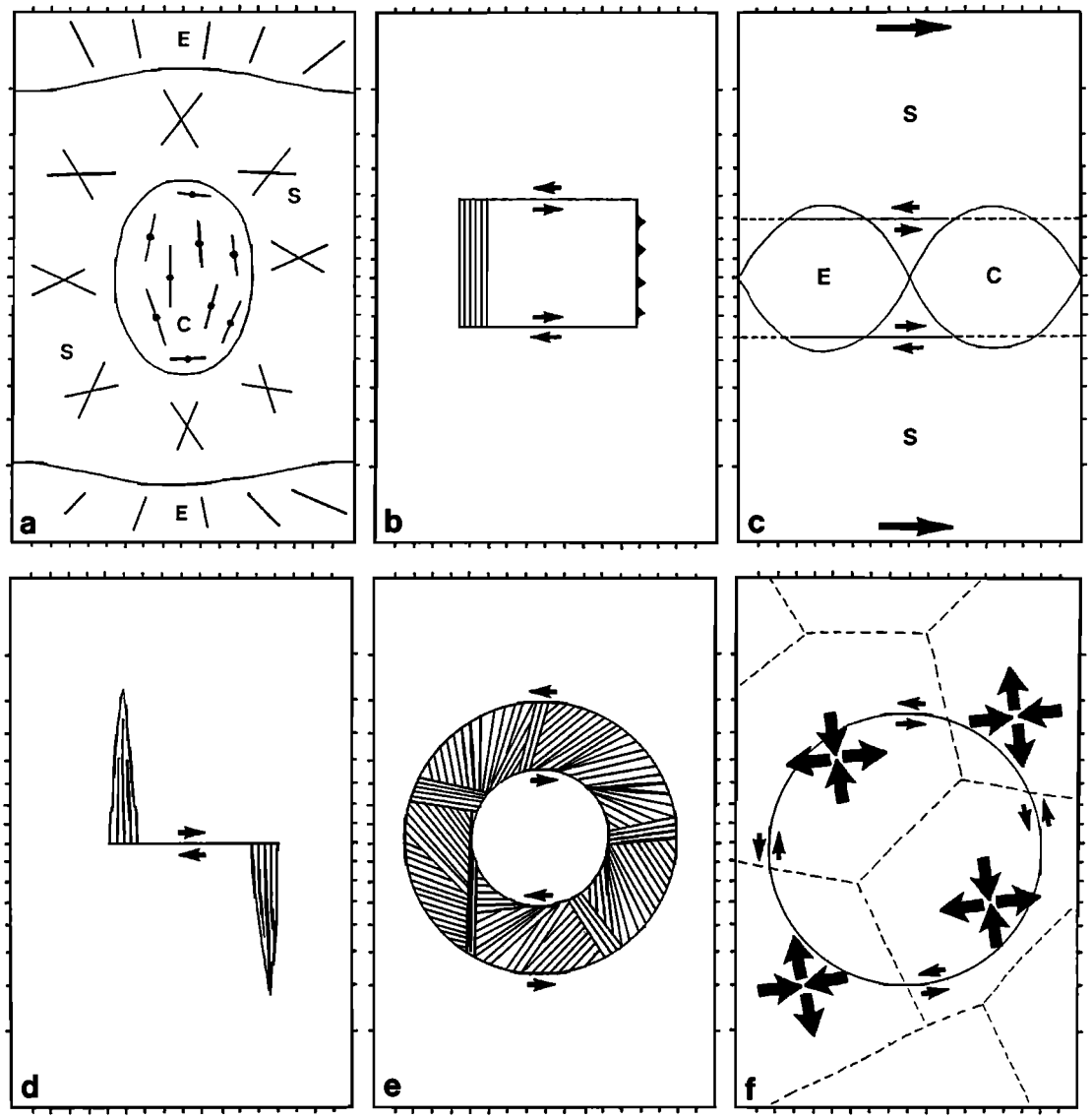

Fig. 20. Mercator maps, from 80°N to 80°S, depicting possible driving mechanisms for shear and their accompanying patterns of regional deformation. Single solid lines or bands of them represent finite extensional features; solid lines crossing at acute angles represent conjugate sets of minor shear faults; solid lines with heavy dots represent ridges; solid lines with arrows showing senses of offset are major shear zones. "E," "C," and "S" denote regions of extensional, compressional, and shear deformation, respectively, which are separated by curved lines. (*a*) Tidal deformation due to orbital recession. Map is of sub-Jovian or anti-Jovian hemisphere. (*b*) Finite lithospheric extension, transform faulting, and subduction. Barbs show upthrust side of subduction zone. (*c*) Nonsynchronous rotation of a mechanically decoupled lithosphere. Dashed lines represent preexisting zones of weakness. Heavy arrows show direction of migration of lithosphere across tidal bulge. Map is of sub-Jovian or anti-Jovian hemisphere. (*d*) Differential extension across a preexisting structural lineament. (*e*) Rotation of circular block of lithosphere, due to nonrandom orientations of surrounding extensional features. (*f*) Rotation of circular block of lithosphere, due to horizontal stresses exerted by nonaxisymmetric mantle convection cells. Heavy arrows show principal stresses over the cells, and dashed lines show the cells' outlines. Circular solid line represents preexisting zone of weakness.

Synthesis of Results and Interpretations

The proposed shear disruption of Ganymede's lithosphere would have occurred after furrow formation, during the earliest stages of grooved terrain formation before virtually all light materials had been emplaced. Proposed offsets occurred mostly across the same global lithospheric "structural fabric" recognized in grooved terrain. Either widespread transtensional fracturing or a continued influence of the shear's driving mechanism may have had a large influence on the regional orientations of subsequently formed grooves. There is also evidence for some transpression, which may be more widespread than is now recognized.

DISCUSSION

Tests for Shear Offsets Using Galileo Imagery

This study summarizes a variety of evidence that major lateral motions were an important part of the deformational history of Ganymede's lithosphere. However, it is emphasized that identification and characterization of shear zones remains tentative, although a preponderance of existing evidence supports the shear zone hypothesis. More observational constraints on Ganymede's geology, such as may be obtained from Galileo images, are required before definitive statements may be made. The following questions are in particular need of being addressed: (1)