

Mars Sedimentology using Laser Remote Optical Granulometry (LROG). D. Sarocchi¹, R. Bartali², G. Norini^{3,4} and Y. Nahmad-Molinari⁵. ¹ Instituto de Geología-Facultad de Ingeniería, Universidad Autónoma de San Luis Potosí, Av. Dr. Manuel Nava 5, Zona Universitaria, 78240 San Luis Potosí, Mexico. e-mail damiano.sarocchi@uaslp.mx, ²Doctorado Institucional en Ingeniería y Ciencia de Materiales, Instituto de Física, Universidad Autónoma de San Luis Potosí, Zona Universitaria, 78240 San Luis Potosí, Mexico. ³Dipartimento di Scienze Geologiche e Geotecnologie, Università degli Studi di Milano-Bicocca, P.zza della Scienza 4, 20126 Milano, Italy. ⁴Computational Geodynamics Laboratory, Centro de Geociencias, Universidad Nacional Autónoma de México, Campus Juriquilla-UNAM, Blvd Juriquilla 3001, 76230 Querétaro, Mexico. ⁵Instituto de Física-Facultad de Ciencias, Universidad Autónoma de San Luis Potosí, Av. Dr. Manuel Nava 6, Zona Universitaria, 78240 San Luis Potosí, Mexico.

Introduction: We are showing a new optical method that allows to obtain remotely valuable information of sedimentary parameters [1],[6]. It is based on stereological analysis [2],[5] of high resolution CCD images, taken through a small aperture telescope (Figure 1). Image scale is obtained projecting on the outcrop three green laser beams forming an equilateral



Figure 1. LROG System and Joya Honda outcrop in the background.

triangle with known size.

Distortion due to perspective and outcrop irregularities can be easily corrected in the image processing phase. Image analysis techniques are then applied to each picture in order to obtain information on deposit stratigraphy, texture and structures. Many sedimentary parameters can be precisely measured by means of LROG technique, the most important of them are: number and thickness of the sedimentary units; granulometric distribution and vertical granulometric profiles; clasts shape analysis and apparent fabric. The same technique allows to measure exactly the distance to the analyzed point.

We developed LROG techniques and actually using it to study inaccessible and consolidated deposits of volcanic sedimentary successions [3],[4]. The method proved to be very useful and provide better and more reliable results with respect to traditional sedimentological techniques. Moreover the method allows to obtain many images in a short time, and safely,

because it is not necessary to stay too close to the outcrop neither to take samples. At a distance of 100 meters LROG allow to resolve clasts of 500 microns width. When comparing LROG granulometry with sieving technique the difference was as low as 10% (Figure 2). This discrepancy is basically due to sieving methodological limitation.

Remote high resolution sedimentology done with a small, lightweight, cheap, easy to use and low power

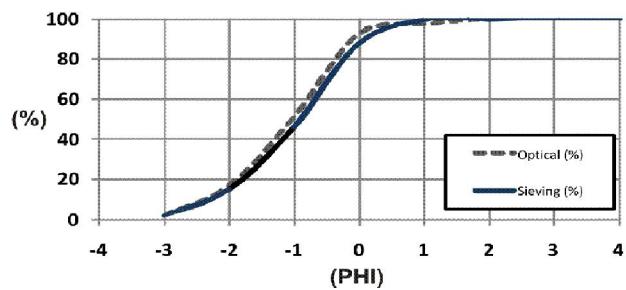


Figure 2. Optical and traditional granulometry comparative results.

instrument, placed aboard a robotic rover, could be a useful tool in exogeology research.

References:

- [1] Sarocchi D. et al. (2008) *IOP Conf. Series Earth Environ. Sci.* 3, 10.1088/1755-1307/3/1/012009.
- [2] Rosiwal A. (1898) Verh K.K. Geol. Reichsants, 5/6, 143-175.
- [3] Sarocchi D. et al. (2009) *UGM*, Granulometrías ópticas remotas para el estudio de depósitos piroclásticos en afloramientos inaccesibles.
- [4] Sarocchi D. et al. (2009) *250th anniversary of Volcán Jorullo's birth in Michoacán*, Detailed stratigraphic study of Joya Honda pyroclastic sequence by means of Laser Remote Optical Granulometry (LROG): preliminary results.
- [5] Sarocchi D. (2007) *Monografías del Instituto de Geofísica UNAM*, ISBN 978-970-32-5008-0.
- [6] Sarocchi D. et al. (2005) *Rev. Mex. C. Geol.*, 23 (2), 371-382.