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Reassessing the Ancient Martian Ocean Hypothesis using Global Distribution of Valley Networks

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We re-examine the connection between true polar wander and the Martian ocean hypothesis. Previous studies have investigated the plausibility of an ancient ocean on Mars by examining the ancient putative sea-level markers on the planet's surface. One such study has argued that topographic benches, or contacts, are ancient shorelines, and that these contacts display long-wavelength topographic variations consistent with post-depositional true polar wander (Perron et al., Nature, 2007). In contrast, a second study has argued that the topography of ancient deltaic deposits associated with an ocean on early Mars are not consistent with the true polar wander scenario (Achille & Hynek, Nature Geosci., 2010). We revisit this issue by examining another marker of ancient shorelines — the fluvial valley networks observed on the surface of Mars. Our results provide further evidence that a true polar wander event drove significant post-depositional deflection of surface features related to an ancient Martian ocean.