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Laser Remote Optical Granulometry (LROG), a tool for the textural study of inaccessible outcrops: could this method help to study Martian sedimentary successions?

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We present a new tool for the textural study of inaccessible outcrops of pyroclastic and epiclastic deposits. The new method, called Laser Remote Optical Granulometry (LROG), is based on high resolution tele-photography and stereologic techniques. LROG consists on taking several pictures of the outcrop with a high resolution CCD camera coupled to a small aperture telescope that can be placed several tenths of meters away. The scale of the image is obtained projecting an equilateral triangle with known size on the outcrop by means of three laser beams. The LROG allows the measurement of clasts less than 1 mm in size from a distance of 80 to 100 meters, and can reach much better resolution when operated closer to the outcrop. Perspective distortion can be corrected with the equilateral triangle projected by the lasers. To get high resolution images and remove the effects of air turbulence, hundreds of frames of the same field are captured in rapid sequence and then stacked and averaged with image processing algorithms developed for astronomical imaging. The LROG was validated on the pyroclastic deposits of the Joya Honda maar (San Luis Potosi, Mexico). The LROG provided precise granulometric analysis and vertical granulometric profiles of this pyroclastic sequence, useful to recognize the eruptive history of the volcano. This method can be used for the analysis of any kind of sedimentary deposits in the granulometric range of clasts greater than fine sand. We are improving the LROG to obtain other useful textural information like clast shape and apparent fabric. This method, implemented on a robotic probe could be a promising tool to carry out detailed stratigraphic and sedimentological study of Martian sedimentary successions.