

Title: Structural analysis of multi-ring basins and lobate scarps on Mercury

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Proposal

Planet Mercury preserves the geological record of tectonic processes and of giant impacts happened mostly around 3.5-4 Ga. The planet tectonics is characterized by faults of various trends and kinematics formed in response to the planet's global contraction. Nevertheless, many of these faults are organized into fault systems, which are correlated to the presence of large crustal regions of different composition that cause lateral crustal discontinuities.

The National Aeronautics and Space Administration (NASA) MErcury Surface, Space Environment, GEochemistry, and Ranging (MESSENGER) mission orbited the planet between 2011 and 2015 providing global coverage of Mercury's surface with monochromatic and false-color images at an average resolution of 200 m/pixel up to 8 m/pixel. MESSENGER data can be openly downloaded from the Planetary Data System (PDS) and used for geospatial analysis and photointerpretation. The joint European Space Agency (ESA) and Japanese eXploration Agency (JAXA) BepiColombo mission is currently on a seven-years journey to the innermost planet and will start orbiting Mercury in December 2025.

An intense geological mapping activity, based on MESSENGER data, has begun to lay the basis for the future observational strategies of the Spectrometer and Imagers for Mpo Bepicolombo-Integrated Observatory System (SIMBIO-SYS) instrument on-board BepiColombo. The geological mapping of Mercury has started as a cooperation between INAF-IAPS and DiSTAR as a quadrangle-based series and is today enlarged to a collaborative effort among several international institutes.

To the mission aim, it is important to study the effects of global processes including large impacts that have produced the so-called multi-ring basins, and the geometry fault segments and growth of fault systems.

Research Program

The proposed projects is devoted to tectonic analysis of multi-ring basins and contractional fault systems (lobate scarps) in selected regions of Mercury. The potential PhD research project will be carried out in collaboration with the National Institute Astrophysics, Institute for Space Astrophysics and Planetology (INAF-IAPS) in Rome, where the PhD candidate will carry part of the research activities.

This PhD project involves the use of camera data from the NASA MESSENGER mission, their processing and photointerpretation, to compile a 1:3M geological map of one of the quadrangles of Mercury and conduct a structural analysis of the faults present in the area. This project is part of the preparatory activities of the BepiColombo mission and of the SIMBIO-SYS instrument, in particular about the understanding of the tectonic evolution of the planet and the identification of

targets to propose for future high-resolution observations.

The candidate expenses for the activities related to the PhD project will be covered by IAPS funds allocated through the ASI-INAF cooperative agreement for the BepiColombo mission. The candidate is expected to have solid background in structural geology/tectonics and a general knowledge of geographic information system software (GIS).