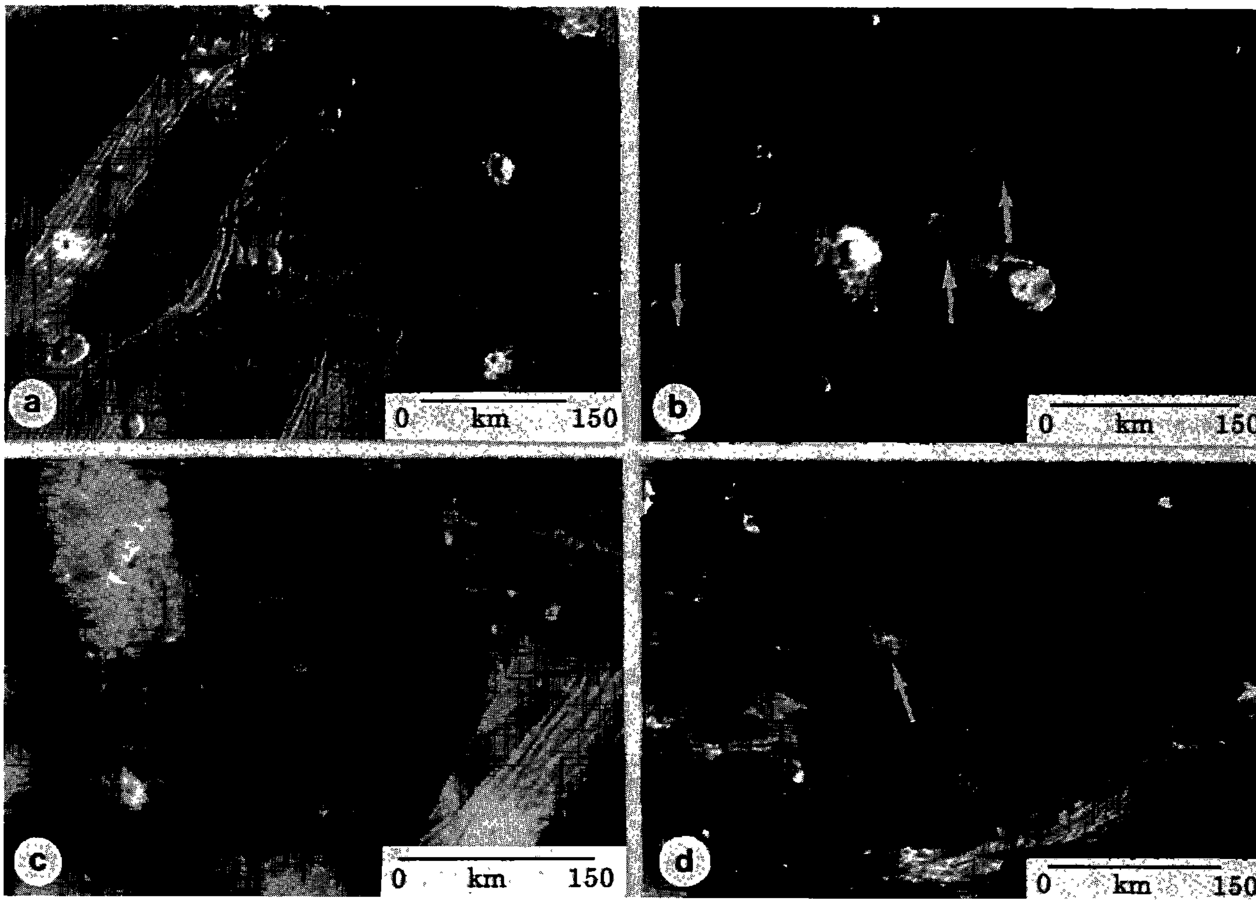

Fig. 10. Images of major dark terrain surface types in the sub-Jovian hemisphere. (*a*) "Eastern Barnard Regio." (Voyager 1 image 16403.52, centered near 23°N,316°W.) (*b*) Southeastern Nicholson Regio. Left arrow shows furrow-cut crater which retains significant relief. Middle arrow marks crater that has been embayed by dark smooth material. Right arrow shows furrow superposed on this smooth material. (Voyager 1 image 16405.12, centered near 14°S,333°W.) (*c*) Barnard Regio. (Voyager 1 image 16405.12, centered near 8°N,354°W.) (*d*) Northwestern Nicholson Regio. Arrow shows the southern portion of the rim of a crater that was infilled by dark terrain resurfacing material and crosscut by an arcuate furrow. (Voyager 1 image 16404.46, centered near 12°S,351°W.)

morphologies, and crater size-frequency distributions of the two surface units, their different calculated crater ages, and the complex stratigraphic relations of furrows and dark material together imply that the dark material and furrows of Barnard Regio and northwestern Nicholson Regio were superposed on the dark material and furrows of an older surface analogous to that observed in "Eastern Barnard Regio" and southeastern Nicholson Regio.

Comparison to models. The dominance in system III of concentrically arranged arcuate furrows, the furrows' locally variable ages relative to dark material, their regionally variable calculated crater ages, and their association with apparently volcanic materials are consistent with four models of furrow origin: model 4, dynamic uplift; model 5, large-scale negative diapirism; model 7, reactivation of parallel tidally generated zones of weakness; and model 8, reactivation of an impact-generated, multiringed structure. The lack of compressional features near the center of the system (and in fact anywhere within it) is inconsistent with simple negative diapirism (model 5), although the portion of the system ≤10° of arc from the center of curvature is buried by younger light materials. Superposed uniform tensional stress due to contemporaneous global expansion could explain the lack of compressional deformation, but it fails to explain the occurrence of partly contemporaneous subradial furrows throughout the system. Reactivation of parallel tidally generated zones of weakness (model 7) would imply that the system is unique; the strong similarity of system III to system I (discussed below) and the presence of the subradial furrows argue against this model. Dynamic uplift (model 4) also fails to explain the occurrence of subradial furrows, and it predicts a concentration of volcanic materials near the center of furrow curvature, which is not evident in the relatively poor resolution images of that area. The one model whose predictions are wholly consistent with the observed characteristics of system III is model 8, reactivation of an impact-generated, multiringed structure by volcanism and endogenic global extension. Although no central, degraded impact feature is observed, the area in which it would occur is entirely buried by younger light terrain.

Interpreted geologic history. The fractures in which system III furrows later developed were created by a tremendous impact at no later than 3.8-4.0 Ga, and were subsequently buried by volcanic resurfacing of large areas. Furrow formation initiated in the fractures but was driven by endogenic global extension. Furrow formation occurred in "Eastern Barnard Regio" on a volcanic surface with a low crater density, but continued long enough in southeastern Nicholson Regio that large craters formed and were crosscut by the furrows.