SHALLOW ICY DÉCOLLEMENTS ON MARS: STRUCTURAL EVIDENCES.

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The Hesperian ridged plains of Mars display long and narrow ridges interpreted as compressional structures. Three different models explain these structures: (1) thrust faults due to buckling, (2) deep rooted thrusts or (3) thrusts rooted on shallow décollement levels. The buckling model supposes a relation between the thickness of the lavas and the ridges spacing. The deep rooted thrust model supposes the absence of shallow mechanisms. The décollement model implies shallow processes controlled by a mechanical discontinuity. In this study observations are focused on irregular ridges shapes, rooting depths of thrusts and occurrence of groundice. These observations are in agreement with a model of décollements levels due to groundice.
Ridges are mainly straightaway but Hesperia and Coprates Planum exhibit curved, circular or en-échelon like ridges. These irregular shapes give informations about their formation. Hesperia Planum and neighboring terrains display half-circular ridges on the floor of impact craters. Craters initiate ridges displaying the shallowness of the mechanism. Because of geometrical relations ridges are probably rooted on the intersection of a horizontal décollement with the crater filling. Ridges with échelons and strike-slip components are observed on Coprates Planum. They have different trends than usual ridges but same trends than preexisting faults. They are therefore interpreted as transpressive structures due to the interruption of décollement by preexisting faults. These unusual shapes are only consistent with shallow processes related to décollement levels. Usual straight ridges show also transfer fault and strike-slip components which are characteristics from horizontal displacements on décollements.
The shallow martian underground is composed by lava layers overlying a megaregolith. The observations of fluidized ejecta craters shows the occurrence of groundice in the megaregolith. The nature of the décollement can therefore be (1) stratigraphical (limit lavas megaregolith) or (2) due to groundice. The depth of the décollement is related to the mean width of the ridges. The ridges are among 3 and 6 km wide implying décollement depths from 1 to 2 km. Lavas thicknesses are estimated by the crater rim versus crater diameter method. Ridged plains have thicknesses from among 150 meters in Arcadia Planitia and 2 or 3 km in Coprates Planum. Décollements depths of 1 to 2 km show that there are localized in the megaregolith but also in lavas interbeds. This conclusion is supported by observations from structures stopping at plains border and structures crosscuting the plains border. Décollements are therefore not constrained by lava thickness or megaregolith depth.
Décollement levels can then be due to the ductile behavior of groundice. Indeed the distribution of ice is deduced from the distribution of fluidized ejecta craters. The depths of the décollements (1-2 km) are consistent with the supposed distribution of ice in the underground (0.5-3 km). The geographical distribution of fluidized ejecta craters is also correlated to the distribution of the ridges. For example ridged plains of Hesperia Planum shows about 80 % of fluidized ejecta craters from more than 5 km diameter. The neighboring Noachian terrains shows only 21 % of these craters. The abundance of groundice in plains with respects to neighboring terrains can explain the occurrence of most of ridges in plains.