

Unit Guide

Petroleum Geoscience

SCE-2-345

Engineering, Science and the Built Environment

2007/8

become what you want to be

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1.0 UNIT DETAILS

| Unit Title: | Petroleum Geoscience |
|---------------------------------------|---|
| Unit Level: | 2 |
| Unit Reference Number: | SCE-2-345 |
| Credit Value: | 15 |
| Student Study Hours: | 150 |
| Contact Hours: | 36 |
| Private Study Hours: | 124 |
| Pre-requisite Learning: | None |
| Co-requisite Units: | Fundamentals of Petroleum Engineering |
| Co-requisite Course(s): | None |
| Year and Semester | Y2 S2 |
| Unit Coordinator: | John Orrin |
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| Subject Area: | Petroleum Engineering |
| Summary of Assessment Method: | 50% Coursework; 50% Examination |

2.0 SHORT DESCRIPTION

This unit will provide 2nd year undergraduate students of Petroleum Engineering with a basic understanding of Petroleum Geoscience. It will provide grounding in the disciplines which may be pursued in more detail at Masters level for a career in the Petroleum Geosciences.

3.0 AIMS OF THE UNIT

- To develop an understanding of the role of geoscience in the oil and gas industry and of basic rock types and their formation and to identify rocks associated with hydrocarbon accumulations.

- To introduce the role of seismology and well logs in delineating subsurface structures -To convey the importance of well control and the part geoscience can play to ensure operational safety.

4.0 LEARNING OUTCOMES

4.1 KNOWLEDGE AND UNDERSTANDING

On completion of the Unit, the student should be able to:

- Understand basic rock types and their formation
- Identify source, reservoir and cap rocks associated with hydrocarbon accumulations
- Interpret simple geological and seismic maps and sections
- Appreciate the role of seismology and well logs in delineating subsurface structures
- Undertake simple calculations, e.g. to estimate size and reserves of an oil field
- Integrate and synthesise data from a variety of sources (including wireline logs and core analysis results), to interpret subsurface lithology and fluid types
- Understand the importance of well control and blowout prevention

4.2 INTELLECTUAL SKILLS

Develop a critical analysis of the field of study and an understanding of how to apply basic principles in a wider context.

4.3 PRACTICAL SKILLS

Develop an awareness of reliable sources of geological information available online through the use of the Blackboard Virtual Learning Environment set up for the Unit.

Develop an understanding of the use of simple tools and equipment used by geoscientists.

4.4 TRANSFERABLE SKILLS

General and engineering skills are exercised to varying extents in this unit:

General

- Working as part of a team and developing interpersonal skills
- Time management and organisation; self-management.
- Information retrieval skills (via Blackboard)

Engineering

- Use of a technical logbook to record findings from field or other practical work
- Handling and presentation of data

5.0 INTRODUCTION TO STUDYING THE UNIT 5.1 OVERVIEW OF THE MAIN CONTENT

Week 1: Introduction to the Geosciences

The geological disciplines, seismology and geophysics; gravity and magnetics; role of the operations geologist; the concept of the value chain

Blackboard website introduction, including ESCC Earth Science Courseware

Week 2: The Earth's Surface

Nature and properties of rocks and minerals; The Earth's crust; Plate tectonics

Week3: Geological History

Stratigraphy and the stratigraphic column; geological time scale Rocks & minerals practical

Week 4: Geological Processes

Weathering, sedimentation, diagenesis, lithification, deformation, catastrophism volcanoes and earthquakes

Week 5: Sedimentology

Sedimentology of petroleum-bearing sequences Geological maps practical

Week 6: Structural Geology

Folds, faults, intrusions, unconformities

Week 7: The Life Cycle of Hydrocarbons

Petroleum generation, migration, entrapment and degradation; stratigraphic traps formation fluids: Brine, oil, gas

Visit to the Earth Lab, Natural History Museum (subject to availability) with practical

Easter Break......

Week 8: Reflection seismology

Acquisition, processing, 3D surveys, interpretation, velocity surveys, depth conversion, contouring

Week 9: Field Study (April 17/18)

Structure and properties of source and reservoir rocks of the Dorset coast including those of the Wytch Farm Field; reservoir homogeneity; an overview of the Wytch Farm Field

Week 10: Petrophysics

Coring and core analysis; log analysis; Electrical, nuclear and sonic logs; Estimation of porosity, lithology, saturation and permeability; formation evaluation practices and pitfalls.

Week 11: Reservoir delineation; Well stability basics and blowout prevention

Thickness, extent, homogeneity, gross and net pay; HIP (Hydrocarbons in Place), STOIIP (Stock Tank Oil in Place) and GIP (Gas in Place) calculations; introduction to reservoir simulation

Precautions, site surveys, pressure balance, gas kicks and detection with case studies

Week 12: Presentations and Case Studies

Team assessed coursework PowerPoint presentations Typical oil and gas fields of the Middle East, Africa and the North Sea; E&P challenges.

5.2 OVERVIEW OF TYPES OF CLASSES

36 hours of lectures and supporting tutorials, which may be delivered or supported by the Blackboard virtual learning environment. These will be complemented by four 3-hr practical lab sessions and an overnight excursion (extra fee applicable) to become familiar with field geology, rocks in situ and geological maps.

5.3 IMPORTANCE OF STUDENT SELF-MANAGED LEARNING TIME

The resources placed on or linked to the Unit Blackboard site should be studied during the self managed learning time, as well as designated sections of the core texts. Formative assessment quizzes placed on Blackboard should also be taken during this time. It is the student's responsibility to ensure that they obtain access to the LSBU network in order to use e-learning resources such as Blackboard, and that core texts are purchased.

6.0 THE PROGRAMME OF TEACHING, LEARNING AND ASSESSMENT

Lectures will generally be held on Monday mornings between 9am to noon in E259 and practical sessions, will be held on alternate Monday afternoons between 2-4pm generally in

J212. Computer lab E250 may be used occasionally for Blackboard VLE activities. See the ESBE online timetable and the Unit Blackboard site for any variations.

7.0 ASSESMENT OF THE UNIT

Coursework (50%): progressive assessment including assignments via Blackboard. Examination (50%): 2-hour end of unit examination.

In addition to marked assignments, formative assessment through quizzes and activities using the Blackboard VLE and the core text will be conducted to ensure an understanding of the subject. Usage of Unit Blackboard resources will be tracked and participants are advised to visit the Blackboard site regularly for Unit announcements and activities.

8.0 LEARNING RESOURCES 8.1 CORE MATERIALS

- Gluyas, M and Richard Swarbrick, *Petroleum Geoscience*, Blackwell Science (UK) 2003; ISBN: 0632037679

(See <u>http://www.amazon.co.uk/exec/obidos/ASIN/0632037679/203-8205581-5787127#product-details</u>) or purchase via Blackwells, London Road where copies have been requested.

8.2 OPTIONAL MATERIALS

- Bacon, M and R. Simm, T. Redshaw, *3D Seismic Interpretation*, Cambridge University Press; ISBN: 0521792037

- Bennson, G. and Keith Moseley, *An Introduction to Geological Structures and Maps,* Hodder Arnold; ISBN: 0340809566

- Edgell, S.E., Significance of Reef Limestones as oil and gas reservoirs of the Middle East and North Africa

- http://perso.wanadoo.fr/brcgranier/gmeop/Edgell_2001.htm

- Hallenberg, J., An introduction to Geophysical Formation Evaluation, CRC Press 1998; ISBN: 1566702631

- Kearey, P., *The New Penguin Dictionary of Geology*, Penguin Books; ISBN: 0140514945

- Lisle, R.J., *Geological structures and Maps*, Pergamon Press, 1990 or Butterworth-Heinemann 2003; ISBN: 0750657804

- Selley, R.C, *Elements of Petroleum Geology,* Second Edition 1998, Academic Press, ISBN 0126363706

NOTES

An overnight field trip to Dorset is planned for **April 17/18 2008**, in S2 Week 9 (Week 30 of the University session calendar). Details will be posted on the Unit Blackboard website. A student contribution of £175 is levied towards the cost of coach travel, main meals and accommodation and this cost added to the fees invoice.

The Blackboard Virtual Learning Environment is an integral part of this Unit's delivery. Exercises, quizzes and assessments will feature on Blackboard as well as links to many other resources and materials to supplement lectures. All content will be tracked using the automatic facilities of Blackboard to establish usage. It is essential, therefore, that familiarity with Blackboard is established early, using the resources in the LRC or in computer lab sessions within the Unit programme.

Much of the published literature in Petroleum Geoscience is pitched at Masters level. The purpose of this undergraduate Unit is to introduce Petroleum Engineers to the fundamentals of geoscience and the lecture programme will indicate the level of detail required, involving a minimum level of mathematics and use of specialised resources.

5/16/2008