Geological mapping in Mercury’s southern latitudes

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Description:

NASA’s MESSENGER orbiter ended its mission in 2015. In preparation for Europe’s Mercury orbiter, BepiColombo (launch October 2018), a co-ordinated effort is being mounted by MESSENGER and BepiColombo scientists to produce 1:3M geological maps of the whole planet using the best MESSENGER data available. These will provide contextual information for planning and interpreting BepiColombo data, replacing partial 1:5M scale map coverage achieved using Mariner-10 data.

Mercury is divided into 15 ‘quadrangles’ (including one at each pole). The student will be responsible for creating a geological map of one of the southern hemisphere quadrangles, guided by the supervision team. This will be either the south polar quadrangle (H-15 Bach) between 66°S and the pole, or one of the three as-yet unmapped quadrangles (H-11 to H-13) in the belt occupying 21-66°S, depending on mapping already underway by colleagues at other institutions. However, every quadrangle has a wide range of features and a long and complex geological history making it an exciting region to study.

It is particularly important to understand Mercury’s southern hemisphere as fully as possible. This was less-well studied by MESSENGER, but it will be observed in detail by BepiColombo and so this mapping will establish the context for what we expect to be BepiColombo’s most novel findings.

The student will compile a geological map in ArcGIS using MESSENGER narrow- and wide-angle-camera images supplemented by topographic and spectral data, available from NASA’s Planetary Data System, and will co-ordinate with colleagues who have mapped adjacent quadrangles. Mapping will follow ‘mapping standards’ protocols and conventions adopted by the ‘Planmap’ consortium, which are consistent with USGS practice. Online digital publication facilitates the inclusion of multiple layers, so that (for example) this new generation of maps could have a chronostratigraphic version (surface units divided by age, such as smooth plains, intercrater plains, and so on) and a more innovative lithostratigraphic version (for example subdividing plains into spectral types). Mercury is tectonically complex, and so the systems of isolated and linked faults will require careful attention.

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Although a quadrangle map will be the main specified deliverable from this study, the intimate insight gained by close examination of any part of Mercury offers many opportunities for spin-off science. These could, for example, be geomorphological, tectonic, related to space-weathering, or related to volatile processes, according to the student’s interests. We would expect the student to present findings at meetings such as the annual Lunar & Planetary Science Conference (Houston) and the European Planetary Science Conference, and also to submit papers for publication in peer-reviewed journals.

The supervisors will train the student in ArcGIS and planetary geological mapping. Experience of geological mapping on the Earth would be an advantage.

References

1. Mariner-10 geological maps http://www.lpi.usra.edu/resources/mercury_maps/


Qualifications required:

A first class or upper second class Msci degree in Earth Sciences or related discipline. Previous experience in using ArcGIS or a comparable GIS package would be an advantage.