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Learning and researching in the classroom

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ABSTRACT

A new method in the course "Carbonate rocks diagenesis" has been tested. This is an optional course in the year 4 of a four year degree in Geology (University of Barcelona, Spain). The number of students in the course is generally reduced (less than ten), and duration of the course is 3 one-hour lecture and 1 three-hour practical per week during 5 weeks. This course has been selected to test a new learning method because is given in the last year of the undergraduate degree and also because the number of students is low, thus achieving a great degree of motivation of the students and favouring the communication in the classroom. The new model implies a general change in the development of the course: students will be trained in scientific research, working in group and using available analytical techniques. Nevertheless, this method does not invalidate the pre-existing educational resources; both new and classic teaching materials coexist in the course.

Traditionally, the course was divided in lectures and practical work. The practical work is done on rock specimens and on thin sections using the petrological microscope, which is essentially invariable every course, and which is related with the theoretical concepts explained in the corresponding lecture. The students describe and interpret the material in a "passive" way, only with minor student-teacher feed-back when specific questions are asked by the student.

The real learning in Sciences is not learning of isolate subjects, but to understand the relationships between all these subjects. Therefore, the student must learn science and how to do science. In the new tested method, the students carry out by themselves a scientific research project from a basic material provided by the teacher. This research work, which is done along the 5 weeks course, consists on a single project developed from all the students as a single group, thus observing the evolution in the student's knowledge and opening a continuous feed-back in the student-student and student-teacher relationships. This proposal implies that the lectures and practicals of the course must be reorganized and adapted.

The research work is presented during the first day of the course, including a general presentation of the geological setting and the main problem to solve. The research work is developed during the entire course in the classroom, and concluded at the end of the course. In the first part of the research (2-3 weeks), the students will describe a set of samples (hand rocks and thin sections) in order to define the petrographic characteristic (mainly focused in diagenetic processes affecting carbonate rocks and the stages of cementation and its relationships with the fracturation events). The samples are distributed among the students and the description of the samples is individual; students must reach and agreement about the common petrographic features of the rocks and establish a global diagenetic sequence for the studied material. The second part of the research consists on the application of advanced instrumentation and analytical techniques, available in the University of Barcelona, such as cathodoluminescence microscope, microprobe and carbona and oxygen isotope analyses. The obtained results must be processed and comparison with published data by means of bibliographic research should be done by the students out of the classroom. The last part of the research project includes a complete and collective analysis of the results, elaboration of an individual final report (which should take into account the conclusions arrived by

the entire group) and an oral presentation of the main results in the classroom. During the development of the work, the teacher acts as a tutor and mediator in the discussions, not only as a transmissor of knowledge. The new proposal differs from the classical undergraduate research projects developed in other courses, which are carried out outside the classroom, and therefore, without the continuous support of the teacher.

The degree of satisfaction of the students at the end of the course is great, as evidenced in the opinion polls; students perceive that their individual effort is manifested in a final and global work. Additionally, implantation of this method in the classroom has been revealed as a good system of developing future researchers as several students having done this research method in the course of "Carbonate rocks diagenesis" have continued their scientific career.

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