



Depth of thrust faulting and ancient heat flows in the Kuiper region of Mercury from lobate scarp topography

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Mercury's most characteristic tectonic features are lobate scarps, which are interpreted to be the surface expression of thrust faults and provide important clues on the geological and thermal history of this planet. In fact, the large depth of faulting deduced from modeling lobate scarps topography suggests that it represents the crustal brittle-ductile transition, which in turn permits us to put limits on the thermal and mechanical properties of the lithosphere at the time when faulting occurred.

In this work we use a forward modeling procedure in order to analyze the fault geometries and depths associated with a group of prominent lobate scarps located in the Kuiper region of Mercury for which Earth-base radar topographic profiles are available. A back thrust, the first one reported for a Mercurian lobate scarp, has been included in this study. Best fits to the topographies are obtained for thrust fault depths of 30-39 km. This result is consistent with the depths of faulting previously calculated by different authors for other lobate scarps on Mercury. This could be indicative of a relatively homogeneous brittle-ductile transition depth at the time when the lobate scarps were formed. However, the heterogeneous insolation pattern on the surface of Mercury should imply a slightly shallower brittle-ductile transition depth for the Kuiper region, although our results do not have sufficient resolution to clearly reveal this difference. Furthermore, the formation of the scarps analyzed in different regions might not have been contemporaneous, and for that reason the depths of faulting obtained might not be indicative of a homogeneous brittle-ductile transition depth.

Calculations of surface heat flow have been performed from the brittle-ductile transition depth beneath these lobate scarps by taking into account crustal heat sources and a heterogeneous surface temperature due to the variable insolation pattern. Deduced surface heat flows are between 16 and 28 mW m⁻². These values are compatible with the predictions of thermal history models for the range of time relevant for scarp formation.