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Editorial

NEW TENDENCIES AND CLASSIC DATA COLLECTION IN GEOMECHANICS: A DIFFICULT BUT NECESSARY FRIENDLY RELATIONSHIP

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In this 21st century we lived a controversy in the world of Earth Sciences. On the one hand, advances in computing allow us to simulate much of the phenomena that exist in nature, and we can also model remote places without accessing them. We have drones and satellites and advanced computing but it is still necessary to use the compass and scratch the rock with our geologist's hammer to capture the smallest details. There are very sophisticated analysis equipment but we cannot replace the human eye in the petrographic and geomechanical characterization.

But what is the degree of precision of these computational approaches? To a certain extent the work of field data collection is being lost or the less relegated to a second position.

We can notice this problem in the syllabi of many university and postgraduate studies. Where we have advanced courses of remote techniques and modelling but there are almost no courses of field data collection, compass, correctly measuring parameters in situ, etc.

It has happened to me personally that I have travelled to remote mines or hydroelectric projects in places of difficult access and have given me preliminary results of very complex modelling. In some of these studies very advanced models have been developed with very few laboratory data and none data taken in the outcrop itself. The remote techniques are of inestimable help but should always be contrasted in key points of the outcrop.

As Dr Hoek [1] quotes: "*Even the most sophisticated analysis can become a meaningless exercise if the geological model upon which it is based is inadequate or inaccurate*"

The Hoek and Brown [2] strength criteria, for instance, gives a crucial importance to the characterization of the rock mass in a visual way, through the GSI – geological Strenght Index. In the beginning this parameter correlated with the RMR, but in the last years authors recommends the visual evaluation using graphical tables [3].

Interestingly in rock mechanics, much has been advanced in the last 40 years with

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empirical approaches, which, although not based on advanced formulations, can respond to a multitude of complex cases. For a particular type of study, for example, slopes, caves, tunnels etc., the idea is to collect as many cases as possible. In each case it is necessary to determinate and note some geometric data of our element to evaluate and the properties of the rock mass. Then we draw graphs of two or more entries, where we establish different categories. The broader the database the better and more realistic our assumptions will be.

Due to the lack of field data and laboratory tests in many cases the stability assessment becomes much more realistic and efficient when graphical-empirical approaches and geomechanical classifications systems are used. (Hoek 2007, Jordá et al 2016a) These are efficient methodologies in pre-feasibility studies, and those Support the decision-making process before even more sophisticated geotechnical studies and geological modelling may be required [4].

In current geological engineering, we should unify criteria and methodologies, taking advantage of new technologies, but also integrating the work of field data collection, both remote and manual. Nowadays, there is still no technology that can substitute the good engineering judgment or characterization of the terrain that an experienced geologist can make. Fortunately Earth Science is today a multidisciplinary science, where investigations are accomplished in teams with very varied fields of study, diverse professional profiles and diverse nationalities. [5] Not so long ago, perhaps 20 years we could see how in projects, studies and articles the fields of technical knowledge were very often watertight compartments instead of communicating vessels of transversal knowledge.

The basic process of modelling and characterization of a geomechanical environment in an engineering geological project could be:

Establish cross-disciplinary knowledge framework and multidisciplinary teams → Geological / geoscientific model (remote and manual data collection - laboratory and geophysics) → preliminary evaluation of the project using empirical approaches → fine-tuning using numerical modelling → rethinking the problem if necessary

Figure: geomechanical in situ characterization of the rock mass in Galapagos volcanic cave (photos of the author). Numerical modelling using Phase2v8 Rocscience

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