en echelon steps, offset occurred and was accompanied by transtensional and transpressional deformation. If the zone of weakness was circular, the enclosed circular block actually rotated and transtensional and local transpressional deformation occurred along irregularities in the zone's trace. As has already been discussed, there is evidence for global tension having occurred (the global dominance of apparent extensional deformation in grooved terrain). There is also evidence for existence of important zones of lithospheric weakness, across which shear offsets are proposed and which are curvilinear or have appropriately configured en echelon steps. Lineament I, which encloses Galileo Regio, is approximately circular; the proposed 500-km left-lateral offset of Galileo Regio and Marius Regio is equivalent to a 14° rotation of Galileo Regio. Therefore it is concluded that mantle convection is a plausible driving mechanism for the tens to hundreds of kilometers shear offsets proposed to have broken up Ganymede's lithosphere.

CONCLUSIONS

A system of arcuate furrows in Galileo Regio and Marius Regio has previously been proposed to be the remnant of an originally more concentric set that was disrupted by shear. Estimates of the two regions' poles of furrow concentricity indicate a considerable westward offset of the Galileo Regio pole, suggesting the possibility of about 500 km of left-lateral offset of the two areas, equivalent to a 14° clockwise rotation of Galileo Regio. This hypothesis is supported by offsets of distinctive structures and furrow-controlled groove orientations and by the geometry of radial furrows. There is evidence that shear deformation was concentrated along a major structural lineament which closely follows a small circle about 45° of arc of radius and which encloses Galileo Regio. There is evidence for a smaller amount of distributed shear across an adjacent 500- to 1500-km-wide band, including deformation of reticulate terrain. There is also morphologic evidence for zones of minor right-lateral shear between central and southern Marius Regio and between Barnard and Nicholson Regio, and for a zone of minor left-lateral shear in Nun Sulci; these zones are parallel to an independently recognized lithospheric "structural fabric." Stratigraphic relations indicate that any major shear offsets occurred before and during the earliest stages of grooved terrain formation, before most grooves had formed and most light material had been emplaced. However, regionally dominant groove orientations are generally consistent with orientations expected for transtensional features. Either widespread shear strain or the shear's driving mechanism may have had a long-term effect on patterns of deformation of the lithosphere.

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