Mechanics in Energy Resources Engineering - Introduction (3 March, week 1)

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Introduction

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- This lecture will be given in English. Why???
  - Lecture: English (80%) + Korean (20%)
  - All the questions in the assignment and exams are in English.
  - Students' questions: Korean or English
  - Assignment submission: Korean or English
  - Useful mathematical expressions in English available at eTL

Introduction
Today's Content

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- Today, we will cover
  - Introduction to the course

Introduction
Schedules, Room and Instructors

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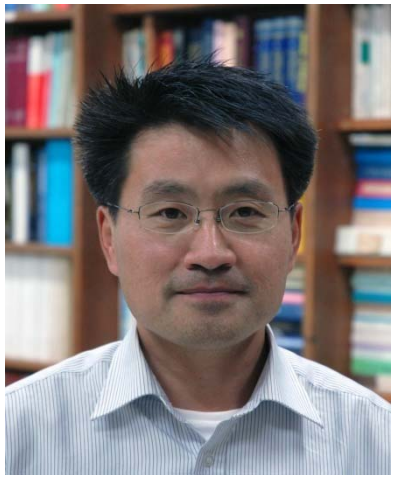
- Lectures (3 credits)
  - Mon & Wed: 9:30 – 10:45
- Lecture Room: 38-433
- Instructor and Teaching Assistant
  - Ki-Bok Min, Room:38-108, kbmin@snu.ac.kr
  - Jae Won Lee, Room:38-125, sodg3135@snu.ac.kr



Introduction
Content of this course

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- This course mainly deals with ‘mechanics of materials’
  - ‘Mechanics of materials’ is a branch of applied mechanics that deals with the behavior of solid bodies subjected to various types of loading
  - Also known as ‘strength of materials’, and ‘mechanics of deformable bodies’.
  - The most important material that is relevant to energy resources engineering is ‘rock’
- Objective
  - Determine the stresses, strains, and displacements in structures due to the loads acting on them

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CCS

(Carbon Capture and Storage)

이산화탄소 포집 및 저장

Underground storage of CO2 is one of the most promising option

Technologies for CO2 storage

In Salah Gas project, Algeria –BP, StatoilHydro, Sonatrach

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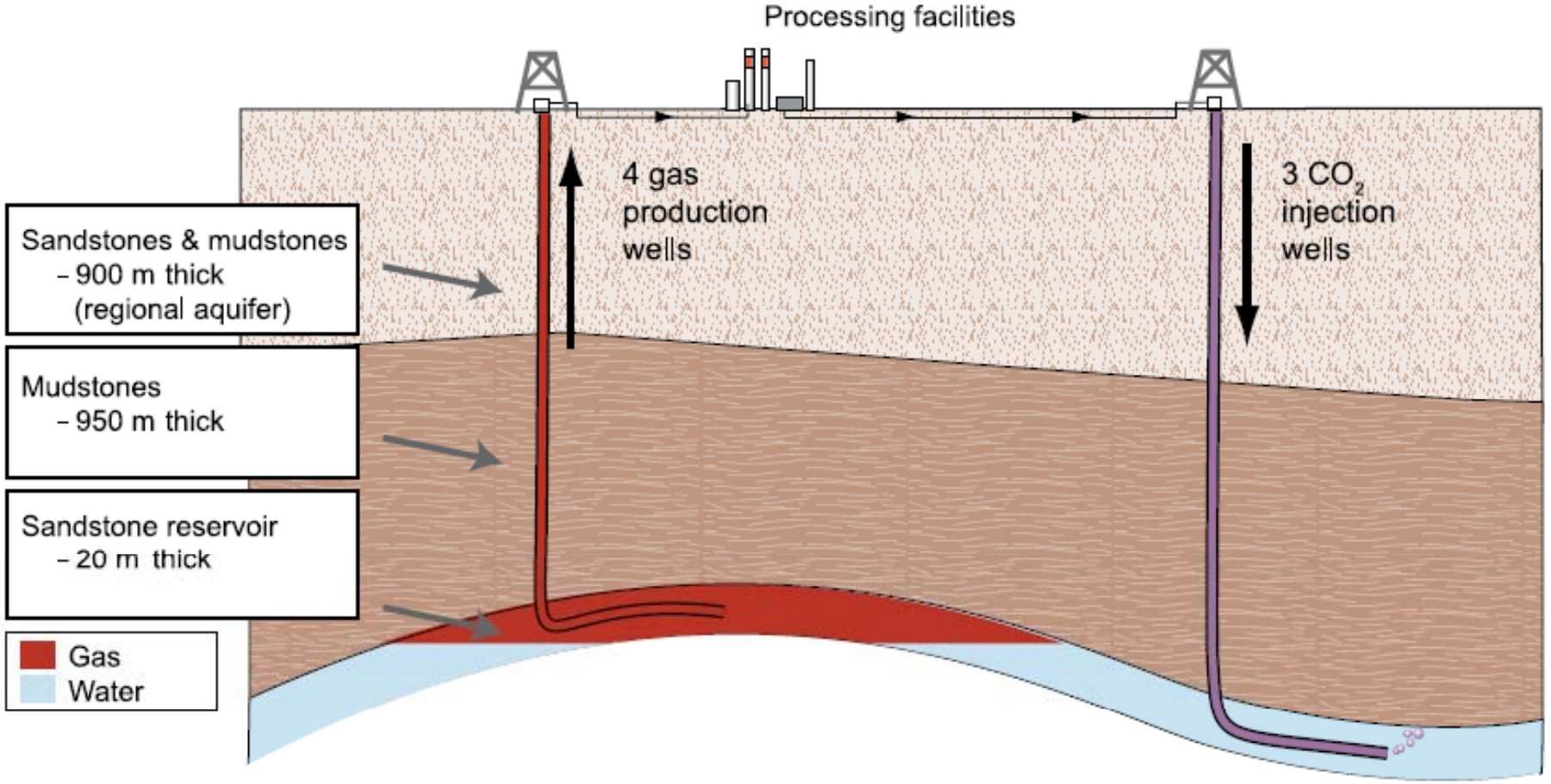

Figure 5.5 Schematic of the In Salah Gas Project, Al
wells with slotted intervals of up to 1.5 km are used to

Started 2004, first depleted gas reservoir Sandstone

1 Mt /year → 17 Mt in total, 3 injections wells

Technologies for CO2 Storage

Monitoring and verification technology – Example at In Salah Gas Project

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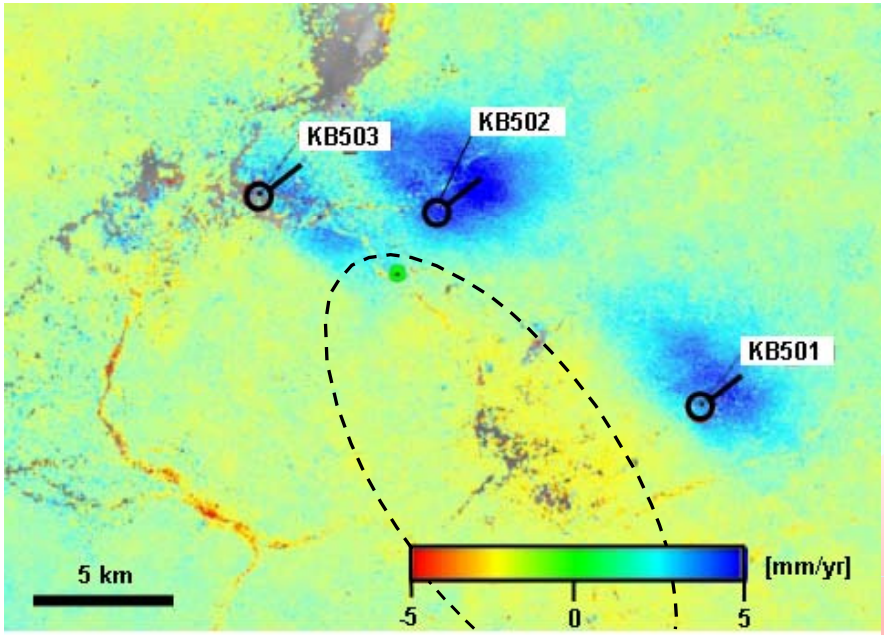
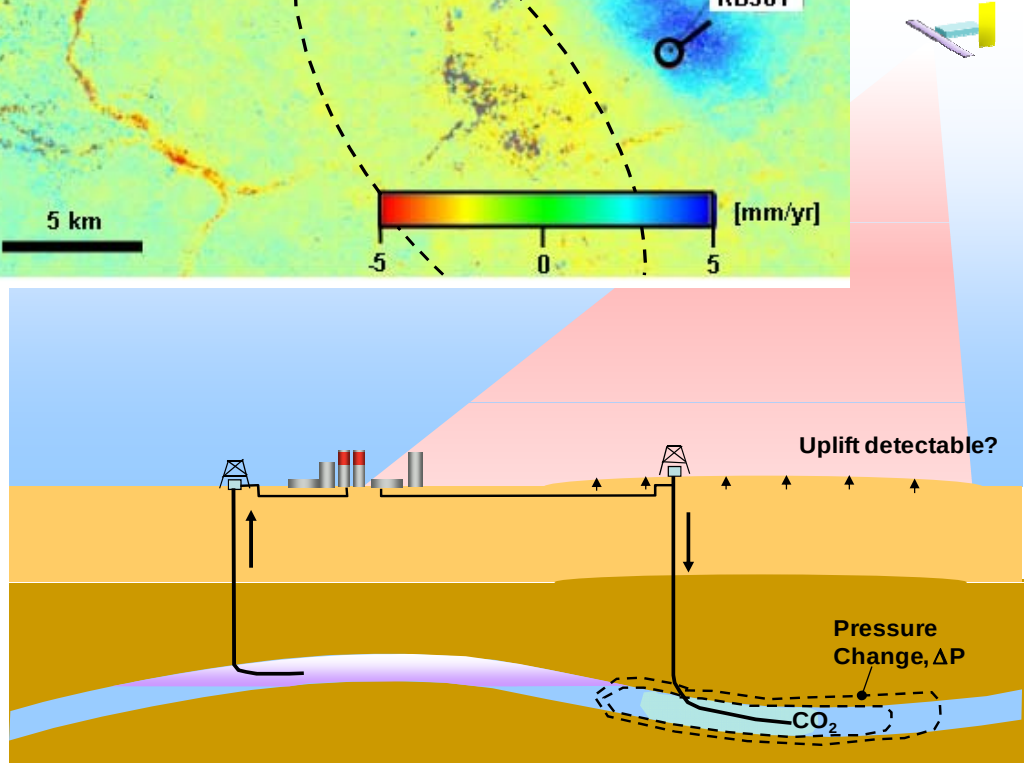
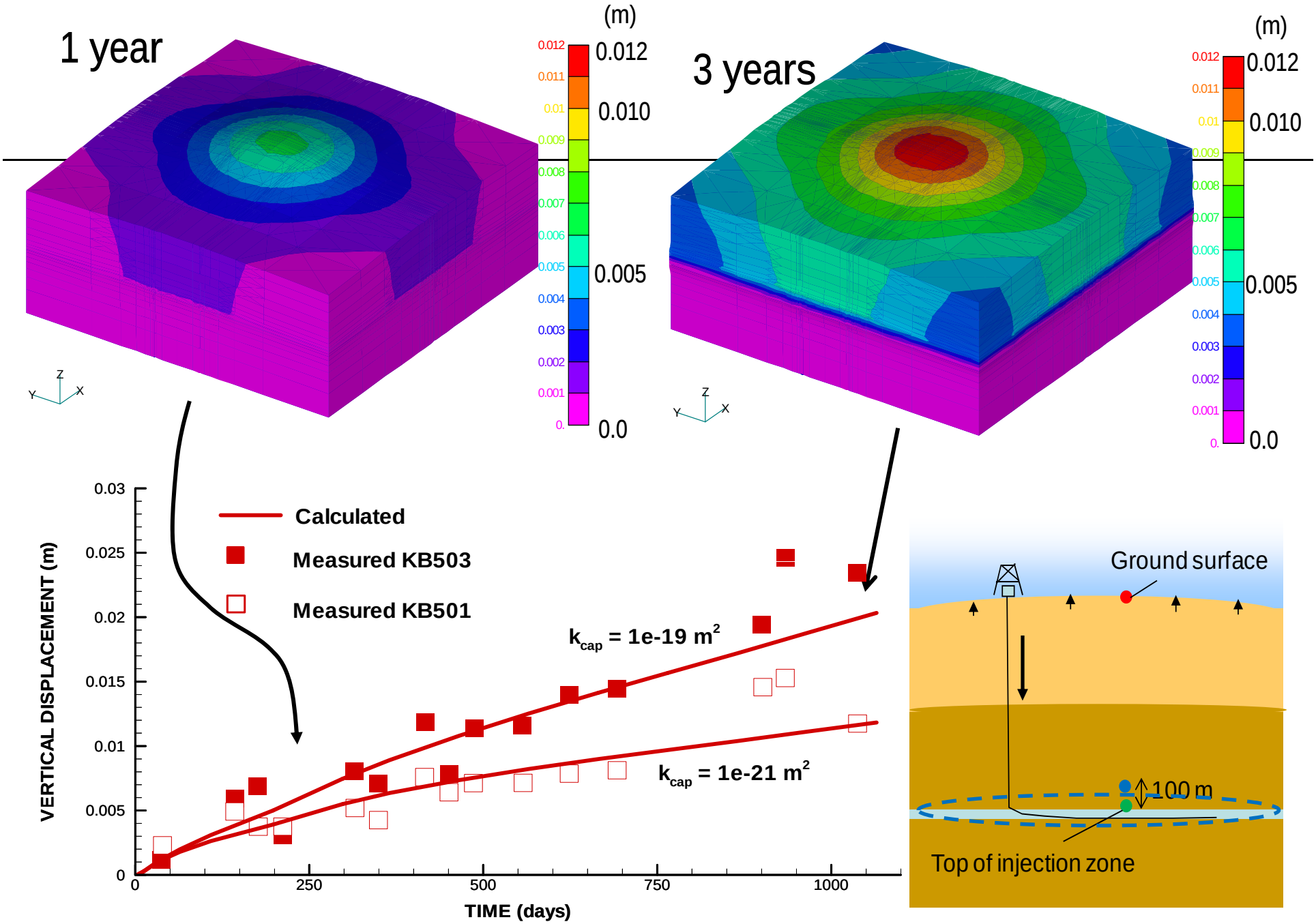




- 5 mm yearly uplift above injection wells
- Settlement above the depleting gas field

* Rutqvist et al., 2009, Coupled reservoir-geomechanical analysis of CO_2 injection and ground deformations at In Salah, Algeria, *Int J Green House Gas Control*, In press

SIMULATION RESULTS FOR BASE CASE PROPERTIES



Examples
Underground space

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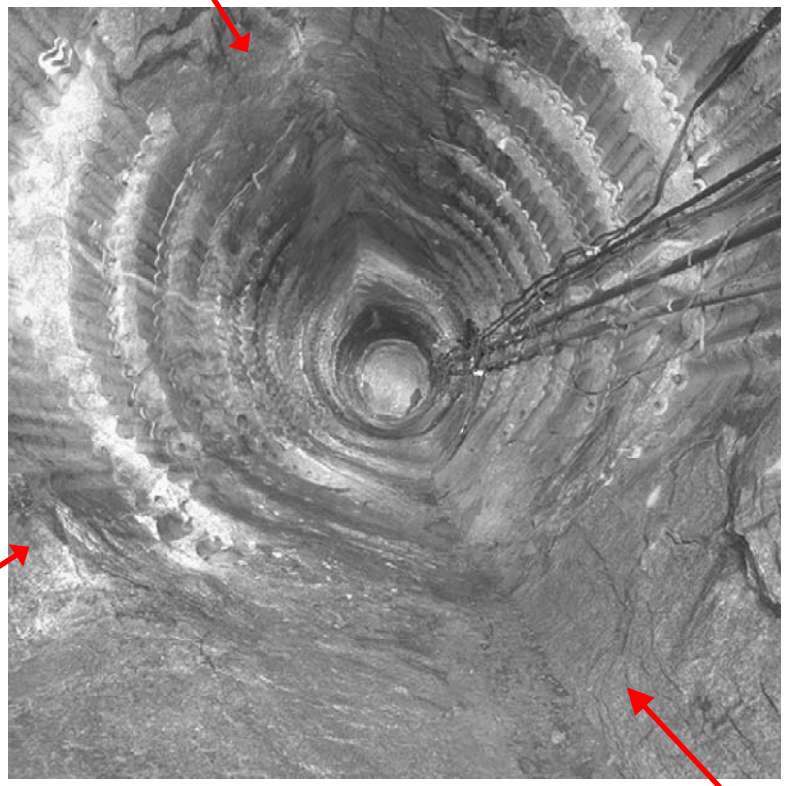

V notched failure induced by high in situ stress, ~400 m deep, Winnipeg, Canada (Chandler, 2004)

Examples
Underground Mine

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- Hendersen Mine, Colorado, USA (Molybdenum)

Deflected steel beam

Examples
Underground repository for nuclear waste

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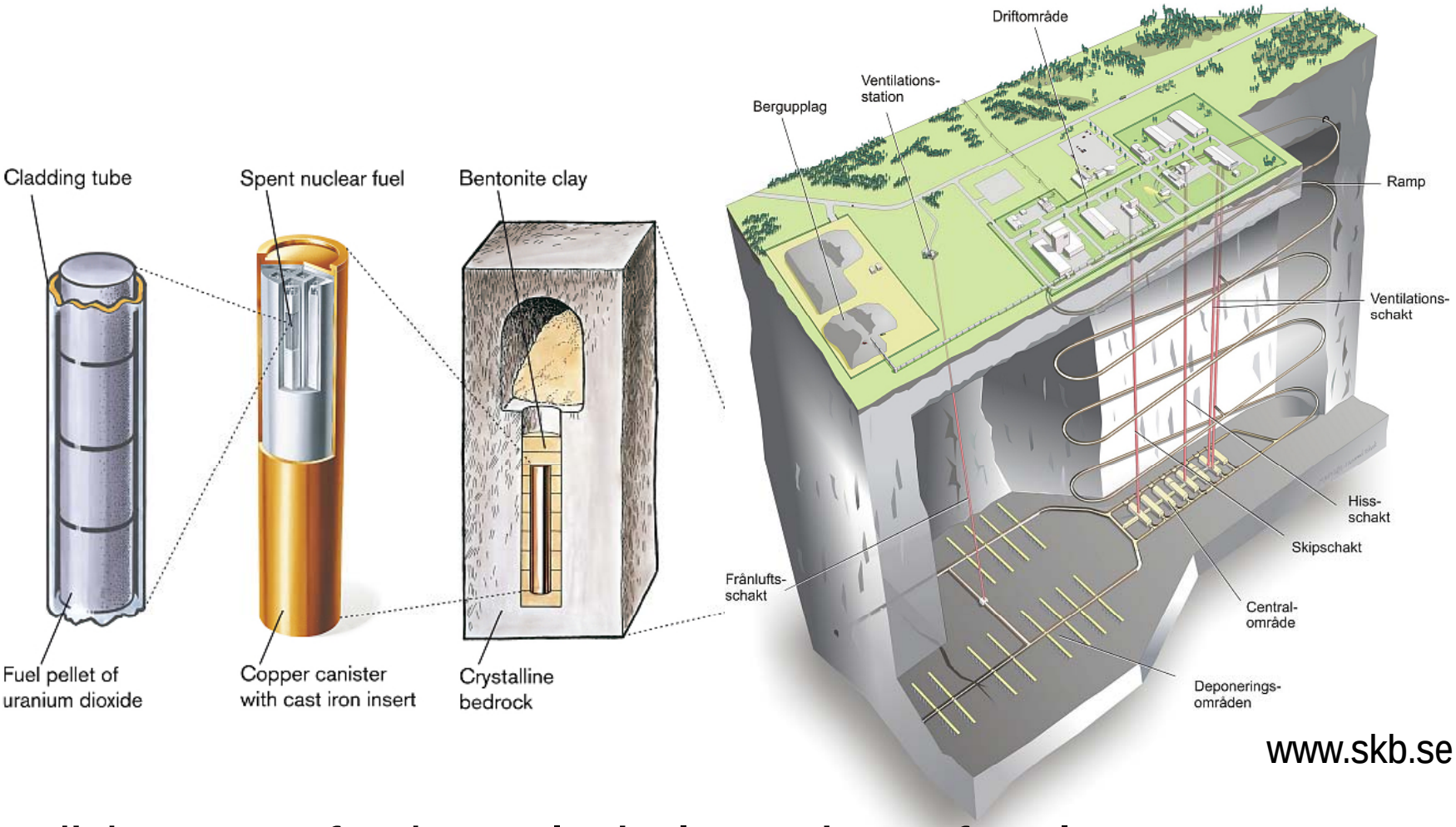

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Swedish concept for the geological repository of nuclear waste

Examples
Geothermal Energy

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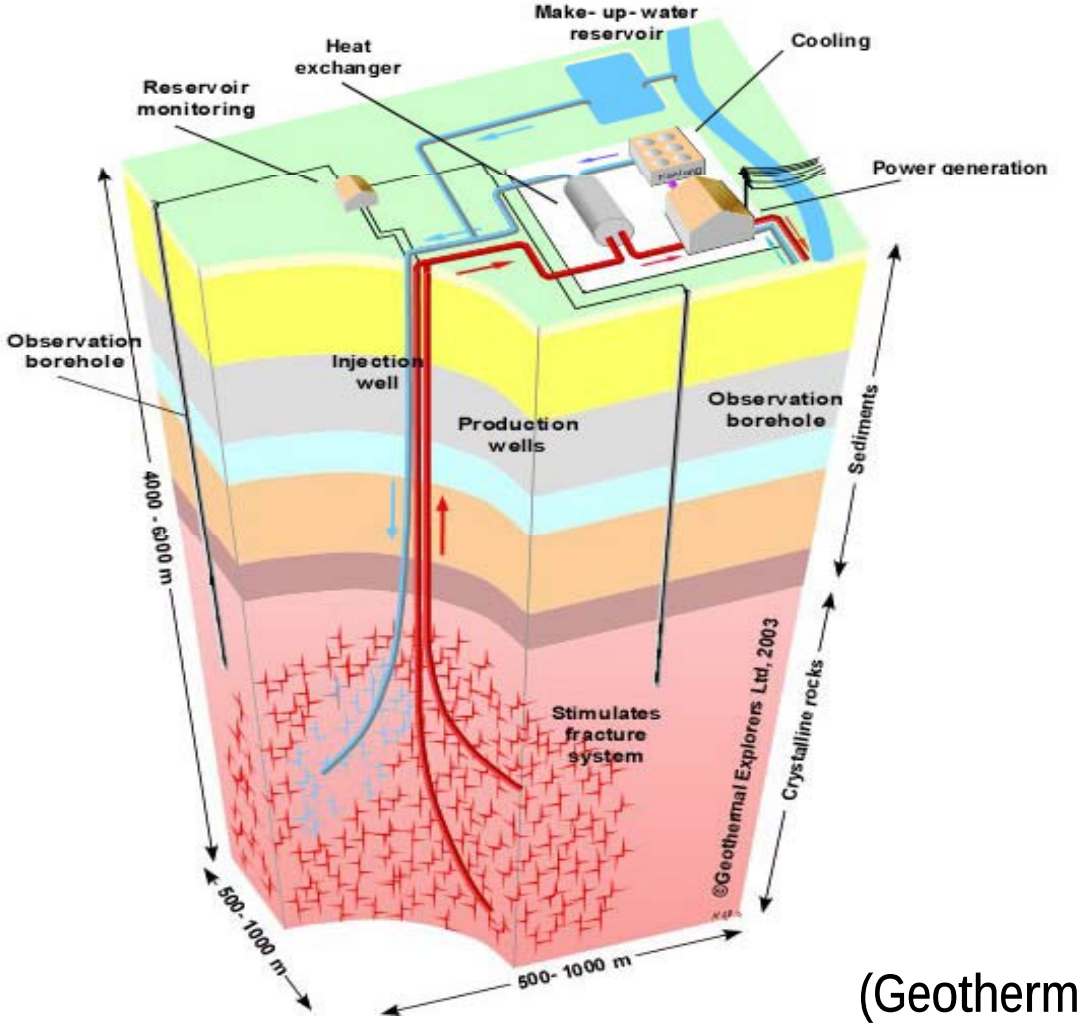

(Geothermal Explorer, 2010)

Introduction
Contents of the course

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- Week 1: Introduction to the course/Ch.1 Tension, Compression and Shear
- Week 2: Ch.1 Tension, Compression and Shear
- Week 3: Ch.2 Axially Loaded Members
- Week 4: Ch.2 Axially Loaded Members
  Ch.3 Torsion
- Week 5: Ch.3 Torsion
  1st Exam (31 March)
- Week 6: Ch.4 Shear Forces and Bending Moments
- Week 7: Ch.4 Shear Forces and Bending Moments
  Ch.5 Stresses in beams.

Introduction
Contents of the course

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- Week 8: Ch.12 Review of Centroids and Moments of Inertia
  Ch.5 Stresses in beams
- Week 9: Ch.5 Stresses in beams/ 2nd Exam (28 April)
- Week 10: Ch.7 Analysis of Stress and Strain
- Week 11: Ch.7 Analysis of Stress and Strain
- Week 12: Ch.8 Application of Plane Stress
- Week 13: Ch.9 Deflection of Beams
- Week 14: Ch.9 Deflection of Beams
  Ch.10 Statically Indeterminate Beams
- Week 15: Ch.10 Statically Indeterminate Beams
  Final Exam (9 June)

Introduction
Textbooks

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- Textbooks
  - Gere JM, Goodno BJ, 2009, Mechanics of Materials, SI Edition, 7th Ed, Cengage Learning, 1002p ← available at SNU bookstore
- References
  - Riley W et al., 2007, Mechanics of Materials, 6th Ed, Wiley, 658p

Introduction
Assessment and Assistance

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- Assessment
  - Assignment : 20 %, around 10 sets
  - 1st/2nd/Final exam : 20% / 20% / 30 %
  - Participation : 10 % (attendance + eTL discussion + α)
- Assistance
  - Q & A at eTL: 24 hours throughout the course
  - Q & A sessions: Before each exam/ as needed
  - You are also welcome to visit my or TA's office (prior appointment via email recommended)

Assignment

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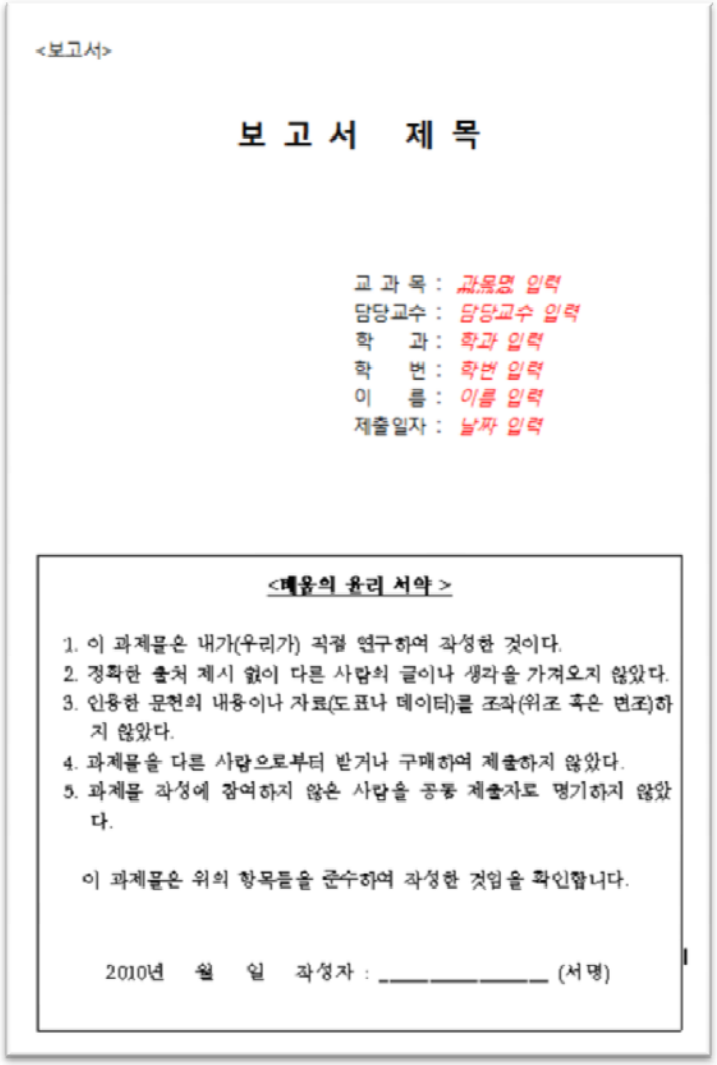
- Late submission (maximum two days) will be penalized at a rate of 20%.
- You must use the cover sheet (statement of originality) declaring that the report is your own original work – sheet is available at eTL
- You also need to acknowledge all sources of information, data, illustrations and copyrighted material contained within the report



<보고서>

보 고 서 제 목

교 과 목 : *교과목명 입력*
담당교수 : *담당교수 입력*
학 과 : *학과 입력*
학 번 : *학번 입력*
이 름 : *이름 입력*
제출일자 : *날짜 입력*

<내용의 윤리 서약 >

1. 이 과제물은 내가(우리가) 직접 연구하여 작성한 것이다.
2. 정확한 출처 제시 없이 다른 사람의 글이나 생각을 가져오지 않았다.
3. 인용한 문헌의 내용이나 자료(도표나 데이터)를 조작(위조 혹은 변조)하지 않았다.
4. 과제물을 다른 사람으로부터 받거나 구매하여 제출하지 않았다.
5. 과제물 작성에 참여하지 않은 사람을 공동 제출자로 명기하지 않았다.

이 과제물은 위의 항목들을 준수하여 작성한 것임을 확인합니다.

2010년 월 일 작성자 : _____ (서명)

Introduction
What I expect from you

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- **Attend** classes & **Be attentive**
- **Keep up** with the lecture material (read the related material *before the lecture* and try to ask fundamental questions).
- **Ask questions** (to your peers or me) if you do not understand what is being taught.
- **Do not plagiarise.** Cheating is not tolerated and cheats will be punished.

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Introduction
eTL

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- All the teaching materials will be available at eTL
- Please register your picture, mobile phone number and email address at eTL
- You are encouraged to engage in Q&A at eTL – bonus points will be awarded after 1st, 2nd and the final exams.