Universidad Zaragoza

Year : 2019/20

26416 - Geological Mapping

Syllabus Information

Academic Year: 2019/20
Subject: 26416 - Geological Mapping
Faculty / School: 100 -

Degree: 296 - Degree in Geology
588 - Degree in Geology

ECTS: 9.0
Year: 588 - Degree in Geology: 3
296 - Degree in Geology: 3

Semester: First semester
Subject Type: Compulsory
Module: ---

1.General information

1.1.Aims of the course

The expected results of the course respond to the following general aims

1. To make accurate and precise geological maps.

2. To interpret geological maps.

3. To introduce and apply the photogeological mapping technique.

4. To introduce and apply the orthographic projection in geological mapping.

5. To understand in the field the basic techniques in geological mapping and to develop skills for data acquisition.

1.2.Context and importance of this course in the degree

This course is part of a group of subjects of the *Degree in Geology* that constitute the basic training in Geology.

1.3.Recommendations to take this course

Geological Mapping represents a basic topic of the field Geology. This subject includes learning on basic geometry of geological bodies (sedimentary or igneous rocks) and geological structures, so it is recommended to know other subjects as Stratigraphy, Structural Geology, Petrology or Geomorphology. The geological mapping is a useful tool for analysing most aspects of Geology and it needs of the development of determined observation skills in the field and the representation of such observations on a map. Other needed skills are the elaboration of geological cross-sections or block-diagrams as additional tools for map interpretation. It is recommended: (i) to attend every theoretical and practical session and to take an active participation in them; (ii) to have passed a previous, basic course on Structural Geology and Stratigraphy; (iii) knowledge of basic Spanish and English.

It is strongly recommended to study this subject before any other whose contents require the use of geological maps.

2.Learning goals

2.1.Competences

1) Acquisition of field data for geological mapping.

2) To use the more adequate laboratory techniques for geological mapping.

3) To interpret geological maps.

4) To do thematic maps and cross-sections.

5) To solve geological questions by using the ortographic projection.

2.2.Learning goals

The student, in order to pass the course, will have to show her/his competence in the following skills:

1. From a geological map: a) identify the main type of stratigraphyc contacts and tectonic structures, b) make geological cross-section and sketches reflecting the geometry of geological structures and their relationships and d) deduce the geological history for the region.

2. From field observations, identify each body rock and contact type (stratigraphic, tectonic, magmatic,...) and the tectonic structures and represent them on a topographyc map.

3. To use the photogeological analysis as a mapping technique.

4. To know and apply the fundamentals of geometrycal analysis for solving problems of geological mapping.

5. To use the compass for measuring the orientation of geological contacts and structures.

6. To make and interpret geological maps.

7. To develop capabilities for scientific work: to select and process critically bibliographic information in Spanish and English; to communicate efficiently scientific contents, both oral and written (in Spanish and, at a basic level, in English); to work alone and within a group.

2.3.Importance of learning goals

Geological mapping, understood as "a set of techniques that are used for the realization of geological maps", is the fundamental tool on which any geological work is based. A correct geological mapping depends not only on the correct interpretation of the geological history of the region represented, but also on the proper use of the geological heritage, which includes both material resources (rocks, minerals and fossils) and landscape (Geological Interest Sites or Areas, Points of Geological Observation,), all of them recognized figures within the National Geological Patrimony.

From a technological point of view, some specific applications of Geological mapping include: 1) Exploration and exploitation of energy and mineral deposits (coal, oil, gas), 2) Location of sites of paleontological interest, 3) Assessment of water resources through flow modeling and heat transport from surface and subsoil data, 4) Seismic hazard estimation through mapping of focal mechanisms in active faults, 5) Evaluation of natural hazards such as slope landslides or karst collapses (risk maps) or 5) Thematic inventories of Geological Interest Sites.

3.Assessment (1st and 2nd call)

3.1.Assessment tasks (description of tasks, marking system and assessment criteria)

General design of evaluation activities

Practical field activities in Geology and, above all, in the subject of Geological Mapping are of special relevance since it is where the student acquires and develops a great part of his / her abilities of observation, recognition and presentation of the results of this work on a Map. In this subject, an important part of the the work is focused on the preparation of a geological mapping report of a field area that will represent 60% of the note in the scale of Evaluation (see evaluation criteria).

There are two modalities of evaluation of the subject Geological Mapping. The first one related to its on-site development (**Continuous Assessment**) and another (under the Regulation of Learning Assessment Standards, agreed on December 22, 2010 by the Governing Council of the University of Zaragoza, Art. 9.1) for cases In which it is not attended in person, by means of the realization of a **Global Assessment Test**, which includes all the theoretical-practical activities contained in this subject.

Assessment activities

Modality A: Continuous assessment

In the normal development of the subject (for First and Second call), i.e. carried out in person by the student during the course, the continuous assessment activities include:

1) **Reports of practices**. Seven practices of the 12 carried out during the semester will be selected for their qualification (20% of the final grade for the subject). This section does not include those practices designed to prepare the Field Zone report. Likewise, this section includes the completion of an interior cartography practice. Results of all learning activities are evaluated. The final grade of this section will be the arithmetic mean of the grades of the selected practices. Learning outcomes of all activities (1 to 6) are evaluated.

2) **Field Zone**. In this section, the work carried out by the student will be evaluated over 6 field days and the cabinet practices aimed at preparing the geological mapping report of a Field Zone (60% of the final grade for the subject). Within this section the activities, of a strictly individual nature, to be evaluated will include: 1) **the acquisition of data** (15% of the final grade of the subject), reflected in the field notebook of the subject (the notebook will be collected during the return of each of the last five days of field) and 2) **the preparation of a written report** (45% of the final grade of the subject), with a set of predetermined sections in advance, in which all obtained results are contained. The final grade of this section will be the sum of these partial grades. This evaluation activity includes a **preliminary exercise of taking data** of orientation of planes and lines with the geological compass for its later stereographic representation. Failure to overcome this practice will involve the realization of practical work (to be determined) aimed at learning skills in the field data collection. Learning outcomes of all learning activities are evaluated (1 to 6).

3) **Written partial tests**. It will consist of three parts that will be done throughout the period of delivery of the subject. **Part 1**: brief theoretical-practical issues on aspects of bounded planes, addressed in the course's practical program of the subject. **Part 2**: photogeological interpretation of a region and transfer of the information to the topographic map. **Part 3**: reading and interpretation of a geological map of the MAGNA series and realization of a geological section. The maximum joint duration of the tests will be 6 hours. Each part is evaluated from 0 to 10. The final grade in this section will be the sum of the grades obtained in the different parts. This test evaluates learning outcomes 1, 2, 3, 4 and 6.

All activities are evaluated from 0 to 10 points.

Modality B. Global test of evaluation

Modality of evaluation for the students who did no attend the subject, or students who, still being it done, wish to take refuge in their right to a global evaluation (for First and Second Summons). In both calls, the following tests:

1) A **written test** similar to that of activity 3 of the Continuous Assessment Mode.

2) A **practical test** that will include exercises in learning activities 2, 4 and 6.

3) An **additional test**, which will consist of two parts: a) a field exam (1 day) in which the student will carry out a mapping of an indicated area and b) a cabinet exam (one morning or afternoon) in which The student will complete the cartography, make a geological cut and make the proper descriptions and interpretations of the field area studied. This second test includes the evaluation of field practices.

Final Assessment Scale

Modality A: Continuous assessment

The final evaluation is made taking into account the following scale that indicates the relative proportion of the different evaluation activities in the total score:

1) Cabinet practices: 20% of the final grade of the subject (factor 0.2).
2) Field Zone: 60% of the final grade of the subject (factor 0.6). Broken down in:
    2.1) 15% corresponding to the data acquisition section (factor 0.15)
    2.2) 45% to the memory of the field area (factor 0.45).
3) Partial / final written tests: 20% of the final grade of the subject (factor 0.2).

In practice it means multiplying the grade obtained in each assessment activity by the indicated factor and adding the results to obtain the total score of the continuous assessment.

In order to pass the course through the **Continuous Assessment mode**, each of the activities 1, 2, and 3 must be independently completed and with a grade of 5 (or higher).

Those parts (assessment activities 1, 2 and 3) that have not been passed in the continuous assessment, especially those related to activity 3, may be recovered during the final exam period (Final evaluation test) established by the Faculty of Sciences (published on its website) for the first and second call. In the case of Activity 3 (written tests), there is the possibility of uploading a grade during the Final Evaluation Test in any of the two exams (February and September), but the grade that will be taken into account will be the last exam accomplished.

Modality B: Global assessment

1) Written test . . . . . 20 % (factor 0.2)

2) Practical test. . . . . 20 % (factor 0.2)

3) Adittional test. . . . . 60 % (factor 0.6)

In order to pass the subject through the **Global Assessment modality**, they must independently pass a score of ? 5 each of the 3 tests.

4.Methodology, learning tasks, syllabus and resources

4.1.Methodological overview

The methodology followed in this course is oriented towards the achievement of the learning objectives. A wide range of teaching and learning tasks are implemented, such as lectures, practice sessions, problem-solving sessions and fieldwork.

The program of the course is not the target of the course, but a framework throughout which students will be able to develop autonomous work. In this way, time devoted to lectures will be reduced to a minimum, in benefit of collective discussion on practical exercises and case studies. Laboratory sessions will be mainly devoted to analysis of the most common techniques for geological mapping construction and interpretation. Fieldwork will focus on the recognition of geological contacts and geological structures, collection of detailed observations and orientation measurements on them. The obtained data will be represented on the student's notebook by means of tectonic schemes and cross-sections and used for the geological mapping of the region.

4.2.Learning tasks

This course is organized as follows:

- **Lectures** (1 ECTS: 10 hours). One weekly hour approximately. Learning of conceptual foundations of geological mapping.
- **Problem-solving sessions** (1 ECTS: 10 hours). Exercises will be solved using orthographic projection in geological mapping.
- **Laboratory sessions** (50 hours). 5 weekly hours approximately. There will be three kind of laboratory sessions.
    - Photogeological interpretation with photograph stereopairs (1.3 ECTS: 13 hours)
    - Realization of geological maps and cross-sections (1.5 ECTS: 15 hours)
    - Interpretation of geological maps (1.2 ECTS: 12 hours)

- **Fieldwork** (3 ECTS: 7 trips). Acquisition of geological data and mapping in field in different regions.
- **Tutorials**. They are considered another academic activity where the student will be free to ask any doubt related with the course, receive orientation about information sources and ask for guidelines about personal work and report elaboration.
- **Activities in English** (1 ECTS) During the development of the course the student is expected to know and apply specialized terminology of Cartography and Basic Geology not only in Spanish but also in English. With this objective, in addition to introducing the terminology in the various face-to-face activities, some of the activities mentioned above will be developed in English. Activities in English will include: 1) bibliography management in English, 2) introduction to the methodology used in photogeology and 3) reading of works in English, provided by teachers, for later application in the writing of the memory of the area Of field. Regarding the latter aspect, a commentary on one or more articles in English should be included in the background section of the report. In addition, the contents of an article in English should be used in the Discussion section of the field memory.

4.3.Syllabus

This course will address the following topics:

Theory contents (covered in lectures and practice sessions)

- **Topic 1. Orthographic projection.** Fundamentals and their use to solve problems of cartography (intersection of planes, calculation of displacements of faults and separations, real displacement and components...).
- **Topic 2. Systems of representation of tectonic structures (review).** Maps and geological sections; Blocks diagram. Thematic maps. Orientation of planes and lines; Direction and dip; Apparent dipping; Immersion and pitch.
- **Topic 3. Elements of cartography (review).** The rule of "VV". Mapping of horizontal stratified, folded and / or fractured series and complex cartography.
- **Topic 4. The geological history.** Bases for interpreting the geological history of a region from the cartography.

Practice sessions

The cabinet internship program includes the following contents:
1. Acquisition of skills for taking field data
2. Reading and interpretation of maps of the MAGNA series.
3. Making geological cuts.
4. Photogeological interpretation of the field area.
5. 3D cartographic interpretation.
6. Interpretation of maps of thematic cartography.
7. Resolution of limited plan exercises.
8. Resolution of questions on interior cartography based on field data.

In the number of sessions devoted to each section, it may vary from one course to another

Fieldwork

- Trips 1 to 6. Cartography and field data collection.
- Trip 7. Cartography and mine data collection.

* Locations are determined each academic year.

4.4.Course planning and calendar

Because of the similar nature of lectures and practice sessions, they have been included in the same schedule, in two 3-hour weekly sessions according to the following two groups. IMPORTANT: Each student must be included in a single group.

- Group 1: Tuesday (1518 h) and Thursday (1619 h).
- Group 2: Wednesday (1518 h) and Thursday (912 h).

Further information concerning the timetable, classroom, office hours, assessment dates and other details regarding this course will be provided on the first day of class or please refer to the Faculty of Sciences and Earth Sciences Department websites (https://ciencias.unizar.es, https://cienciastierra.unizar.es) and Moodle.

The day of delivery of the documents requested for the continuous assessment of activities 1 and 2 will be indicated in advance throughout the course.

4.5.Bibliography and recommended resources

http://biblos.unizar.es/br/br_citas.php?codigo=26416&year=2019