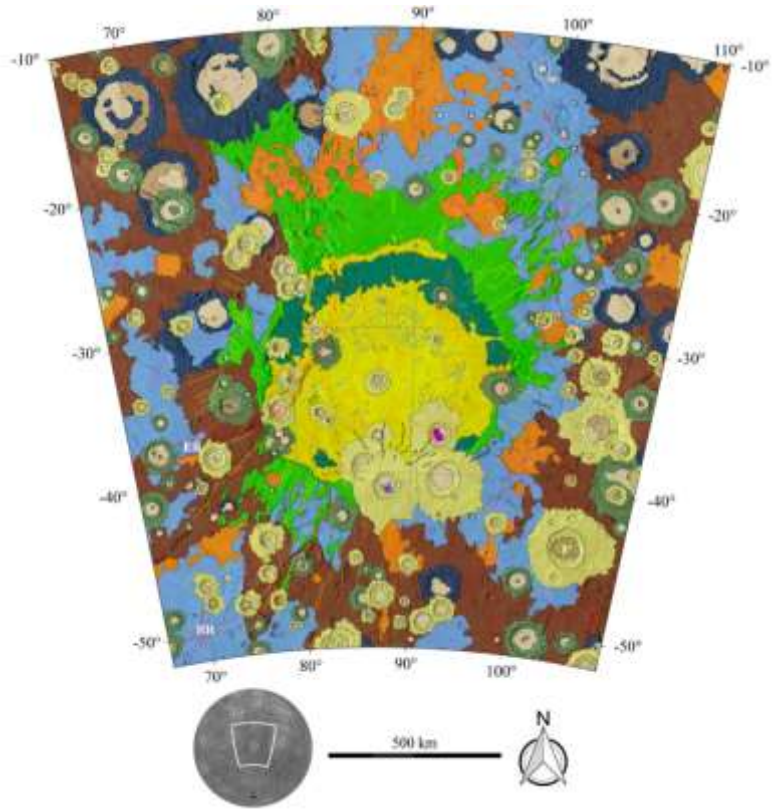
Volcanism and Tectonism across Mercury

(Prof. Matteo Massironi, Dott. Riccardo Pozzobon)

Interpretation, mapping and age estimates of tectonic and igneous features and units are pivotal for the understanding of the thermal and magmatic evolution of planetary bodies. Being of modest size Mercury is particularly suited for investigating the early stage processes of terrestrial planets evolution such as the relationship between impact basin formation, regional tectonism and magmatism of large igneous provinces. Although plate tectonics is lacking on Mercury, tectonic structures such as compressional wrinkle ridges, grabens and strike slip faulting are still present and related to tidal despinning, contractional cooling and basin tectonism interplaying with igneous activity often triggered by large basins impacts. Unravelling the tectonic settings on such planetary surfaces will allow us to get more information not only on the origin of the deformations and the associated stress fields, but also obtain constraints on the thickness and mechanical layering of the evolving crust.

It is expected that the PHD student will carry out analysis of high-resolution imagery and topographic data, developing new methodologies for structural analysis on planetary surfaces with particular regard to Mercury.



In particular the PHD should be able to deal with one or more of the following activities:

- compilation and analysis of high-resolution imagery and topographic data from Mercury.
- identification, characterization and mapping of volcano-tectonic structures, including fissures, grabens, and faults.
- identification, characterization and mapping of volcanic fields, lava flows, and igneous units.
- the development of new methodologies for structural analysis, including fracture analysis, stress and strain analysis, and fault kinematic analysis.
- the comparison of structural characteristics across different volcanic provinces, and correlation with planetary magmatic evolution.

- the age determination of volcanic units through crater counting.
- The automatic and semi-automatic detection of geological features on planetary surfaces using Machine learning and Deep learning
-the integration of results with existing geological maps and models, and development of new maps and cross-sections.

Hence a good background in photointerpretation of geo-structural and/or volcanic features would be required. Proficiency in GIS, remote sensing and Digital mapping software is also essential whereas familiarity with programming languages such as Python and MATLAB as well as supervised and unsupervised classifications would be desirable.
Experience in geological mapping and ability to work in international teams is also well-received. Indeed, the PhD will carry out his work in collaboration to SIMBIOSYS team of the Bepi-Colombo mission whose insertion to Mercury orbit is foreseen by the end of 2025. For this reason, the PhD is also expected to contribute on operation, target selection and data acquisition activities

Collaborations: Bepi Colombo AND SIMBIOSYS team members (INAF-OAPD, INAF-IAPS, Westfälische Whilelms-Universität Münster, DLR, Observatoire de Paris).

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