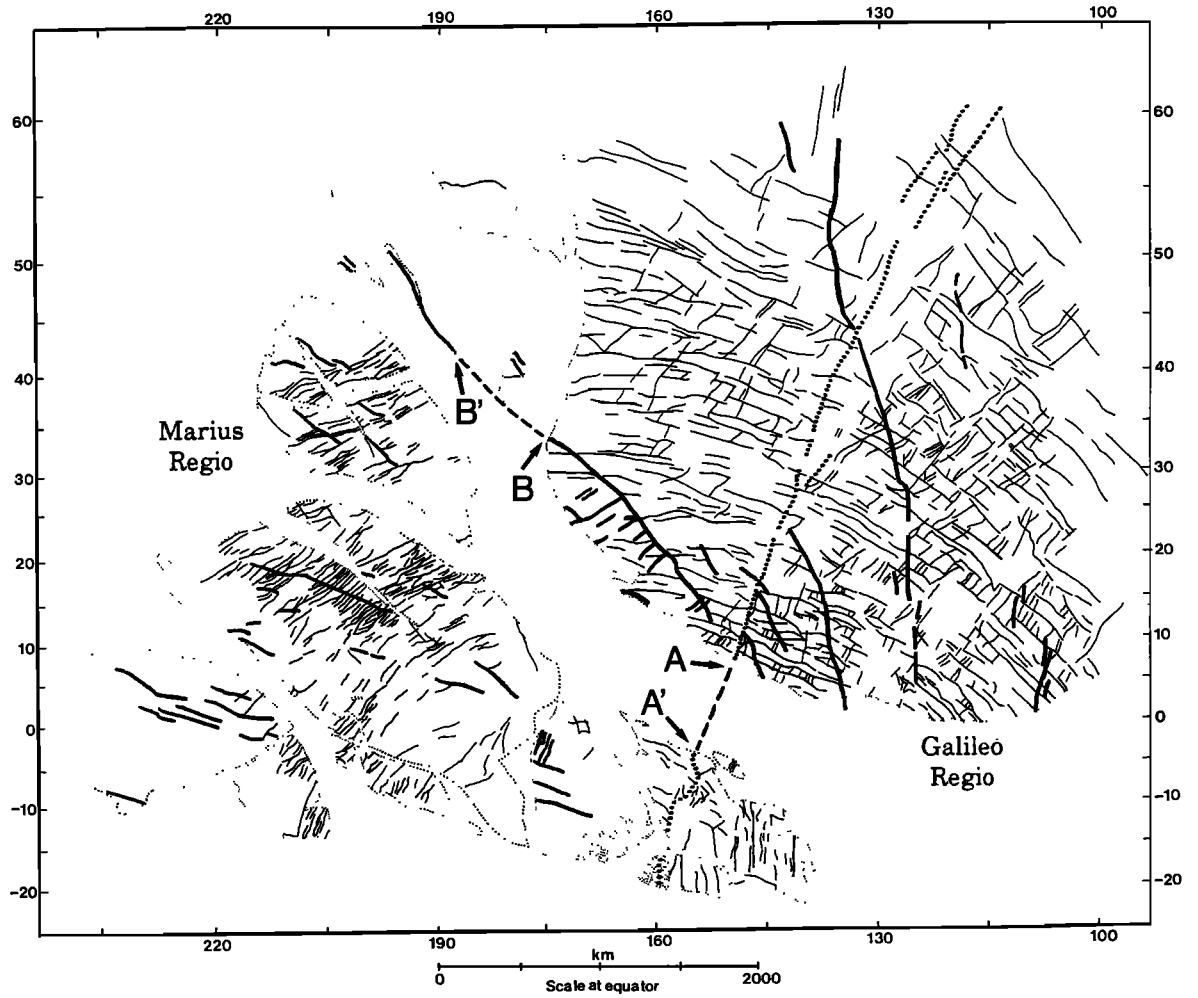

Fig. 2. Mercator map of dark terrain structures in the anti-Jovian hemisphere, after restoration of 500 km of left-lateral offset of Galileo Regio and Marius Regio. Removing the shear restores continuity to the unique postfurrow trough (A and A') and to the structure of system II (B and B'), and restores the system I arcuate furrows to a more concentric configuration around the giant palimpsest.

terrain itself have also been published. In the "prevailing interpretation" of *Passey and Shoemaker* [1982], *Shoemaker et al.* [1982], and *McKinnon and Parmentier* [1986], dark terrain is the upper layer of a differentiated ice mantle, darkened by intermixed meteoritic materials, from which a denser Callisto-like crater population had been removed by viscous relaxation. Alternatively, *Croft and Strom* [1985], *Croft and Goudreau* [1987], *Murchie et al.* [1989*b*], and *Croft et al.* [1990] interpreted dark terrain to consist of multiple blankets of volcanic material that buried an older, more heavily cratered surface. Evidence supporting this latter interpretation includes complex age relations of furrows and dark materials, depleted densities of small craters in areas where smoother patches are observed, and embayment of large craters by dark material.

In this study the origins of dark terrain and its three furrow systems are investigated, and results of this analysis are used to develop a hypothesis for the early evolution of Ganymede. First, multiple, testable models of furrow origin are presented. Second, each furrow system's structure, stratigraphy, global organization, and relationship to regional patterns of dark terrain resurfacing are characterized using geologic mapping and observations and crater density measurements. Third, the models of furrow origin are tested separately for each system using observed geologic features and relations. Finally, the results of these tests are considered in light of theoretical models of convection in spheres, and a hypothesis linking dark terrain geology to Ganymede's early thermal evolution is outlined and discussed.

PROCEDURE

Mapping

Resolvable furrows in both hemispheres were mapped using Voyager 1 and 2 images and controlled U.S. Geological Survey quadrangle maps. Furrow traces and light terrain-dark terrain contacts were digitally compiled and reprojected into Mercator maps of both hemispheres. Where two furrow systems occur together they were separated on the basis of relative age using stratigraphic relations, so that each system could be analyzed separately. Different dark terrain surface units were defined on the basis of the presence or absence of furrows, surface morphology, and single-scattering albedos calculated by *Helfenstein* [1986]. In the anti-Jovian hemisphere, for which higher-resolution images are available, six recognized dark terrain surface units were mapped in detail.

Systems I and II occur in Marius Regio and Galileo Regio, which may have been offset left-laterally by 500 km since