深地科学论坛（第二十讲）：深地科学前沿热点问题探究

时间：2021 年 11 月 24 日

14：30-15：30（陈光齐报告、Zoom 直播）

15：30-16：30（Veerle Vandeginste 报告、腾讯会议直播）

地点：Zoom、腾讯会议直播

报告人	报告人单位	报告题目
陈光齐	日本九州大学	**Development of numerical methods for analyzing geo-disasters** Zoom 会议 ID: 971 8842 8118 PD: 786961 网址（直播链接）： https://us06web.zoom.us/j/97188428118?pwd=ZTZUOW0zeXd5N3haUjBlcFVDYk1yUT09
Veerle Vandeginste	比利时鲁汶大学	**Fluid-rock interactions in geothermal reservoirs and implications for carbon storage** 腾讯会议（ID：718 317 6634）

欢迎全校教师及同学参加！

深部岩土力学与地下工程国家重点实验室

深部地下工程学科创新基地

《深地科学（英文）》

力学与土木工程学院

江苏省岩土力学与工程学会

2021.11.18

报告人简介：

Guangqi CHEN is currently both a Professor of Faculty of Arts and Science and a Professor of Department of Civil and Structural Engineering, Kyushu University, Japan. He received his Doctoral Degree of Science from the University of Tokyo in 1993 and worked as a lecturer at the Department of Civil Engineering, Kyoto University before transferred to Kyushu University in 2000. His recent research interests are, earthquake engineering, geo-disaster prevention, numerical simulation. He has developed **a series of numerical simulation techniques including high-order manifold method, landslide simulation techniques by considering seismic energy and matric suction, simulation technique for landslide-dam formation and collapse, simulation technique for debris flow with huge rock based on discontinuous deformation analysis and smoothed particle hydrodynamics.** He published more than 200 peer-reviewed papers (h-index=21 and FWCI=2.9). Also, He proposed a new possible mechanism of earthquake induced landslide focusing on pulse-like ground motion which is attracting more and more researchers. (https://kyushu-u.pure.elsevier.com/en/persons/guangqi-chen)

Veerle Vandeginste graduated as a geologist in 2001 and obtained her PhD degree in Geology in 2006 at **KU Leuven**. Then, she conducted research at the **Geological Survey of Belgium**, and subsequently, at CEREGE (Aix-en-Provence, France). She joined the Department of Earth Science and Engineering at **Imperial College London** in 2009, and in 2012, she started there her own Diagenesis research group as an independent research fellow. In 2015, she was appointed as an assistant professor at the **University of Nottingham**, where she established the Geochemistry research discipline in the School of Chemistry, and was promoted to associate professor in 2020. Since October 2020, she is an associate professor in **Materials Engineering at KU Leuven,** where she contributes **teaching in chemistry and material science, engineering and technology, and research on physical chemistry and behaviour of material interfaces**. She received several institutional and international awards, e.g. Arthur Holmes Centenary Research Award, QCCRSC Best poster prize, the Stephen E. Laubach Research in Structural Diagenesis Award, the GDL Foundation Research Fellowship. She is a Fellow of the Geological Society of London, and Fellow of the Higher Education Academy. The motivation behind her research arises from major challenges the world is currently facing, in particular global warming, pollution and finite resources. Hence, her research aims to bring solutions by driving innovation in applications of carbon capture, utilization and storage, renewable energy and energy storage, ecological products and processes, renewable resources, and circular economy. The common focus in her current and previous research is physical chemistry of material interfaces linked with material behaviour. She has spoken at many international conferences, and published her research in the top scientific journals (e.g. Nature Communication, Science Advances). (https://www.vandeginstelab.be/)

报告摘要：

Development of numerical methods for analyzing geo-disasters

A strong earthquake or a heavy rainfall can induce landslides. And a large-scale landslide can create a landslide dam when falling sediments stop a river. Because of its rather loose nature and absence of controlled spillway, a landslide dam is easy to fail and lead to debris flow or downstream flooding. Also, since the landslide sediments can be removed into a valley or a ravine by excessive precipitation, which can lead to a debris flow. In order to clarify the mechanisms and evaluate risks of these geo-hazards, we have developed a series of numerical simulation techniques using discontinuous deformation analysis (DDA) and smoothed particle hydrodynamics (SPH). In this presentation, developments and applications of the following numerical simulation techniques will be introduced and some key issues will be discussed based on the results obtained from simulations: 1) a simulation technique for earthquake-induced landslide using DDA; 2) a simulation technique for rainfall-induced landslide using DDA based on matric suction; 3) a simulation technique for soil-rock slope and structure using DDA coupled with SPH of soil particles; 4) a simulation technique for debris flow with large rock and wood using DDA coupled with general debris flow simulation (DFS); 5) a simulation technique for landslide-dam formation and collapse using DDA coupled with SPH of water particles.

Fluid-rock interactions in geothermal reservoirs and implications for carbon storage

Global warming is one of the biggest challenges humankind is currently facing. To mitigate the increasing levels of greenhouse gases in the atmosphere, caused by fossil fuel burning and deforestation, the world is transitioning towards greater use of renewable energy sources. Simultaneously, during this transition, the carbon dioxide emissions need to be abated, and hence, significant efforts are needed in carbon capture, utilization and storage (CCUS). Previous research and pilot plants have demonstrated the success and efficiency of geological carbon storage in basalt reservoir rocks. In this study, we investigate the potential of andesite geothermal reservoir rocks for geological carbon storage. The methodology involves mineralogical and chemical characterization of geothermal reservoir samples, and batch reactor experiments to determine the type of fluid-rock interactions and the rate of these geochemical reactions. The results show that andesite rocks are likely to support relatively rapid carbon storage via mineral trapping under conditions relevant for carbon dioxide injection. Moreover, the effect of salinity in the fluids on feldspar dissolution is very small, and thus, the study suggests that saline fluids could be used for CO_2 injection. Long term effects of the geochemical dissolution and precipitation reactions, and consequent changes in permeability, triggered by CO_2 injection in andesitic geothermal reservoir rocks still need to be further explored.