**STYLES OF STRIKE-SLIP FAULTING IN THE SOLAR SYSTEM AND THE CORRESPONDING MODES OF THERMAL-BOUNDARY-LAYER DEFORMATION.** A. Yin[1] and V. Hansen[2], [1]Department of Earth, Planetary, and Space Sciences and Institute of Planets and Exoplanets (iPLEX), University of California, Los Angeles, CA 90095-1567, USA (yin@ess.ucla.edu), [2] Department of Geological Sciences, University of Minnesota, Duluth, MN 55812, USA (vhansen@d.umn.edu)

A fundamental problem in the studies of solar-system-body tectonics is to determine the mode of their outer-shell deformation, using structural patterns displayed on the surface. On Earth, the modern mode of outer-shell deformation is plate tectonics, which is expressed by the combination of the following two fundamental processes: (1) rigid-body motion of fragments of its thermal boundary layer and (2) recycling of the thermal boundary layer. Testing whether and to what extent one or both processes operate on other solar-system bodies thus depends on our ability to quantify the two plate-tectonic processes. In this study we address the problem of determining the fundamental mode of tectonics by comparing the geometric and kinematic properties of dominant strike-slip faults on the hosting solar-system bodies. We select this class of structures over others because their geometry, kinematics, and morphology can be observed and quantified easily using remote-sensing techniques. In addition, the magnitude of strike-slip motion can be used as the most direct test of whether recycling of thermal boundaries layers is geometrically and kinematically possible on a solar-system body. To achieve this goal, we outline the fundamental principles governing the initiation and kinematic development of strike-slip faults and strike-slip fault systems. We propose a set of quantitative measures that can be used to define the *rigidity (R)* of fault-bounded terranes, the *slip efficiency (SE)* of a fault zone, and the *mobility (M)* of a terrane bounded by a dominant strike-slip fault on a solar-system body. Using this knowledge, we classify strike-slip systems into two general categories: (1) those accommodating plate-like deformation and their kinematics can be described by rigid-body motion, and (2) those accommodating flow-like deformation and their kinematics can be quantifiable by the principles of continuum mechanics. Following this scheme, we systematically examined the most dominant strike-slip faults and relate the two types of strike-slip deformation to the mode of outer-shell tectonics on all the rocky planets, a rocky satellite, and selected icy satellites in the solar system. Using *mobility M*, a dimensionless parameter defined by the ratio of the largest displacement on the most dominant strike-slip fault on a hosting solar-system body, we are able to compare the relative motion of the outer shell of different solar-system bodies. One Earth, the largest mobility number may exceed 1, with a plate that could have travelled across a large fraction of the globe. As summarized in Fig. 1, the solar-system bodies other than Earth that have the high mobility values include Mars, Europa, and Ganymede, with mobility number on the order of $10^{-2}$. Venus and Mercury have mobility number on the order of $10^{-3}$, whereas the Moon has the lowest mobility value, which is on the order of $10^{-6}$.

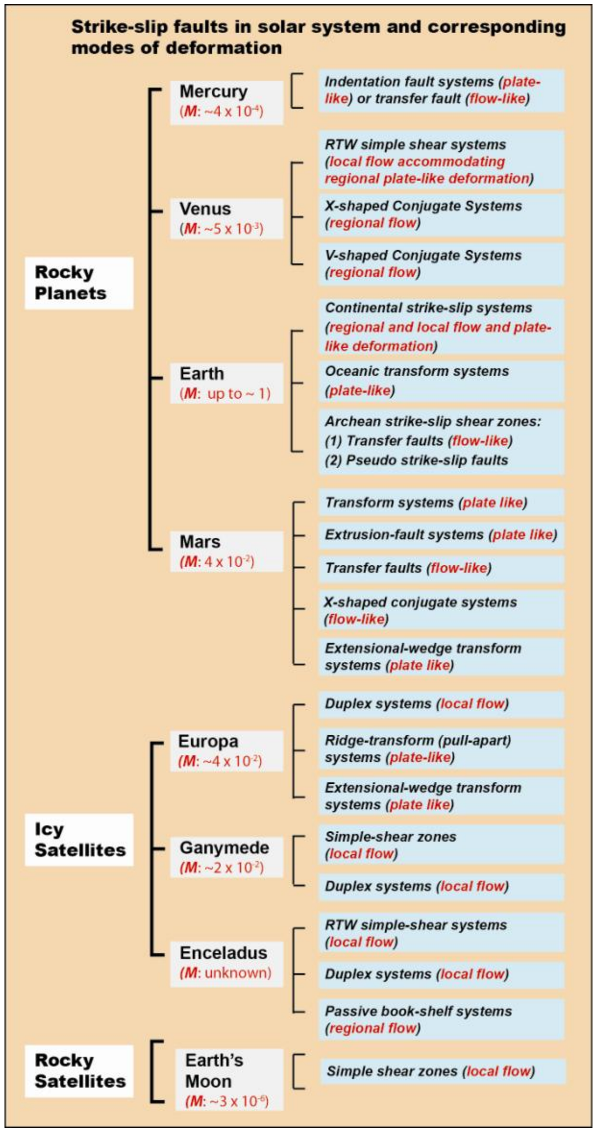


**Figure 1. Summary of strike-slip systems and corresponding mode of tectonic deformation on different solar-system bodies.**