Geological mapping of the planet Mercury

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Description: The four-year orbital mission of NASA’s MESSENGER spacecraft will end in March 2015. In preparation for Europe’s Mercury orbiter (BepiColombo), which will be launched in 2016, a co-ordinated effort is being mounted by the MESSENGER and BepiColombo teams to produce geological maps of the whole of Mercury using the best MESSENGER data available. The maps will provide very important contextual information for planning and interpreting BepiColombo data, and will replace the partial map coverage at 1:5M scale achieved using Mariner-10 data.

Mercury is divided into 15 mapping ‘quadrangles’ (including one at each pole), and the student on this project will be responsible for creating a geological map of one of these under the guidance of the supervision team. The allocation of quadrangles between groups is being negotiated and should become clear by early summer. However, every quadrangle has a wide range of features and a long and complex geological history making it an exciting region to study.

The student will compile a geological map in ArcGIS using MESSENGER narrow- and wide-angle-camera images supplemented by topographic, spectral and geochemical data, all of which will be available from NASA’s Planetary Data System (pds.nasa.gov), and will co-ordinate with colleagues mapping adjacent quadrangles. Mapping will follow United States Geological Survey protocols and conventions agreed among the joint MESSENGER-BepiColombo geological mapping team, and the map will be published via USGS. 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/geochemical types). Mercury is tectonically complex, and so the systems of isolated and linked faults will require careful attention.

Although a thorough quadrangle map will be the main product of this study, the intimate insight gained by close examination of any part of Mercury will offer plenty of opportunities for spin-off science. These could, for example, be geochemical, 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, in addition to which there will be opportunities to attend MESSENGER-BepiColombo mapping workshops in Europe and/or the USA. Experience of geological mapping in Earth would be an advantage.

References:
Mariner-10 geological maps of Mercury 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.