea, a Ship that Revolutionized Earth Science*. Princeton, NJ: Princeton University Press.

Griffiths G (ed.), 2003. *Technology and application of Autonomous Underwater Vehicles*. London: Taylor and Francis.

[Http:// www.cobo.org.uk](http://www.cobo.org.uk). _Coastal Ocean Benthic Observatory.

Allmendinger EE, 1990. *Submersible vehicle systems design*, New York: Sname.

Pisias NG and Delaney ML(eds), 1999. *Complex : conference of Multiple Platform Exploration of the Ocean*. Washinton, DC: Joint Oceanographic Institute.

Pulsipher AG.(eds), 1996. *Proceedings : An international workshop on offshore lease abandonment and Platform disposal: technology, Regulation and Environmental Effects*. MMS contract 14-35-0001-30794. Baton Rouge, LA:Center for Energy studies

Forma W,1999. *The history of American Deep submersible operations*. Flagstaff, AZ: Best Publishing Co.

Brekhovskikh LM and Lysanov YP, 1991. *Fundamentals of Ocean Acoustics*, Berlin: Springer- Verlag.

Akal T and Berkson JM (eds.), 1986. *Ocean Seismo-Acoustics*. New York and London: Plenum press.

Clarke JH, 2000. Present-day methods of depth measurement, In: Cook PJ and Carleton CM (eds.) *Continental shelf limits: The Scientific and legal interface*, pp.139-159. Oxford, UK: Oxford University Press.

Duennebieer FK and Sutton GH, 1995. Fidelity of Ocean bottom seismic observations. *Marine geophysical research* 17: 535-555.

第一章 绪论（2 学时）

问题：

1. 推动海洋地质学近期发展的动力？
2. 海洋地质学发展阶段是如何划分的？其学术思想有什么变化？

进一步阅读文献：

- Manten, A.A., 1964. The origin of marine geology. *Marine Geology* 2, 1-28.
- Deacon M, 1971. *Scientist and the Sea, 1650-1900: A study of Marine science*. London: Academic press.
- James P. Kennett, 1981. *Marine Geology, Introduction*.
- Manten, A.A., 1964. The origin of marine geology. *Marine Geology* 2, 1-28.

第二章 地球结构与海底岩石圈（4 学时）

问题：

1. 大陆岩石圈和大洋岩石圈的区别是什么？
2. 标准洋壳的结构及其物质组成？
3. 大陆型地壳与大洋型地壳的主要区别？
4. 软流圈不均一性的科学意义是什么？

进一步阅读文献：

- Kump LR, Kasting JF, and Crane RC, 1999. *The Earth System*. London: prentice-hall.
- Fowler CMR, 1990. *The solid earth*, Cambridge: Cambridge University Press.
- James P. Kennett, 1981. *Marine Geology, Introduction*.

第三章 海底地形地貌（6 学时）

问题：

1. 海底由那些构造单元组成，各单元的特征是什么？
2. 大陆架有哪些地形和地貌特征？
3. 大陆边缘有哪些地貌，其地貌特征是什么？
4. 什么是海岸带？海岸带有那几种类型？各种类型的特征是什么？

进一步阅读文献：

- Fowler CMR, 1990. *The solid earth*, Cambridge: Cambridge University Press.
- Bird ECF, 1984. *Coasts*, 3rd edn, London: Blackwell.

Burk CA and Drake CL(eds), 1974. The Geology of Continental margins. New York” Springer-Verlag.
Trenhaile AS, 1997. Coastal dynamics and landforms. Oxford: Clarendon Press.
Floyd PA (ed.), 1991. Oceanic Basalts. Glasgow: Blackie and Son.

第四章 海底构造（6 学时）

问题：

- 1.洋壳扩张假说有什么缺点？
2. 洋中脊主要的构造特征是什么？
3. 岩石圈板块的边界有哪些类型？各种类型的特征是什么？
4. 影响岩浆岩性质的因素有哪些？
5. 什么是板块俯冲？板块俯冲发生的原因是什么？

进一步阅读文献：

Moore EM and Twiss RJ, 1995. Tectonics, New York: WH Freeman.
Perfit MR and Davidson JP, 2000. Plate Tectonics and Volcanism. In: Sigurdson H (ed) ENcyclopedia of Volcanoes. San Diego: Academic Press.
Solomon SC and Toomey DR, 1992. The structure of Mid-ocean Ridges. Annual review of Earth and Planetary Sciences 20: 329-364.
Nicolas A, 1990. The Mid-Ocean Ridge. Springer Verlag, Berlin.
Hey RN, Sinton JM, Duennebieck FK, 1989. Prograding rifts and spreading centers. In : Winterer EL, Hussong DM, and Decker RW (eds.) Decade of North American geology: The Eastern Pacific Ocean and Hawaii, PP161-176.
Price JF, 2001. Subduction, In: Ocean circulation and Climate: Observing and Modelling the Global Ocean, G. Siedler, J.Church and J. Gould (eds), Academic Press, pp. 357-371

第五章 海平面变化（4 学时）

问题：

1. 海平面的定义与变化特征是什么？
2. 地质时期海平面是如何变化的？
3. 哪些过程造成了现代海平面的变化，其环境影响有哪些？

进一步阅读文献：

Kominz M.A., Browning J.V., Miller K.G., Sugarman P.J., Mizintseva S. and Scotese C.R. (2008) Late Cretaceous to Miocene sea-level estimates from the New Jersey and Delaware coastal plain coreholes: an error analysis. Basin Research 20, 211–226.
Miller, K.G., Browning, J.V., Schmelz, W.J., Kopp, R.E., Mountain, G. S. and Wright, J.D. (2020) Cenozoic

sea-level and cryospheric evolution from deep-sea geochemical and continental margin records. *Sci. Adv.* 6, eaaz1346.

Müller, R.D., Sdrolias, M., Gaina, C., Steinberger, B. and Heine, C. (2008) Long-Term Sea-Level Fluctuations Driven by Ocean Basin Dynamics. *Science* 319, 1357–1362.

第六章 海洋环境要素与地质作用（4 学时）

问题：

1. 海洋物理过程（海浪、潮汐、洋流的侵蚀、搬运、沉积等）是怎样影响海底的？
2. 海洋化学过程（盐跃层、密跃层、碳酸钙补偿深度等）对海洋地质过程有哪些作用？
3. 海洋生物过程对海洋地质过程有哪些作用？

进一步阅读文献：

Pickard GL and Emery WJ, 1992. *Descriptive Physical Oceanography*, 5th edn. Oxford: Pergamon Press.

Cartwright DE, 1999. *Tides-a Scientific History*, Cambridge: Cambridge university press.

Summerhayes CP and Thorpe SA, 1996. *Oceanography-An Illustrated Guide*. London: Manson Publishing.

Gill AE, 1982. *Atmosphere-Ocean Dynamics*, London: Academic Press.

Lavrenov I, 2003. *Wind-Waves in Oceans: Dynamics and Numerical simulation*. New York: Springer.

Covey C and Barron E, 1988. The role of Ocean heat transport in climatic change. *Earth- Science review*24: 429-445.

Siedler G, Church J and Gould, 2001. *Ocean circulation and Climate*, London: Academic press.

Simpson JE, 1997. *Gravity Currents*, 2nd Edn. Cambridge: Cambridge University Press.

Emery WJ and Meincke J, 1986. Global water masses summary and review. *Oceanologica Acta* 9:383-391.

第七章 大陆边缘与深海沉积（8 学时）

问题：

1. 什么是浊流沉积、等深流沉积、和半深海沉积，这些沉积之间的区别是什么？
2. 控制浅海与深海沉积的主要因素和过程有哪些？
3. 深海沉积的类型及其分布特征是什么？

进一步阅读文献：

Davis RA, 1985. *Coastal sedimentary environments*. New York: Springer-verlag.

Lisitzin AP, 1996. *Oceanic sedimentation, Lithology and Geochemistry*. Washington DC: American Geophysics Union.

Miall AD, 1997. *The geology of Stratigraphic sequences*. Berlin: Springer-Verlag.

Huh C-A and Kadko DC, 1992. Marine sediments and sedimentation process, In: Ivanovich M and Harmon RS (eds) . *Uranium Series Disequilibrium: applications to earth, Marine and Environmental Sciences* 2nd

edn. PP. 460-486. Oxford: Oxford University Press.

Lisitzin AP, 1996. Oceanic sedimentation, lithology and Geochemistry, Washington, DC: American Geophysical Union.

Boyd R, Darlymple R, and Zaitlin BA, 1992. Classification of clastic coastal depositional environments. *Sedimentary geology* 80:139-150.

Peltier WR, 1998. Postglacial variations in the level of the sea: implication for climate dynamic and solid-earth geophysics, *Review in geophysics* 36:603-689.

Milliman JD and Farnsworth KL, 2002. River runoff, Erosion and Delivery to the Coastal Ocean: A Global Analysis. Oxford University Press.

Wunsch C and Ferrari R, 2004. Vertical Mixing, energy, and the general circulation of the oceans. *Annual reviews of Fluid Mechanics* 36: 281-314.

第八章 古海洋学 (8 学时)

问题:

1. 古海洋研究中主要的物理、化学、生物替代指标有哪些? 掌握自己感兴趣的一种指标的原理与应用。

2. 建立年代序列的主要方面有哪些?

3. 古海洋环境主要包括哪些内容? 如何重建这些环境背景?

4. 西太平洋暖池形成的地质历史过程与原因?

5. 南极冰盖形成的机制?

6. 冰期期间海洋环境具有什么样的特征?

进一步阅读文献:

Hillaire-Marcel C and de Vernal A, 2007. *Proxies in Late Cenozoic Palaeoceanography*, Amsterdam: Elsevier.

Gradstein F, Ogg J, and smith AG, 2004. *A Geological Time scale*. Cambridge, UK: Cambridge University Press.

Broecker WS, 1991. The great ocean conveyor. *Oceanography* 4: 79-89.

Orsi A, Johnson G and Bullister J, 1999. Circulation, mixing, and production of Antarctic bottom water, *Progress in Oceanography* 43: 55-109.

Covey C and Barron E, 1988. The role of Ocean heat transport in climatic change. *Earth- Science review* 24: 429-445.

Rind D and Chandler M, 1991. Increased ocean Heat transports and warmer climate. *Journal of Geophysical Research* 96:7437-7461

Lisiecki LE and Raymo ME, 2005. A Pliocene-Pleistocene stack of 57 globally distributed benthic delta O-18 records. *Paleoceanography* 20:PA1003.

Wilson DS, 1993. Confirmation of the astronomical calibration of the magnetic polarity timescale from sea-floor spreading rate. *Nature* 364: 788-790.

Huber BT, Macleod KG, and Wing S, 1999. Warm Climates in Earth History, Cambridge, UK: Cambridge University Press.

Zachos JC, Rohl U, Schellenberg SA, et al., 2005. Rapid acidification of the ocean during the Paleocene-Eocene Thermal Maximum, Science 308:1611-1615.

Zachos JC, Pagani M, Sloan L, et al., 2001. Trends, rhythms, and aberrations in Global climate 65 Ma to present, Science 292:686-694.

第九章 国际重大海洋地质科学研究项目 (6 学时)

问题:

1. 大洋钻探计划对海洋地质学的发展有哪些贡献?
2. 大洋中脊计划的主要研究内容和任务是什么?
3. 海洋地质调查的主要技术手段有哪些? 各种手段的应用与优缺点是什么?

进一步阅读文献:

Becker K and Davis EE, 2000. Plugging the seafloor with CORKs, Oceanus 42(1): 14-16

Cullen V, 1993/1994. 25 years of Ocean Drilling, Oceans 36 (4) .

Warne JE, Douglas GR, and Winterer EL, 1981. The Deep sea Drilling Project: A decade of progress, special publication 32, Tulsa, OK: Society of Economic Paleontologists and Mineralogists.

Hsu KJ, 1992. Challenger at sea, a Ship that Revolutionized Earth Science. Princeton, NJ: Princeton University Press.

Griffiths G (ed.), 2003. Technology and application of Autonomous Underwater Vehicles. London: Taylor and Francis.

[Http:// WWW.cobo.org.uk](http://WWW.cobo.org.uk). _Coastal Ocean Benthic Observatory.

Allmendinger EE, 1990. Submersible vehicle systems design, New York: Sname.

Pisias NG and Delaney ML(eds), 1999. Complex: conference of Multiple Platform Exploration of the Ocean. Washinton, DC: Joint Oceanographic Institute.

Pulsipher AG.(eds), 1996. Proceedings: An international workshop on offshore lease abandonment and Platform disposal: technology, Regulation and Environmental Effects. MMS contract 14-35-0001-30794. Baton Rouge, LA:Center for Energy studies

Forma W,1999. The history of American Deep submersible operations. Flagstaff, AZ: Best Publishing Co.

Brekhovskikh LM and Lysanov YP, 1991. Fundamentals of Ocean Acoustics, Berlin: Springer- Verlag.

Akal T and Berkson JM (eds.), 1986. Ocean Seismo-Acoustics. New York and London: Plenum press.

Clarke JH, 2000. Present-day methods of depth measurement, In: Cook PJ and Carleton CM (eds.) Continental shelf limits: The Scientific and legal interface, pp.139-159. Oxford, UK: Oxford University Press.

Duennebieer FK and Sutton GH, 1995. Fidelity of Ocean bottom seismic observations. Marine geophysical researches 17: 535-555.

18.	教材及其它参考资料 Textbook and Supplementary Readings
	<p>《Marine Geology》，James P. Kennett，1981</p> <p>《Marine Geology-Exploring the New Frontiers of the Ocean》，Jon Erickson，2003</p> <p>《海洋地质学》，李学伦，青岛海洋大学出版社，1997。</p> <p>《近代海洋地质学》，朱而勤，青岛海洋大学出版社，1991。</p>

教学评估 ASSESSMENT					
19.	评估形式 Type of Assessment	评估所需时间 Duration	占考试总成绩百分比 % of final score	违纪处罚 Penalty	备注 Notes
	出勤 Attendance		10		
	课堂表现 Class Performance		10		
	小测验 Quiz				
	课程项目 Projects		20		
	平时作业 Assignments				
	期中考试 Mid-Term Test				
	期末考试 Final Exam		60		
	期末报告 Final Presentation				
	其它（可根据需要 改写以上评估方式） Others (The above may be modified as necessary)				

课程审批 REVIEW AND APPROVAL	
20.	本课程设置已经过以下责任人/委员会审议通过 This Course has been approved by the following person or committee of authority
	<p>海洋科学与工程系本科教学委员会 Department of Ocean Science and Engineering Undergraduate Committee</p>

课程详述

COURSE SPECIFICATION

以下课程信息可能根据实际授课需要或在课程检讨之后产生变动。如对课程有任何疑问，请联系授课教师。

The course information as follows may be subject to change, either during the session because of unforeseen circumstances, or following review of the course at the end of the session. Queries about the course should be directed to the course instructor.

1.	课程名称 Course Title	海洋地质学 Marine Geology
2.	授课院系 Originating Department	海洋科学与工程系 Department of Ocean Science and Engineering
3.	课程编号 Course Code	OCE306
4.	课程学分 Credit Value	3
5.	课程类别 Course Type	专业核心课 Major Core Course 理论课（不含实践） Lectures（no lab course）
6.	授课学期 Semester	春季学期 Spring
7.	授课语言 Teaching Language	双语授课 Bilingual teaching
8.	授课教师、所属学系、联系方式（如属团队授课，请列明其他授课教师） Instructor(s), Affiliation& Contact (For team teaching, please list all instructors)	刘青松 海洋科学与工程系 慧园 6 栋 209, 0755-88018789 Dr. Qingsong Liu, Department of Ocean Sciences and Engineering, Wisdom Valley-6 209, 0755-88018789
9.	实验员/助教、所属学系、联系方式（请列出本课所有教辅人员） Tutor/TA(s), Contact (Please list all)	
10.	选课人数限额(可不填) Maximum Enrolment (Optional)	

11.	授课方式 Delivery Method	讲授 Lectures	习题/辅导/讨论 tutorials	实验/实习 Lab/Practical	其它(请具体注明) Other (Please specify)	总学时 Total
	学时数 Credit Hours	48				48

12.	先修课程、其它学习要求 Pre-requisites or Other Academic Requirements	OCE303 普通地质学 Physical Geology				
13.	后续课程、其它学习规划 Courses for which this course is a pre-requisite					
14.	其它要求修读本课程的学系 Cross-listing Dept.					

教学大纲及教学日历 SYLLABUS

15. 教学目标 Course Objectives

本课程为海洋科学本科生的专业核心课。本课程主要介绍海洋地质学的研究对象、研究内容、发展历程、调查研究方法及本学科所涉及的基本知识和基础理论，重点阐述海底地形地貌、大陆边缘与深海沉积、海底构造、古海洋学、海洋地质调查技术以及海洋灾害与预防。本课程为寻找海洋资源、建设海洋工程、预测和防治海洋地质灾害、保护海洋生态环境、维护国家海洋权益等方面提供科学依据。

This course is designed for all the undergraduate students major in Marine Sciences. This course introduces basic theories, contents, and objectives of marine geology. The major topics include morphology of the sea floor, marginal seas, paleoceanography, tectonics, and marine survey, etc. The course provides the scientific supports for surveying marine resources, marine engineering, marine geological disasters, protection of marine ecology, and etc.

16. 预达学习成果 Learning Outcomes

通过本课程学习，使学生了解海洋地质的基本原理及主要研究内容，让学生能够解释各种沉积类型的地质含义。

In this course, students will investigate theories and research scope of marine geology. They can interpret various kinds of geological depositions.

17. 课程内容及教学日历 (语言与授课语言一致, 例: 如授课语言以英文为主, 则课程内容介绍可以用英文; 如团队教学或模块教学, 教学日历须注明主讲人) Course Contents (in Parts/Chapters/Sections/Weeks. In consistency with instructional language. Please notify name of instructor for course section(s), if this is a team teaching or module course.)

Chapter One: Introduction (2 credit hours)

Questions:

1. What are the main drivers promoted the recent development of Marine Geology?
2. How many stages are there in the development history of Marine Geology? What are the main academic ideas in each stage?

Readings:

- Manten, A.A., 1964. The origin of marine geology. *Marine Geology* 2, 1-28.
- Deacon M, 1971. *Scientist and the Sea, 1650-1900: A study of Marine science*. London: Academic press.
- James P. Kennett, 1981. *Marine Geology, Introduction*.
- Manten, A.A., 1964. The origin of marine geology. *Marine Geology* 2, 1-28.

Chapter Two: Structure of the Earth and Lithosphere of Seafloor (4 credit hours)

Questions:

1. What are the differences between continental lithosphere and Oceanic Lithosphere?
2. What is the structure and composition of the standard oceanic crust?
3. What are the differences between the continental crust and oceanic crust?
4. What is the scientific significance of the Heterogeneity of Asthenosphere?

Readings:

- Kump LR, Kasting JF, and Crane RC, 1999. *The Earth System*. London: prentice-hall.
- Fowler CMR, 1990. *The solid earth*, Cambridge: Cambridge University Press.
- James P. Kennett, 1981. *Marine Geology, Introduction*.

Chapter Three: Tectonics of Seafloor (6 credit hours)

Questions:

1. Are there any shortages of the theory of ocean floor spreading?
2. List the main tectonic structures of the ocean mid-ridge.
3. How many types of the Lithospheric plate boundary are there? What are the characteristics of them?
4. List the factors influence the quality of magmatic rock.
5. What is the subduction of plate? How does it happen?

Readings:

- Moores EM and Twiss RJ, 1995. *Tectonics*, New York: WH Freeman.
- Perfit MR and Davidson JP, 2000. Plate Tectonics and Volcanism. In: Sigurdsoon H (ed) *ENcyclopedia of Volcanoes*. San Diego: Academic Press.

Solomon SC and Toomey DR, 1992. The structure of Mid-ocean Ridges. *Annual review of Earth and Planetary Sciences* 20: 329-364.

Nicolas A, 1990. *The Mid-Ocean Ridge*. Springer Verlag, Berlin.

Hey RN, Sinton JM, Duennebieer FK, 1989. Prograding rifts and spreading centers. In : Winterer EL, Hussong DM, and Decker RW (eds.) *Decade of North American geology: The Eastern Pacific Ocean and Hawaii*, PP161-176.

Price JF, 2001. Subduction, In: *Ocean circulation and Climate: Observing and Modelling the Global Ocean*, G. Siedler, J. Church and J. Gould (eds), Academic Press, pp. 357-371

Chapter Four: Topography and Geomorphology of Seafloor (6 credit hours)

Questions :

1. List different tectonic units of sea floor and think about their characteristics.
2. What is the topographic and geomorphological character of continental shelf?
3. List the main geomorphological types of continental margins and their characteristics.
4. What is coastal? List the different types of them.

Readings :

Fowler CMR, 1990. *The solid earth*, Cambridge: Cambridge University Press.

Bird ECF, 1984. *Coasts*, 3rd edn, London: Blackwell.

Burk CA and Drake CL(eds), 1974. *The Geology of Continental margins*. New York” Springer-Verlag.

Trenhaile AS, 1997. *Coastal dynamics and landforms*. Oxford: Clarendon Press.

Floyd PA (ed.), 1991. *Oceanic Basalts*. Glasgow: Blackie and Son.

Chapter Five: Factors of Marine Environment (4 credit hours)

Questions :

1. How do sea waves, tides, and ocean currents influence sea floor?
2. What is pycnocline, halocline, and CCD depth?
3. What are the main roles of ocean organisms on the ocean geological process?

Readings :

Pickard GL and Emery WJ, 1992. *Descriptive Physical Oceanography*, 5th edn. Oxford: Pergamon Press.

Cartwright DE, 1999. *Tides-a Scientific History*, Cambridge: Cambridge university press.

Summerhayes CP and Thorpe SA, 1996. *Oceanography-An Illustrated Guide*. London: Manson Publishing.

Gill AE, 1982. *Atmosphere-Ocean Dynamics*, London: Academic Press.

Lavrenov I, 2003. *Wind-Waves in Oceans: Dynamics and Numerical simulation*. New York: Springer.

Covey C and Barron E, 1988. The role of Ocean heat transport in climatic change. *Earth- Science review*24:

429-445.

Siedler G, Church J and Gould, 2001. Ocean circulation and Climate, London: Academic press.

Simpson JE, 1997. Gravity Currents, 2nd Edn. Cambridge: Cambridge University Press.

Emery WJ and Meincke J, 1986. Global water masses summary and review. *Oceanologica Acta* 9:383-391.

Chapter Six: Sedimentation of Continental Margins and Deep Sea (8 credit hours)

Questions :

1. What is turbidity current deposition, contour current deposition and semi-deep sea deposition, and what are the main differences among them?
2. What are the main factors controlling deposition process in deep sea and coastal environments?
3. What is the relationship between sea-level changes and formation of river deltas?

Readings :

Davis RA, 1985. Coastal sedimentary environments. New York: Springer-verlag.

Lisitzin AP, 1996. Oceanic sedimentation, Lithology and Geochemistry. Washington DC: American Geophysics Union.

Miall AD, 1997. The geology of Stratigraphic sequences. Berlin: Springer-Verlag.

Huh C-A and Kadko DC, 1992. Marine sediments and sedimentation process, In: Ivanovich M and Harmon RS (eds) . Uranium Series Disequilibrium: applications to earth, Marine and Environmental Sciences 2nd edn. PP. 460-486. Oxford: Oxford University Press.

Lisitzin AP, 1996. Oceanic sedimentation, lithology and Geochemistry, Washington, DC: American Geophysical Union.

Boyd R, Darlymple R, and Zaitlin BA, 1992. Classification of clastic coastal depositional environments. *Sedimentary geology* 80:139-150.

Peltier WR, 1998. Postglacial variations in the level of the sea: implication for climate dynamic and solid-earth geophysics, *Review in geophysics* 36:603-689.

Milliman JD and Farnsworth KL, 2002. River runoff, Erosion and Delivery to the Coastal Ocean: A Global Analysis. Oxford University Press.

Wunsch C and Ferrari R, 2004. Vertical Mixing, energy, and the general circulation of the oceans. *Annul reviews of Fluid Mechanics* 36: 281-314.

Chapter Seven: Paleoceanography (10 credit hours)

Questions :

1. List the main biological, physical and chemical proxies in the research of Paleoceanography, and understand the principles and applications of one of them which you are interested in.
2. List the main methods to build chronological sequence.
3. What are the main aspects that consist of the Paleoceanography environment and how to reconstruct them?

4. What is the formation progress of the West Pacific warm pool?
5. How did the Antarctic ice sheet form?
6. What did the ocean environments like during the glacial periods?

Readings :

Hillaire-Marcel C and de Vernal A, 2007. Proxies in Late Cenozoic Palaeoceanography , Amsterdam : Elsevier.

Gradstein F, Ogg J, and smith AG, 2004. A Geological Time scale. Cambridge, UK: Cambridge University Press.

Broecker WS, 1991. The great ocean conveyor. *Oceanography* 4: 79-89.

Orsi A, Johnson G and Bullister J, 1999. Circulation, mixing, and production of Antarctic bottom water, *Progress in Oceanography* 43: 55-109.

Covey C and Barron E, 1988. The role of Ocean heat transport in climatic change. *Earth- Science review* 24: 429-445.

Rind D and Chandler M, 1991. Increased ocean Heat transports and warmer climate. *Journal of Geophysical Reseach* 96:7437-7461

Lisiecki LE and Raymo ME, 2005. A Pliocene-Pleistocene stack of 57 globally distributed benthic delta O-18 records. *Paleoceanography* 20:PA1003.

Wilson DS, 1993. Confirmation of the astronomical calibration of the magnetic polarity timescale from sea-floor spreading rate. *Nature* 364: 788-790.

Huber BT, Macleod KG, and Wing S, 1999. Warm Climates in Earth History , Cambridge , UK : Cambridge University Press.

Zachos JC, Rohl U, Schellenberg SA, et al., 2005. Rapid acidification of the ocean during the Paleocene-Eocene Thermal Maximum, *Science* 308:1611-1615.

Zachos JC, Pagani M, Sloan L, et al., 2001. Trends, rhythms, and aberrations in Global climate 65 Ma to present, *Science* 292:686-694 .

Chapter Eight: Technology of Survey for Marine Geology (4 credit hours)

Questions :

1. List the main technologies used in the research of Marine Geology, and understand their applications and shortages.

Readings :

Griffiths G (ed.), 2003. Technology and application of Autonomous Underwater Vehicles. London: Taylor and Grancis.

[Http:// WWW.cobo.org.uk](http://WWW.cobo.org.uk) . _Coastal Ocean Benthic Observatory.

Allmendinger EE, 1990. Submersible vehicle systems design, New York: Sname.

Pisias NG and Delaney ML(eds), 1999. Complex : conference of Multiple Platform Exploration of the Ocean. Washinton, DC: Joint Oceanographic Institute.

Pulsipher AG.(eds), 1996. Proceedings : An international workshop on offshore lease abandonment and Platform disposal: technology, Regulation and Environmental Effects. MMS contract 14-35-0001-30794. Baton Rouge, LA:Center for Energy studies

Forma W,1999. The history of American Deep submersible operations. Flagstaff, AZ: Best Publishing Co.

Brekhovskikh LM and Lysanov YP, 1991. Fundamentals of Ocean Acoustics, Berlin: Springer- Verlag.

Akal T and Berkson JM (eds.), 1986. Ocean Seismo-Acoustics. New York and London: Plenum press.

Clarke JH, 2000. Present-day methods of depth measurement, In: Cook PJ and Carleton CM (eds.) Continental shelf limits: The Scientific and legal interface, pp.139-159. Oxford, UK: Oxford University Press.

Duenebier FK and Sutton GH, 1995. Fidelity of Ocean bottom seismic observations. Marine geophysical researches 17: 535-555.

Chapter Nine: Disaster and Prevention (2 credit hours)

Questions :

1. What are the main natural disasters affecting coastal places?

Readings:

Viles H and Spencer T, 1995. Coastal Problems: Geomorphology, Ecology, and Society at the Coast, New York: Oxford University Press.

Burton I, Kates RW and White GF, 1993. The environmental as Hazard, 2nd edn. New York: the Guilford press.

Pugh DT, 1987. Tides, Surges and Mean sea level. Chichester: John Wiley Sons.

Kajiura K and Shuto N, 1990. Tsunamis. In: Le Mehaute B and Hanes DM (eds), The Sea ocean Engineering Science, PP395-420.

Gubbay S, 1996. Marine protected areas: Principles and techniques for management. New York: Chapman Hall.

Cicin-Sain B and Knecht RW, 1998. Integrated Coastal and Ocean Management: Concepts and Practices. Washington, DC: Island Press.

Birkland C, 1997. Life and Death of Coral Reefs, New York: Chapman and Hall.

Chapter Ten Major International Marine Geological Research Programs (2 credit hours)

Questions:

1. How did ocean drilling programs (e.g. IODP, ODP, DSDP) contribute to the development of Marine Geology?

2. What is the main mission of InterRidge?

Readings:

Becker K and Davis EE, 2000. Plugging the seafloor with CORKs, Oceanus 42(1): 14-16

Cullen V, 1993/1994. 25 years of Ocean Drilling, Oceans 36 (4) .

Warne JE, Douglas GR, and Winterer EL, 1981. The Deep sea Drilling Project: A decade of progress, special publication 32, Tulsa, OK: Society of Economic Paleontologists and Mineralogists.

Hsu KJ, 1992. Challenger at sea, a Ship that Revolutionized Earth Science. Princeton, NJ: Princeton University Press.

第一章 绪论（2 学时）

问题：

1. 推动海洋地质学近期发展的动力？
2. 海洋地质学发展阶段是如何划分的？其学术思想有什么变化？

进一步阅读文献：

Manten, A.A., 1964. The origin of marine geology. Marine Geology 2, 1-28.

Deacon M, 1971. Scientist and the Sea, 1650-1900: A study of Marine science. London: Academic press.

James P. Kennett, 1981. Marine Geology, Introduction.

Manten, A.A., 1964. The origin of marine geology. Marine Geology 2, 1-28.

第二章 地球结构与海底岩石圈（4 学时）

问题：

1. 大陆岩石圈和大洋岩石圈的区别是什么？
2. 标准洋壳的结构及其物质组成？
3. 大陆型地壳与大洋型地壳的主要区别？
4. 软流圈不均一性的科学意义是什么？

进一步阅读文献：

Kump LR, Kasting JF, and Crane RC, 1999. The Earth System. London: prentice-hall.

Fowler CMR, 1990. The solid earth, Cambridge: Cambridge University Press.

James P. Kennett, 1981. Marine Geology, Introduction.

第三章 海底构造（6 学时）

问题：

1. 洋壳扩张假说有什么缺点？
2. 洋中脊主要的构造特征是什么？
3. 岩石圈板块的边界有哪些类型？各种类型的特征是什么？

4. 影响岩浆岩性质的因素有哪些？
5. 什么是板块俯冲？板块俯冲发生的原因是什么？

进一步阅读文献：

Moore EM and Twiss RJ, 1995. *Tectonics*, New York: WH Freeman.

Perfit MR and Davidson JP, 2000. Plate Tectonics and Volcanism. In: Sigurdson H (ed) *Encyclopedia of Volcanoes*. San Diego: Academic Press.

Solomon SC and Toomey DR, 1992. The structure of Mid-ocean Ridges. *Annual review of Earth and Planetary Sciences* 20: 329-364.

Nicolas A, 1990. *The Mid-Ocean Ridge*. Springer Verlag, Berlin.

Hey RN, Sinton JM, Duennebieck FK, 1989. Propagating rifts and spreading centers. In: Winterer EL, Hussong DM, and Decker RW (eds.) *Decade of North American geology: The Eastern Pacific Ocean and Hawaii*, pp161-176.

Price JF, 2001. Subduction, In: *Ocean circulation and Climate: Observing and Modelling the Global Ocean*, G. Siedler, J. Church and J. Gould (eds), Academic Press, pp. 357-371

第四章 海底地形地貌（6 学时）

问题：

1. 海底由那些构造单元组成，各单元的特征是什么？
2. 大陆架有哪些地形和地貌特征？
3. 大陆边缘有哪些地貌，其地貌特征是什么？
4. 什么是海岸带？海岸带有那几种类型？各种类型的特征是什么？

进一步阅读文献：

Fowler CMR, 1990. *The solid earth*, Cambridge: Cambridge University Press.

Bird ECF, 1984. *Coasts*, 3rd edn, London: Blackwell.

Burk CA and Drake CL(eds), 1974. *The Geology of Continental margins*. New York: Springer-Verlag.

Trenhaile AS, 1997. *Coastal dynamics and landforms*. Oxford: Clarendon Press.

Floyd PA (ed.), 1991. *Oceanic Basalts*. Glasgow: Blackie and Son.

第五章 海洋环境要素（4 学时）

问题：

1. 海浪、潮汐和洋流是怎样影响海底的？
2. 什么是盐跃层、密跃层、以及 CCD 深度（碳酸钙补偿深度）？
3. 海洋生物对海洋地质过程有哪些作用？

进一步阅读文献：

Pickard GL and Emery WJ, 1992. Descriptive Physical Oceanography, 5th edn. Oxford: Pergamon Press.

Cartwright DE, 1999. Tides-a Scientific History, Cambridge: Cambridge university press.

Summerhayes CP and Thorpe SA, 1996. Oceanography-An Illustrated Guide. London: Manson Publishing.

Gill AE, 1982. Atmosphere-Ocean Dynamics, London: Academic Press.

Lavrenov I, 2003. Wind-Waves in Oceans: Dynamics and Numerical simulation. New York: Springer.

Covey C and Barron E, 1988. The role of Ocean heat transport in climatic change. Earth- Science review24: 429-445.

Siedler G, Church J and Gould, 2001. Ocean circulation and Climate, London: Academic press.

Simpson JE, 1997. Gravity Currents, 2nd Edn. Cambridge: Cambridge University Press.

Emery WJ and Meincke J, 1986. Global water masses summary and review. Oceanologica Acta 9:383-391.

第六章 大陆边缘与深海沉积（8学时）

问题：

1. 什么是浊流沉积、等深流沉积、和半深海沉积，这些沉积之间的区别是什么？
2. 控制深海和海岸带沉积的主要因素和过程有哪些？
3. 三角洲形成演化和海平面变化之间的关系是什么？

进一步阅读文献：

Davis RA, 1985. Coastal sedimentary environments. New York: Springer-verlag.

Lisitzin AP, 1996. Oceanic sedimentation, Lithology and Geochemistry. Washington DC: American Geophysics Union.

Miall AD, 1997. The geology of Stratigraphic sequences. Berlin: Springer-Verlag.

Huh C-A and Kadko DC, 1992. Marine sediments and sedimentation process, In: Ivanovich M and Harmon RS (eds) . Uranium Series Disequilibrium: applications to earth, Marine and Environmental Sciences 2nd edn. PP. 460-486. Oxford: Oxford University Press.

Lisitzin AP, 1996. Oceanic sedimentation, lithology and Geochemistry, Washington, DC: American Geophysical Union.

Boyd R, Darlymple R, and Zaitlin BA, 1992. Classification of clastic coastal depositional environments. Sedimentary geology 80:139-150.

Peltier WR, 1998. Postglacial variations in the level of the sea: implication for climate dynamic and solid-earth geophysics, Review in geophysics 36:603-689.

Milliman JD and Farnsworth KL, 2002. River runoff, Erosion and Delivery to the Coastal Ocean: A Global Analysis. Oxford University Press.

Wunsch C and Ferrari R, 2004. Vertical Mixing, energy, and the general circulation of the oceans. Annul reviews of Fluid Mechanics 36: 281-314.

第七章 古海洋学（10 学时）

问题：

1. 古海洋研究中主要的物理、化学、生物替代指标有哪些？掌握自己感兴趣的一种指标的原理与应用。
2. 建立年代序列的主要方面有哪些？
3. 古海洋环境主要包括哪些内容？如何重建这些环境背景？
4. 西太平洋暖池形成的地质历史过程与原因？
5. 南极冰盖形成的机制？
6. 冰期期间海洋环境具有什么样的特征？

进一步阅读文献：

Hillaire-Marcel C and de Vernal A, 2007. Proxies in Late Cenozoic Palaeoceanography, Amsterdam : Elsevier.

Gradstein F, Ogg J, and smith AG, 2004. A Geological Time scale. Cambridge, UK: Cambridge University Press.

Broecker WS, 1991. The great ocean conveyor. Oceanography 4: 79-89.

Orsi A, Johnson G and Bullister J, 1999. Circulation, mixing, and production of Antarctic bottom water, Progress in Oceanography 43: 55-109.

Covey C and Barron E, 1988. The role of Ocean heat transport in climatic change. Earth- Science review 24: 429-445.

Rind D and Chandler M, 1991. Increased ocean Heat transports and warmer climate. Journal of Geophysical Reseach 96:7437-7461

Lisiecki LE and Raymo ME, 2005. A Pliocene-Pleistocene stack of 57 globally distributed benthic delta O-18 records. Paleoceanography 20:PA1003.

Wilson DS, 1993. Confirmation of the astronomical calibration of the magnetic polarity timescale from sea-floor spreading rate. Nature 364: 788-790.

Huber BT, Macleod KG, and Wing S, 1999. Warm Climates in Earth History , Cambridge , UK : Cambridge University Press.

Zachos JC, Rohl U, Schellenberg SA, et al., 2005. Rapid acidification of the ocean during the Paleocene-Eocene Thermal Maximum, Science 308:1611-1615.

Zachos JC, Pagani M, Sloan L, et al., 2001. Trends, rhythms, and aberrations in Global climate 65 Ma to present, Science 292:686-694 .

第八章 海洋地质研究方法与调查技术（4 学时）

问题：海洋地质调查的主要技术手段有哪些？各种手段的应用与优缺点是什么？

进一步阅读文献：

Griffiths G (ed.), 2003. Technology and application of Autonomous Underwater Vehicles. London: Taylor and Francis.

[Http:// WWW.cobo.org.uk](http://WWW.cobo.org.uk). _Coastal Ocean Benthic Observatory.

Allmendinger EE, 1990. Submersible vehicle systems design, New York: Sname.

Pisias NG and Delaney ML(eds), 1999. Complex : conference of Multiple Platform Exploration of the Ocean. Washinton, DC: Joint Oceanographic Institute.

Pulsipher AG.(eds), 1996. Proceedings : An international workshop on offshore lease abandonment and Platform disposal: technology, Regulation and Environmental Effects. MMS contract 14-35-0001-30794. Baton Rouge, LA:Center for Energy studies

Forma W,1999. The history of American Deep submersible operations. Flagstaff, AZ: Best Publishing Co.

Brekhovskikh LM and Lysanov YP, 1991. Fundamentals of Ocean Acoustics, Berlin: Springer- Verlag.

Akal T and Berkson JM (eds.), 1986. Ocean Seismo-Acoustics. New York and London: Plenum press.

Clarke JH, 2000. Present-day methods of depth measurement, In: Cook PJ and Carleton CM (eds.) Continental shelf limits: The Scientific and legal interface, pp.139-159. Oxford, UK: Oxford University Press.

Duennebieer FK and Sutton GH, 1995. Fidelity of Ocean bottom seismic observations. Marine geophysical researches 17: 535-555.

第九章 海洋灾害与预防（2学时）

问题：影响海岸带地区的自然灾害有哪些？

进一步阅读文献：

Viles H and Spencer T, 1995. Coastal Problems: Geomorphology, Ecology, and Society at the Coast, New York: Oxford University Press.

Burton I, Kates RW and White GF, 1993. The environmental as Hazard, 2nd edn. New York: the Guilford press.

Pugh DT, 1987. Tides, Surges and Mean sea level. Chichester: John Wiley Sons.

Kajiura K and Shuto N, 1990. Tsunamis. In: Le Mehaute B and Hanes DM (eds), The Sea ocean Engineering Science, PP395-420.

Gubbay S, 1996. Marine protected areas: Principles and techniques for management. New York: Chapman Hall.

Cicin-Sain B and Knecht RW, 1998. Integrated Coastal and Ocean Management: Concepts and Practices. Washington, DC: Island Press.

Birkland C, 1997. Life and Death of Coral Reefs, New York: Chapman and Hall.

第十章 国际重大海洋地质科学研究项目（2 学时）

问题：

1. 大洋钻探计划对海洋地质学的发展有哪些贡献？
2. 大洋中脊计划的主要研究内容和任务是什么？

进一步阅读文献：

Becker K and Davis EE, 2000. Plugging the seafloor with CORKs, *Oceanus* 42(1): 14-16

Cullen V, 1993/1994. 25 years of Ocean Drilling, *Oceans* 36 (4) .

Warne JE, Douglas GR, and Winterer EL, 1981. The Deep sea Drilling Project: A decade of progress, special publication 32, Tulsa, OK: Society of Economic Paleontologists and Mineralogists.

Hsu KJ, 1992. *Challenger at sea, a Ship that Revolutionized Earth Science*. Princeton, NJ: Princeton University Press.

18. 教材及其它参考资料 Textbook and Supplementary Readings

《Marine Geology》，James P. Kennett, 1981

《Marine Geology-Exploring the New Frontiers of the Ocean》，Jon Erickson, 2003

《海洋地质学》，李学伦，青岛海洋大学出版社，1997。

《近代海洋地质学》，朱而勤，青岛海洋大学出版社，1991。

教学评估 ASSESSMENT

19.	评估形式 Type of Assessment	评估所需时间 Duration	占考试总成绩百分比 % of final score	违纪处罚 Penalty	备注 Notes
	出勤 Attendance		10		
	课堂表现 Class Performance		10		
	小测验 Quiz				
	课程项目 Projects				
	平时作业 Assignments		10		
	期中考试 Mid-Term Test				
	期末考试 Final Exam		60		
	期末报告 Final		10		

Presentation				
其它（可根据需要 改写以上评估方 式） Others (The above may be modified as necessary)				

课程审批 REVIEW AND APPROVAL

20.	本课程设置已经过以下责任人/委员会审议通过 This Course has been approved by the following person or committee of authority
	海洋科学与工程系本科教学委员会 Department of Ocean Science and Engineering Undergraduate Committee