

**DESIGN AND CONSTRUCTION OF AN ADJUSTABLE SHOOTER FOR THE MODELIZATION OF IMPACT CRATERS IN THE CLASSROOM.** *Luis Martín<sup>1</sup>, Concha López<sup>2</sup>, Gabriel Castilla<sup>3</sup>, Miguel Ángel de Pablo<sup>3,4</sup>.* <sup>1</sup>I.E.S. 'Isabel "La Católica"'. C/ Alfonso XII, 3-5. 28014 Madrid. Spain. <sup>2</sup>I.E.S. 'María Zambrano'. C/ Alpujarras, 52. 28915 Leganés, Madrid. Spain. <sup>3</sup>Seminar on Planetary Sciences. Facultad de Ciencias Geológicas. Universidad Complutense de Madrid. 28040 Madrid. Spain. <sup>4</sup>Área de Geología. Escuela Superior de Ciencias Experimentales y Tecnología. Universidad Rey Juan Carlos. 28933 Móstoles, Madrid. Spain. (depablo@geo.ucm.es).

### Introduction.

The exploration of the Solar System has demonstrated that "the impacts of solid bodies is the most fundamental of all processes that have taken place on the terrestrial planets" [1]. By this reason have been published various activity guides where are collected experiences related with impacts for different educational levels [2,3,4]. The simple modelizations of craters that these guides propose they were employed with success by investigating like Alfred Wegener at the beginning of the twenty century [5]. These experiences have like result very simple craters (only cavity and eject), where hardly have into account some few physical parameters. In order to improve these results have built a shooter appliance for modelization impacts in the classroom in a easy and sure way, that we employ for the development of the subject of Geology in the Obligatory Secondary Education of Spain [6].

### Description.

The impacts machine that we have built occupies a surface of 1 m<sup>2</sup>, it has a height of 1 m and the total weight does not reach 15 kg. It is divided into four parts (or modules) detachable so that its movement will be easier: a platform where is located who accomplishes the shot, the shooter mechanism, that we will use to launch projectiles; a booth full of sand that it will be the place where will be generated the crater, and a support structure on the one which are fixed the previously mentioned modules. (Fig.1).

*a. Shot platform.* it is designed to sustain the weight of the teacher or of the pupil. Its function is to permit to accomplish the craters with comfort and in a sure way. Its high position facilitates the election of the impact point and it help to obtain a great shot force.

*b. Joint shooter.* Consist on a guide frame that it is sustained and rotated by the supports; and the shooter device where is located a pipe of plastic with a globe embraced to one of its extreme.

*c. Impacts booth.* In its fund we will put an elastic material (a fine glue mattress) that will facilitate the rebound of the impacts and will permit the central peak training. This material is thereafter covered for caps of sand with different colors so that give contrast to the ejects.

*d. Support structure.* It is formed by a base and two vertical supports punctured to locate the joint shooter. On the base will be supported the shot platform and the sandbox.

### Construction and experiences in the classroom.

Due to its simple design this machine can be built by pupils of 14 to 17 years old. For the moment we have only accomplished activities with geology students of the secondary school (17 years), but we believe that it can be used as

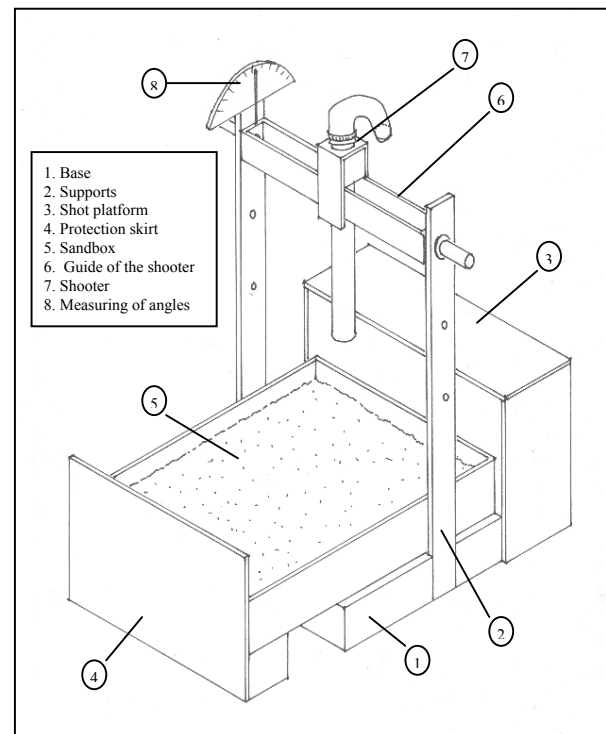
a didactic tool in subjects like Geology, Physical [7] or Technology.

The activity that we develop in class consists of three parts:

1<sup>st</sup>. The impact. The pupil rises to the machine and accomplishes a shot (Fig. 2). It will be able take into account the following parameters: shot and impact angle, employed force (measuring the height of the shooter globe), weight of the projectile, type of sand (size of the grain) and degree of dampness, depth to the one which is found the buried elastic material and type of painting that will give a better contrast of the obtained shapes.

2<sup>nd</sup>. Description. The pupil draws and identifies the different parts of the structure: cavity, eject, terrace, central peak and ring [8] (Fig. 3).

3<sup>rd</sup>. Comparison. Finally the pupil can compare the structure that it has obtained with a collection of impact crater images from different bodies of the Solar System. Also it is able to do a table where are compared the parameters by him used and the obtained results [2].



**Fig. 1:** diagram of the device adjustable shooter for the modelization of impact craters.

**A new tool for the scientific spreading.**

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For the moment the impacts machine has been presented with great success in the III Feria de Madrid por la Ciencia (III Fair Madrid by the Science) -March of 2002, and in the XII Symposium on Teaching of the Geology, celebrated in Gerona, Spain (July of 2002) [6].

In Madrid (Spain) the impact machine was used as a scientific spreading tool in order to approach the Planetary Geology to the public; and in the Symposium of Gerona (Spain), and in a forum of secondary education teachers [9], was exposed for that the assistant teachers could prove the good results that they can be obtained, in order to promote this type of activities in many other educational centers.

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Fig. 2: photograph of a pupil in the moment of accomplishing a shot and to create an impact crater.



Fig. 3: Photograph of an impact crater accomplished with the described shooter, where is possible to observe some of its more important features: eyect, central peak, rings,...