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| **114(1)/2025 Fall Semester TIGP-ESS課程資料表**  **114(1)/2025 Fall Semester TIGP-ESS course information form** | | | | |
| 科目名稱(中文) | | | 同位素地球化學 | |
| Course Title (English) | | | Isotope geochemistry | |
| 授課時間  Time | | | 9:10-12:00 am on Tuesday | |
| 授課地點  Location | | | Room 611, 6F, IES building, Academia Sinica, | |
| 學分數  Course Credits | | | 3 | |
| 主要授課老師 Main Instructors | | | Der-Chuen Lee, Kuo-Fang Huang, Kwan-Nang Pang, Yi-Wei Liu, Ching-Chou Fu, Kuo-Lung Wang | |
| 聯絡郵件  E-mail | | | [klwang@gate.sinica.edu.tw](mailto:klwang@gate.sinica.edu.tw) | |
| 辦公時間 Office Hours | | | By appointment | |
| 課程目標 Course Objectives | | | Isotope geochemistry has grown over the last 50 years to become one of the most important fields in the earth sciences as well as in geochemistry. It has played an important role in transforming geology from a qualitative, observational science to a modern quantitative one. This course will start from fundamental principles then touch on many, though not all, of the applications of isotope geochemistry. We’ll focus first on geochronology will be focused first and then consider how radiogenic isotopes have been used to understand the origin and evolution of the Earth. Next, applications of stable isotope geochemistry to fields as diverse as paleoclimate, paleontology, archeology, ore genesis, and magmatic evolution will be examined. In addition, how the horizons of stable isotope geochemistry have broadened from a few light elements such as hydrogen, carbon, and oxygen to much of the periodic table will be shown. Finally, isotope geochemistry of the noble gases, whose isotopic variations are due to both nuclear and chemical processes and provide special insights into the origins and behavior of the Earth will be considered. | |
| 授課內容 Course Description | | | 1. Introduction  2. Decay systems and Geochronology I  3. Geochronology II  4. Mass spectrometry and analytical result assessment  5. Radiogenic isotope geochemistry of the mantle  6. Radiogenic isotope geochemistry of the lithosphere  7. Radiogenic isotope geochemistry of the ocean  8. Stable isotope geochemistry I-theory  9. Stable isotope geochemistry II-appl.  10. Stable isotope geochemistry III-appl.  11. Stable isotope geochemistry IV (non-traditional)  12. Noble gas isotope geochemistry | |
| 教科書/參考書 Textbooks/References | | | 1. Isotope Geochemistry, 2014. William M. White, John Wiley & Sons (pub.), 495p.  2. Isotope Geology, 2008. Claude J. Allegre, Cambridge (pub.), 512p.  3. Principle of Isotope Geology, 2nd Edition, 1986. Gunter Faure, Wiley & Sons (pub.), 589p. | |
| 自編教材比例  Self-compiled Textbook/References Proportion(if any) | | | 80 % | |
| 授課方式 Course Requirements | | | ▓講授(Lecture)；  ▓研討(Seminar)；  □實習/實驗(Internship/Experiment)；  □個別指導(Individual Discussion)；  □其他(Other) | |
| 評量配分比重 Course Grade | | | Term presentation: 70%  Performance in Class: 30% | |
| 對應之永續發展目標(SDGs)(請選擇至多3項與教學內容相關的項目) 翻譯成英文的話就是：  Corresponding Sustainable Development Goals (SDGs) (Please choose up to 3 items related to the teaching content) | | | □SDG1消除貧窮No Poverty  □SDG2消除飢餓Zero Hunger  □SDG3健康與福祉Good Health and Well-being  ▓SDG4優質教育Quality Education  □SDG5性別平等Gender Equality  □SDG6潔淨飲水與衛生Clean Water and Sanitation  ▓SDG7永續能源Affordable and Clean Energy  □SDG8就業與經濟成長Decent Work and Economic Growth  □SDG9產業永續創新Industry, Innovation, and Infrastructure  □SDG10減少不平等Reduced Inequality  □SDG11永續城市與社區Sustainable Cities and Communities  □SDG12永續消費及生產Responsible Consumption and Production  ▓SDG13氣候行動Climate Action  □SDG14水生生態Life Below Water  □SDG15陸地生態Life on Land  □SDG16和平與正義制度Peace, Justice, and Strong Institutions  □SDG17全球夥伴Partnerships for the Goals | |
| 課程類別Course Category | | | □STEAM  □人文關懷Humanities and Social Sciences  □跨域課程Interdisciplinary Courses  □問題導向Problem-Based Learning  ▓總整課程Integrated Curriculum  □媒體識讀Media Literacy  □創新課程Innovative Curriculum  □自主學習課程Self-Directed Learning  □無None | |
| 課程領域Areas | | | ▓基礎學科(共同)(Basic subjects (common))  ▓固態地球科學(Solid earth sciences)  □水圈科學(Aquatic sciences)  □應用語言(Applied Languages)  □大氣科學(Atmospheric sciences) | |
| 產業領域Areas | | | ▓地探科技(Geological monitoring technology)  □氣象科技(meteorological science and technology)  □太空科技(Space Technology)  □環保科技(environmental protection science and technology)  □資訊科技(Informational Technology)  ▓教學研究(Teaching & research)  ▓地質科技(Geosciences and technology) | |
| 課程進度與內容  Lecture outline and content | | | | |
| 週次  week | | 主題  Topic | | 授課教師/指定閱讀或作業  Instructor/Readings or assignments |
| 1 | 9/2 | Introduction | | All lecturers; Yi-Wei Liu劉怡偉 |
| 2 | 9/9 | Decay systems and geochronology | | Kuo-Lung Wang王國龍 |
| 3 | 9/16 | Mass spectrometry and analytical result assessment | | Kuo-Lung Wang王國龍 |
| 4 | 9/23 | Cosmochemistry | | Der-Chuen Lee李德春 |
| 5 | 9/30 | Radiogenic isotope geochemistry of the mantle | | Kwan-Nang Pang彭君能 |
| 6 | 10/7 | Radiogenic isotope geochemistry of the lithosphere | | Kuo-Lung Wang王國龍 |
| 7 | 10/14 | Radiogenic isotope geochemistry of the ocean | | Kuo-Fang Huang黃國芳 |
| 8 | 10/21 | Stable isotope geochemistry I-theory | | Der-Chuen Lee李德春 |
| 9 | 10/28 | Stable isotope geochemistry II-appl. (1) | | Kuo-Fang Huang黃國芳 |
| 10 | 11/4 | Stable isotope geochemistry II-appl. (2) | | Yi-Wei Liu劉怡偉 |
| 11 | 11/11 | Stable isotope geochemistry III-appl. (3) | | Yi-Wei Liu劉怡偉 |
| 12 | 11/18 | Stable isotope geochemistry IV (non-traditional) | | Kwan-Nang Pang彭君能 |
| 13 | 11/25 | Noble gas isotope geochemistry (1) | | Ching-Chou Fu傅慶州 |
| 14 | 12/23 | Noble gas isotope geochemistry (2) | | Ching-Chou Fu傅慶州 |
| 15 | 12/9 | Lab. & instruments visit | | Kuo-Lung Wang王國龍 |
| 16 | 12/16 | Term presentation | | Students; all lecturers |
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| 課程所屬學制(Educational System): 博士班(Doctoral Program) | | | | |
| 核心能力I: 請點選本課程培養學生具備核心能力之強度指數，並填寫對應之評量方式  Please select core abilities and its corresponding assessments of this course | | | | |
| 請勾選學程所訂之核心能力(可複選)  ▓獨立思考與研究能力Independent thinking and research capacity  ▓進階數理及專業知識能力Advanced mathematical and professional knowledge and ability  □觀測模擬及分析推理能力Observation simulation and analysis of reasoning ability  □電腦及程式語言運用能力Computer and programming language proficiency  □國際視野與語文溝通能力International perspective and language communication skills  □專業倫理及服務學習能力Professional ethics and service-learning ability | | | | |
| 核心能力II: 請點選本課程培養學生具備核心能力之強度指數，並填寫對應之評量方式  Please select the core abilities and its corresponding assessments of this course | | | | |
| |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | 強度指數 Overall rating of Core Abilities | 1 非常低 Very Low | 2 低 Low | 3 普通 Medium | 4 高 High | 5 非常高 Very High | 評量方式 Corresponding Assessments | | 獨立思考與研究能力 Independent thinking and research capacity | □ | □ | □ | ▓ | □ | □紙筆測驗/會考(Test/Exam)  □作業練習(Assignments)  ▓口頭報告/口試(Presentation/Oral Exam)  □專題研究報告(書面)  (Research Report(printed on paper))  □實作/實驗(Practices/Experiments)  ▓出席/課堂表現(Attendance/Performance)  □學習檔案評量(Portfolios Assessment)  □自我評量/同儕互評  (Self-Assessment/ Peer Assessment)  □作品/創作展演  (Products/Creative Performance)  □其他(Others) | | 進階數理及專業知識能力 Advanced mathematical and professional knowledge and ability | □ | □ | □ | ▓ | □ | □紙筆測驗/會考(Test/Exam)  □作業練習(Assignments)  □口頭報告/口試(Presentation/Oral Exam)  □專題研究報告(書面)  (Research Report(printed on paper))  □實作/實驗(Practices/Experiments)  □出席/課堂表現(Attendance/Performance)  □學習檔案評量(Portfolios Assessment)  □自我評量/同儕互評  (Self-Assessment/ Peer Assessment)  □作品/創作展演(Products/Creative Performance)  □其他(Others) | | 觀測模擬及分析推理能力 Observation simulation and analysis of reasoning ability | □ | □ | □ | □ | □ | □紙筆測驗/會考(Test/Exam)  □作業練習(Assignments)  □口頭報告/口試(Presentation/Oral Exam)  □專題研究報告(書面)  (Research Report(printed on paper))  □實作/實驗(Practices/Experiments)  □出席/課堂表現(Attendance/Performance)  □學習檔案評量(Portfolios Assessment)  □自我評量/同儕互評  (Self-Assessment/ Peer Assessment)  □作品/創作展演(Products/Creative Performance)  □其他(Others) | | 電腦及程式語言運用能力Computer and programming language proficiency | □ | □ | □ | □ | □ | □紙筆測驗/會考(Test/Exam)  □作業練習(Assignments)  □口頭報告/口試(Presentation/Oral Exam)  □專題研究報告(書面)  (Research Report(printed on paper))  □實作/實驗(Practices/Experiments)  □出席/課堂表現(Attendance/Performance)  □學習檔案評量(Portfolios Assessment)  □自我評量/同儕互評  (Self-Assessment/ Peer Assessment)  □作品/創作展演(Products/Creative Performance)  □其他(Others) | | 國際視野與語文溝通能力 International perspective and language communication skills | □ | □ | □ | □ | □ | □紙筆測驗/會考(Test/Exam)  □作業練習(Assignments)  □口頭報告/口試(Presentation/Oral Exam)  □專題研究報告(書面)  (Research Report(printed on paper))  □實作/實驗(Practices/Experiments)  □出席/課堂表現(Attendance/Performance)  □學習檔案評量(Portfolios Assessment)  □自我評量/同儕互評  (Self-Assessment/ Peer Assessment)  □作品/創作展演(Products/Creative Performance)  □其他(Others) | | 專業倫理及服務學習之能力 Professional ethics and service-learning ability | □ | □ | □ | □ | □ | □紙筆測驗/會考(Test/Exam)  □作業練習(Assignments)  □口頭報告/口試(Presentation/Oral Exam)  □專題研究報告(書面)  (Research Report(printed on paper))  □實作/實驗(Practices/Experiments)  □出席/課堂表現(Attendance/Performance)  □學習檔案評量(Portfolios Assessment)  □自我評量/同儕互評  (Self-Assessment/ Peer Assessment)  □作品/創作展演(Products/Creative Performance)  □其他(Others) | | | | | |