南方科技大学
SOUTHERN UNIVERSITY OF SCIENCE AND TECHNOLOGY

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**	地球化学 Geochemistry
2.	**授课院系 Originating Department**	地球与空间科学系 Department of Earth and Space Sciences
3.	**课程编号 Course Code**	ESS406
4.	**课程学分 Credit Value**	2
5.	**课程类别 Course Type**	专业选修课 Major Elective Courses
6.	**授课学期 Semester**	秋季 Fall
7.	**授课语言 Teaching Language**	中英双语 English & Chinese
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）**	陈斌，地球与空间科学系 邮箱：chenb6@sustech.edu.cn 电话：0755-88015516 办公室：创园 9 栋 407 Bin Chen, Department of Earth and Space Sciences Email: chenb6@sustech.edu.cn Tel: 0755-88015516 Office: Innovation Park #9-407
9.	**实验员/助教、所属学系、联系方式 Tutor/TA(s), Contact**	待公布 To be announced
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	32				32

12. 先修课程、其它学习要求 Pre-requisites or Other Academic Requirements	
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

本课程主要讲授元素地球化学和同位素地球化学基本概念、基本理论及其在地球科学领域的应用,为地球物理、海洋地质/化学、环境科学、行星科学和地质学专业本科生的专业基础课。

This course aims to teach the basic concepts and theories of elemental and isotopic geochemistry and their applications in different fields of Earth Sciences. It is extremely important to undergraduate students of Geophysics, Ocean Geology/Chemistry, Environmental Sciences, Planetary Sciences, and Geology.

16. 预达学习成果 Learning Outcomes

学生完成本课程后，将会掌握以下知识：

1. 了解地球化学在地球科学中的地位，地球化学学科分支，基本问题和地球化学研究的现状；了解地球各圈层的元素丰度，化学组成，不同岩石单元、矿物、水圈的化学成分；地球系统中常量和微量元素行为的控制因素；

2. 掌握微量元素地球化学的基本概念，元素的分类和配分的原理和影响因素，元素迁移的形式和动力，地球化学演化的总趋势和主要过程，地球化学演化的热力学和动力学条件；

3. 掌握同位素年代学的基本原理，放射性同位素的基本原理和同位素示踪方法；

4. 掌握稳定同位素（包括传统的 C-O-S-B 和非传统的金属稳定同位素）的基本原理，同位素分馏机制和影响因素；

5. 了解利用微量元素和同位素地球化学原理研究岩浆起源和演化、俯冲带过程、造山带演化、水-岩相互作用、成矿机理岩，以及大陆风化及其对海洋化学、古气候-古环境的指示意义。

Upon completing the course, students will be able to:

1. To know (1) the role of geochemistry in Earth Sciences, academic branches, fundamental scientific issues and proceedings of geochemistry, (2) the abundance of elements and chemical compositions of different rock units and minerals in different lithospheres and hydrosphere, and (3) geochemical behaviour of major and trace elements in Earth Systems, and the key factors that control the partitioning of elements between different phases;

2. To command the basic concepts of trace elements geochemistry, the classification,

distribution and transport of elements and controlling factors, the chief trends and processes of geochemical evolution, and the thermodynamics and kinetics of geochemical evolution;

3. To command the basic principles of geochronology, radiogenic isotopes and isotopic tracing;

4. To command the basic principles of stable isotopes (including the traditional C-O-S-B and non-traditional metal stable isotopes), isotopic fractionation mechanisms and factors that control the fractionation;

5. To study magma origin and evolution, subduction zone processes, evolution of orogenic belt, water-rock interaction, ore-forming mechanism, and continental weathering and relationship with paleo-environmental/climate change.

17. 课程内容及教学日历 （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. Please notify name of instructor for course section(s), if this is a team teaching or module course.)

第一章 地球化学导论 （2 学时）

介绍地球化学学科性质、地球化学基本问题、地球化学分支学科、地球化学的研究现状及其在地球科学中的地位。

第二章 地球系统的化学组成和化学演化（4 学时）

介绍地球系统的结构和化学组成；地幔熔融和玄武岩成因；地壳深熔和大陆地壳的形成机制；壳幔物质循环过程；表生过程和化学演化。

第三章 微量元素地球化学 （6 学时）

介绍微量元素分类、性质；微量元素在矿物、熔体和流体中的配分和影响因素；微量元素地球化学示踪和模拟；微量元素现在俯冲带过程、地幔交代、岩浆起源和水-岩相互作用研究领域的应用。

第四章 放射性同位素基本原理和地质年代学（6 学时）

介绍主要放射性同位素（如 Rb-Sr, Sm-Nd, Re-Os, Lu-Hf, U-Pb, K-Ar 等）的原理和同位素示踪方法；同位素定年的原理和方法。

第五章 稳定同位素 C-O-S 和 B 的原理和应用（6 学时）

介绍常规的稳定同位素 C-B-O-S 的原理，同位素分馏机理及其热力学、动力学条件；在岩浆起源、水-岩相互作用、成矿机理、俯冲带脱水、地幔交代作用、大陆风化和海洋沉积作用领域的应用研究。

第六章 非传统稳定同位素原理和应用（8 学时）

主要介绍 Fe, Cu, Cr, Ca, Mg, Li 等非传统稳定同位素的地球化学性质、分馏机理和影响因素，及其在玄武质岩浆起源和演化、壳-幔相互作用、俯冲带过程、地壳深熔作用、成矿过程、水-岩相互作用、大陆

风化和碳循环等研究领域的应用。

Chapter 1 Introduction to Geochemistry (2 hours)

Introduce the basic concepts of geochemistry, fundamental academic issues, branches of geochemistry, research proceedings, and roles in earth sciences.

Chapter 2 Chemical Compositions and Chemical Evolution of Earth Systems (4 hours)

To teach the structure and chemical compositions of Earth Systems, partial melting of mantle rocks and basalt generation, crustal anatexis and continental growth, mantle-crustal interaction, surface processes and chemical evolution.

Chapter 3 Trace Elements Geochemistry (6 hours)

Classification and nature of trace elements; partitioning of trace elements in minerals, melt and fluid, and factors that control the partition of elements between different phases; element geochemical tracing and modelling; behaviour of trace elements in subduction zone processes, mantle metasomatism, magma generation and water-rock interaction.

Chapter 4 Radiogenic Isotopes, Isotopic Tracing and Geochronology (6 hours)

To introduce the principles and isotopic tracing of major radiogenic isotopic systems such as Rb-Sr, Sm-Nd, Re-Os, Lu-Hf, U-Pb and K-Ar; principles, methods and application of isotopic dating in natural cases.

Chapter 5 Conventional Stable Isotopes (C-O-S-B) and Applications (6 hours)

Principles of conventional stable isotopes C, O, S and B, the isotopic fractionation mechanism and thermodynamic and kinetic conditions that govern the isotopic fractionation, use of stable isotopes in magmatism, water-rock interaction, ore-forming processes, dehydration and melting of subducting slab, mantle wedge metasomatism, continental weathering, and marine sedimentation.

Chapter 6 Non-Traditional Stable Isotopes and Applications (8 hours)

Geochemical behaviour of non-traditional stable isotope systems (Fe, Cu, Cr, Ca, Mg, Li) and factors that control the isotopic fractionation; the application of non-traditional stable isotopes in basalt generation, mantle-crustal interaction, subduction zone processes, crustal anatexis, ore-forming mechanism, water-rock interaction, continental weathering and carbon cycling.

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

1. Francis Albarède, Geochemistry: An Introduction. Cambridge University Press, 2003.

2. Rollinson, H., Using Geochemical Data: Evaluation, Presentation, Interpretation. Longman, Harlow, 1993.

课程评估 ASSESSMENT

19.

评估形式 Type of Assessment	评估时间 Time	占考试总成绩百分比 % of final score	违纪处罚 Penalty	备注 Notes
出勤 Attendance		5		
课堂表现 Class Performance		5		
小测验 Quiz				
课程项目 Projects				
平时作业 Assignments				
期中考试 Mid-Term Test				
期末考试 Final Exam				
期末报告 Final Presentation		90		
其它（可根据需要改写以上评估方式） Others (The above may be modified as necessary)				

20. 记分方式 GRADING SYSTEM

√ A. 十三级等级制 Letter Grading
☐ B. 二级记分制（通过/不通过） Pass/Fail Grading

课程审批 REVIEW AND APPROVAL

21. 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