

60381 - Subsurface geology

Syllabus Information

Academic year: 2024/25

Subject: 60381 - Subsurface geology

Faculty / School: 100 - Facultad de Ciencias

Degree: 624 - Master's in Geology: Techniques and Applications

ECTS: 6.0

Year: 1

Semester: Second semester

Subject type: Optional

Module:

1. General information

The objectives of this subject are:

To acquire a precise vision of the subsurface exploration methods and the usefulness of each method, in order to select the most appropriate techniques for each case.

To acquire the necessary skills for the handling of geophysical prospecting equipment and for the processing of the data and the interpretation of the results obtained in each type of prospection.

To be able to integrate the results of different methods and produce simple 3D models of the subsurface.

2. Learning results

Upon completion of the subject, the student will be able to:

- Work autonomously with gravimetric and magnetic anomaly maps of specific areas and interpret them in geological terms.
- Apply inverse modelling algorithms and interpret small and large scale gravimetric and magnetic anomalies.
- Handle the equipment normally used in gravimetric, magnetic, electrical, electromagnetic (GPR) and hammer seismic surveys in an autonomous manner.
- Interpret well logs and apply them to seismic prospecting.
- Fluently interpret seismic reflection profiles in geological terms and apply them to the geological knowledge of a region, combining them with magnetometry and gravimetry.
- Know the basics and fundamentals of 3D reconstruction.
- Interpret refraction seismic profiles and apply them to the interpretation of the subsurface structure.
- Interpret electrical and electromagnetic survey profiles and apply them to the interpretation of subsurface structure.

3. Syllabus

1. Subsurface exploration methods: geological, geophysical, mechanical. Types of representations and maps.
2. Gravimetric prospecting. Measurement of gravity. Corrections. Calculation of gravimetric anomalies. Reverse modelling. Applications.
3. Magnetic prospecting and data processing. Interpretation of magnetic anomalies. Inverse modelling. Applications.
4. Seismic prospecting. Refraction seismic. Methodology for the conducting and interpretation of refraction profiles.
5. Reflection seismic. Data processing. Reflection profiles. Structural and stratigraphic interpretation of seismic profiles.
6. Borehole geophysics. Well logs.
7. Electrical prospecting. Electromagnetic prospecting. Magnetotelluric method. GPR.
8. Methodology and software for 3D reconstruction and restitution.

Practical sessions:

1. Construction of subsurface geological cross-sections and maps from boreholes.
2. Gravimetric corrections, from real case data (Excel).
3. Working with anomaly maps, based on data from a real case (Surfer).
4. Gravimetric and magnetic inverse modelling (Gravmag32).
5. Interpretation and modelling of refraction seismic (REFRACT).
6. Interpretation of reflection seismic profiles.

7. Interpretation of well logs and their application in reflection seismic profiles.
8. Interpretation and modelling of electrical survey profiles (RESIST).
9. Geophysical prospecting (gravimetric, magnetic, electromagnetic-GPR, electrical and refraction seismic) in an area near Zaragoza.
- 10 and 11. Processing and interpretation of survey data (GemLink, Excel, GravMaster).
12. Integrated example; interpretation of the subsurface geology of an area from gravimetric, magnetic, refraction seismic, reflection seismic and log data.
- 13 and 14. 3D model elaboration from real subsurface data.

4. Academic activities

This subject consists of 60 hours of classroom activities, organized into theoretical and practical sessions, field work and guided work. Students will have notes as a basis for learning, and will have to complete the information received in the classroom by consulting technical books and scientific articles.

The material necessary for the development of the classes will be available via Moodle.

The program offered to the student comprises the following activities:

- 1- Lectures (12h)
- 2- Practical sessions (12h)
- 3- Laboratory and computer practices (24h)
- 4- Works and Seminars (4h)
- 5- Geophysical field prospecting (8h)

5. Assessment system

Continuous assessment:

1. Solving of 2 questionnaires, each one grouping half of the topics **(30%)**. The assessment criteria are: mastery of content, use of terminology, accuracy of concepts, reasoning of arguments.

2- Delivery, at the end of each block, of the practices conducted in the classroom weekly (45%).

3- Survey report (25%). The assessment criteria are: data processing, interpretation of results, integration of results from different methods, use of terminology, reasoning of arguments.

Global assessment:

For those students who do not opt for continuous assessment or have not passed it, there will be a theoretical-practical exam that will account for 100% of the grade.

6. Sustainable Development Goals

11 - Sustainable Cities and Communities