STRIKE-SLIP KINEMATICS ON MERCURY: EVIDENCES AND IMPLICATIONS.
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Introduction: Mercury is classically dominated by contractional features at a global scale (e.g. [1-3]). Nonetheless, numerous evidences of strike-slip kinematics have been found on Mercury Dual Imaging System (MDIS) camera images mainly derived from the three MESSENGER flybys and acquired near the terminator. This proves that several lobate scarps and high-relief ridges may be interpreted as transpressional structures more than thrust and back-thrusts systems. This finding may support either tidal despinning or residual mantle convection on ruling the nucleation and development of lobate scarps, although within the general framework of planetary contraction and cooling. In addition, the presence of faults with a clear strike-slip kinematic component may possibly affect future estimates of the hermean radius shortening.

Strike-slip kinematics on Mercury: Up to date hermean lobate scarps and high-relief ridges have been interpreted as exclusively associated to thrusts or pop- up systems related to pure compression [1-3]. An unique exception has been raised for the Beagle Rupes which is charcterized by a frontal thrust and two oblique ramps likely associated to a transpressional kinematics [4].

The MESSENGER MDIS images acquired at high phase angles have highlighted geomorphological details which led us to find many other examples of lateral shearing along lobate scarps and high-relief ridges. In particular strike-slip duplexes, pop-ups and flower structures, that tipically develop along contractional step-overs and bands of strike-slip faults (e.g. [5]), seem to be very frequent on the hermean surface (Fig.1). Besides, several folds arranged in an en-echelon fashion definitively prove lateral shears in some locations (Fig. 2). Finally many lobate scarps, like for example the Beagle Rupes one, are associated to oblique and lateral ramps along which strain could have been very likely accommodated by a strike-slip component.

Although contractional bands and step-over are evident in several places, we have not found unambiguous examples of extensional jogs and pull-aparts yet. These features could have been indeed impeded by the general contraction due to global cooling that should have guaranteed an important inverse component along all the hermean structures. Hence, even the fault arrays with the most beautiful examples of lateral shearing should be also associated to a substantial contractional component and, thus, a transpressional behavior.

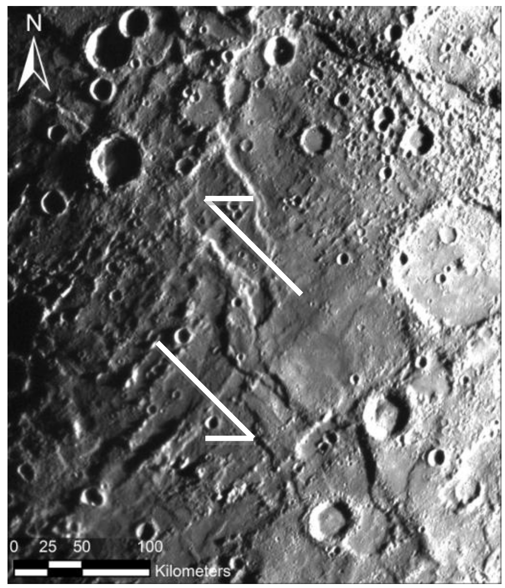

Figure 1. Left lateral strike-slip duplex (21.9° S – 100.5° E). NAC MDIS images EN0108828302, EN0108828255, EN0108828307 (sinusoidal projection).

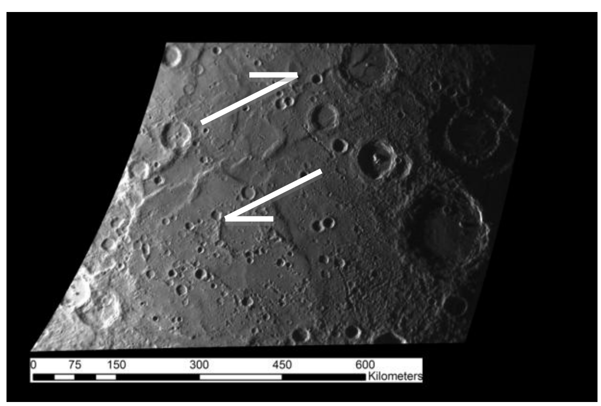

Figure 2. En-echelon folds array indicating a dextral strike-slip kinematics (12° S - 94° W). NAC MDIS image EN0108821402m (equirectangular projection).

Implications: Strike slip faults are not associated to any shortening by definition whereas transpressional faults are typically related to fault planes steeper than thusts (>60° vs 20-30°). Hence the same amount of hanging-wall uplift on transpressional faults is classically associated to a minor amount of shortening with respect to thrusts. This may have some implications on estimates of planetary radius decrease [6].

A further and even more significant consequence of the identified strike-slip kinematics is related to Mercury geodynamics. Three major models have been advocated to explain the structural features at the hermean surface: global cooling [1-3], tidal despinning [7-8] and mantle convection [9-10]. Although these mechanisms are not mutually exclusive, the ubiquitous presence of contractional structures and the lack of extensional features at a global scale suggest the dominance of the isotropic contractional cooling. Nevertheless according to the global cooling model alone, lobate scarps should be uniformely arranged and should not display any strike-slip movement. On the contrary both the two other models imply some lateral shearing and a non random distribution of structures with different kinematics. Therefore, the presence of numerous strike-slip features suggests that tidal despinning or residual mantle convection may have played a substantial role during the Mercury's evolution although yet within the global framework of cooling and contraction. A detailed analysis on the distribution and orientation of transpressional features is however needed to discriminate between tidal despinning and mantle convection contributes.

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