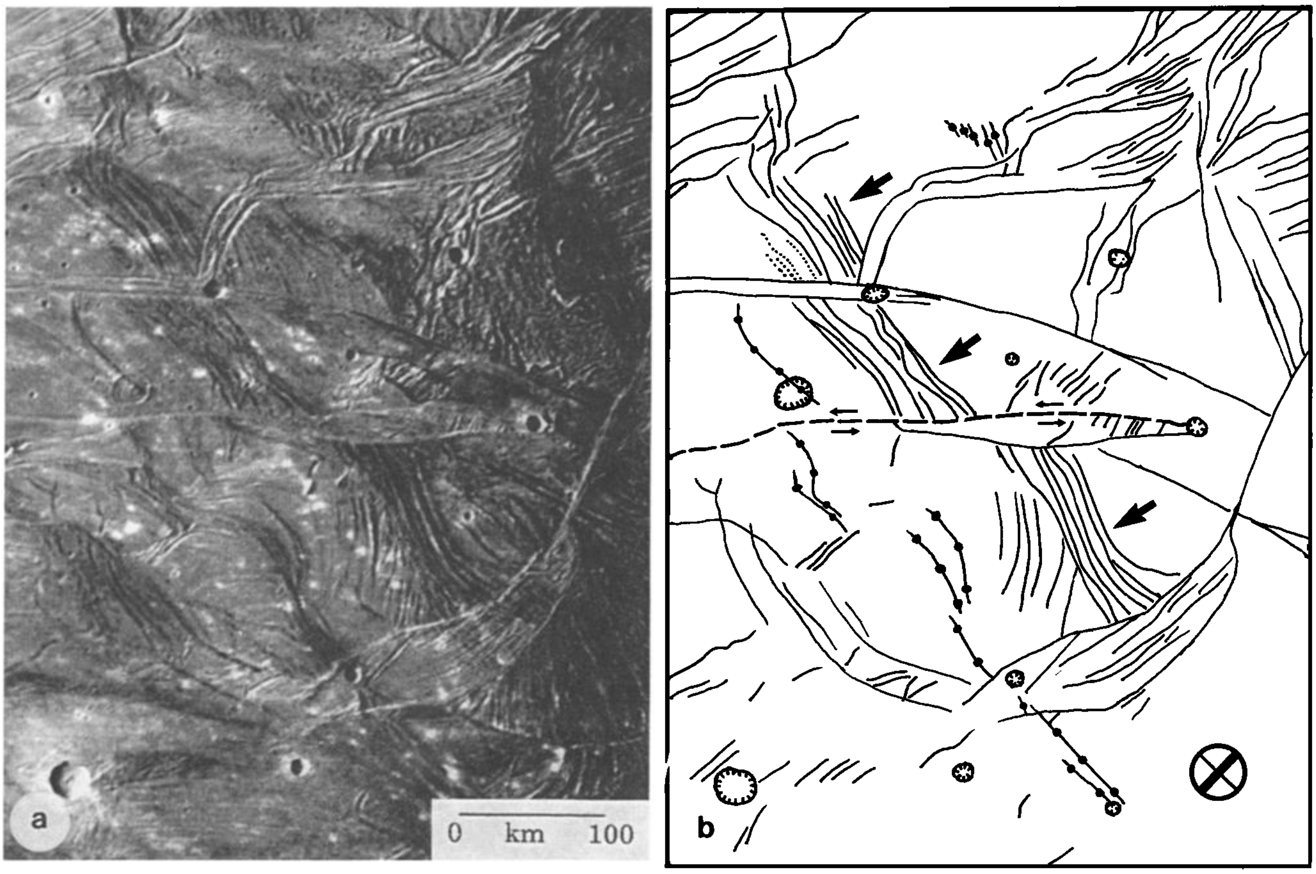

Fig. 19. (*a*) Left-laterally offset feature in Nun Sulci. Note the abundance of northeast oriented grooves, whose orientations are consistent with transtensional structures. North is up. (Voyager 1 image 16405.42, centered near 45°N,320°W.) (*b*) Structural map of same area, showing the north-northwest oriented feature and contemporaneous or younger structures. Criteria used for determining age relations are those described by *Murchie et al.* [1986]. Grooves or troughs are shown as fine lines, ridges as fine lines with heavy dots, and crater rims as hachured lines. Arcuate and radial furrow orientations in the large block of dark terrain immediately to the south (Figures 1 and 17) are shown as heavy and fine lines, respectively, within the circle. The strike-slip fault is shown as a heavy dashed line, and the sense of offset is shown by arrows.

ously offset zones of weakness (Figures 8, 15, and 18). These groove lanes are generally interpreted to be relatively old because they are crosscut by most or all adjacent grooves. Third, groove lanes that crosscut most or all adjacent groove sets also crosscut the proposed shear zones without being observably offset. Strike-slip faults were possibly reused by groove lanes (e.g. Figures 12 and 15), but these groove lanes are not themselves disrupted by shear. Fourth, reticulate terrain is proposed to have been deformed by distributed shear. Crater density measurements of reticulate terrain (S. Murchie et al., submitted manuscript) indicate an age younger than furrows but older than most or all grooves and all large areas of light terrain. Therefore the proposed shear offsets must have occurred subsequent to the formation of major structures confined to dark terrain, during the very earliest stages of grooved terrain formation before the emplacement of virtually all light materials. This timing is consistent with constraints imposed on any large-scale dark terrain disruption by the results of *Zuber and Parmentier* [1984*a*], i.e., that if it occurred it preceded most or all light terrain formation.

Possible Effect of Shear on Grooved Terrain Formation

Grooved terrain formation is believed to have been globally dominated by extension, with individual grooves possibly having formed as graben, tension fractures, or by lithospheric necking [*Fink and Fletcher*, 1981; *Parmentier et al.*, 1982; *Squyres*, 1982]. The commonly suggested driving mechanism, global expansion [e.g., *Zuber and Parmentier*, 1984*b*], would have created uniform tension in the lithosphere but no single preferred orientation of structures. However, regional tectonic processes could have added a deviatoric stress to the uniform tension or could have "prefractured" the lithosphere, in either case imparting a preferred orientation to grooves.

Dominant groove orientations have been observed on in a variety of grooved terrain areas [*Murchie and Head*, 1985, 1986*a*; *Forni*, 1985; *Bianchi et al.*, 1986; *Murchie et al.*, 1986]. At least regionally, these dominant orientations have been interpreted to result from structural control of groove orientations either by furrows or by the lithospheric "structural fabric." Finally, it was noted in this study that orientations of grooves in Figures 2 and 19 are consistent with those expected for transtensional features, this despite stratigraphic relations indicating that any large-scale shear occurred before formation of most grooves.

On the basis of these observations and interpretations, it is proposed that shear offsets of large blocks of dark terrain could have exerted some control over which zones of weakness were reactivated during groove formation. This control may have