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Terrestrial analogues models based on MOURA magnetometer data. Application to Gusev crater and Apollinaris volcano

Marina Díaz-Michelena (1), Miguel Felipe Cerdán (1,2), María Ramírez-Nicolás (2,3), Beatríz Sánchez-Cano (2,3), Marina Sánchez-Bayton (2), and Rolf Kilian (4)

(1) Instituto Nacional de Técnica Aeroespacial – INTA, Madrid, Spain, (2) Universidad Complutense de Madrid, Física de la Tierra, Astronomía y Astrofísica I, Madrid, Spain, (3) Instituto de Geociencia - IGEO (UCM-CSIC), Madrid, Spain, (4) Universität Trier, Trier, Germany

Sometimes it is a problem to determine whether a crater was formed by an explosive volcanic event or a meteorite impact. This issue is of interest even on Earth where geological features are often masked by erosion or vegetation and for the interpretation of ancient craters on other planets or moons, where the geological context is not clearly determined. Thus we propose a geophysical modelling approach to study the formation of such craters with potential application to Mars, whose surface is fully covered with craters. The evolution of this study might shed more light over the martian ancient geodynamo.

The Earth provides many examples to develop models for the geological features of such craters since it is feasible to perform magnetic and gravity surveys at different altitudes, and therefore to have information on different surface scales. The models developed with real satellite, airborne and on ground data on Earth (Moar, 2004) can be extrapolated to other bodies, like Mars or the Moon, where only satellite and limited ground data are available.

In the present study, surveys are mainly based on vector data from surveys with MOURA magnetometer developed by INTA for Mars MetNet mission. Since the ambient conditions of Mars are so extreme, MOURA is capable to withstand the extreme conditions of the terrestrial analogues.

The models of craters are based on typical crater structures proposed by Lorenz (2003) and Grieve (2006), where distinct susceptibilities and remanent magnetization have been attributed to different volcanic or impact related rock units (bedded upper diatreme facies and unbedded lower diatreme facies, tephra rims and ejecta blankets, high pressures and temperature volumes, etc) and target rocks. The analysis of the scalar magnetic potential and its harmonics can help in the interpretation of the origin of these craters and their geological context by means of the magnetic signature.

In this study, it will be presented the correlation between models and on Earth surveys data. Furthermore, the Apollinaris volcano (Robinson, 1993) and the Gusev crater (Bertelsen, 2004) have been selected as the most appropriate edifices for the extrapolated analysis. They both belong to the Noachian period which comprise the needed characteristics described above. We aim to analyse if the magnetic measurements made on Earth with MOURA at specific crater structures can be reproduced on Mars with our model.

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