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How fast were huge landslides in Valles Marineris (Mars)?

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The dynamics of three landslides in Valles Marineris on Mars was inferred by using geomorphological indicators. The three landslides were characterized by similar volume, ranging from 10^{11} to 10^{12} m^3, and deposition areas, of the order 2000 km^2.

The first landslide is located in Melas Chasma, while, the other two (Ophir Labes and Coprates Labes) are located at the boundary between Melas and Coprates Chasma. Melas Chasma and Ophir Labes landslides were analyzed as they have come across natural obstacles along their path, thus allowing for an estimate of the velocity by the run-up and runout measurements. On the other hand, Coprates Labes landslide travelled unconfined on a completely flat area.

The following high resolution images were used for the detailed morphological analyses: High-Resolution Stereo Camera on board Mars Express (HRSC), [1], the Thermal Emission Imaging System (THEMIS) on board Mars Odyssey [2] and Context CTX camera on board Mars Reconaissance Orbiter [3].

Geomorphological maps of each landslide were produced, with a specific focus on those characteristics of the landslides deposits that can provide information on the dynamics and velocity such as runout, run-up on obstacles along their path and curvature.
Mathematical dynamics calculations based on the observed morphologies allowed to estimate velocities exceeding 100 m/s, thus suggesting for a low basal friction experienced by these landslides during the flow.

In order to understand the reasons of these low frictions, different environments have been considered in the calculations such as subaqueous and glacial environment. Achieved results show that the glacial environment is the most reasonable one, thus supporting the hypothesis of the possible occurrence of Amazonian glaciations at mid-latitudes [4] and the potential presence of ice at equatorial latitudes within some hundreds meters depth.

References:

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