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The proto-Valles Marineris history illuminated by the interacting Martian dynamo and crustal dichotomy

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Right-lateral megashears are observed in the most deeply eroded troughs of northern Valles Marineris. They are located at the margin of the Borealis basin, a pre-Noachian impact structure behind the formation of the crustal dichotomy, while the early dynamo was active. The shears are aligned with the putative basin margin, giving credit to its existence; shearing would correspond to ring normal fault reactivation. If correct, other structures circling the basin should exist nearby, though unexposed due to the lack of other erosional windows. Magnetic anomalies measured in eastern Valles Marineris follow such a trend. Dykes and sills injected along ring structures at the time of basin formation gradually cooled, recording the field reversals. Some of these structures were then reactivated in strike-slip regime in a stress field controlled by the growing Tharsis bulge and the crustal step imposed by the dichotomy boundary. All this happened in Valles Marineris before the troughs opened.



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