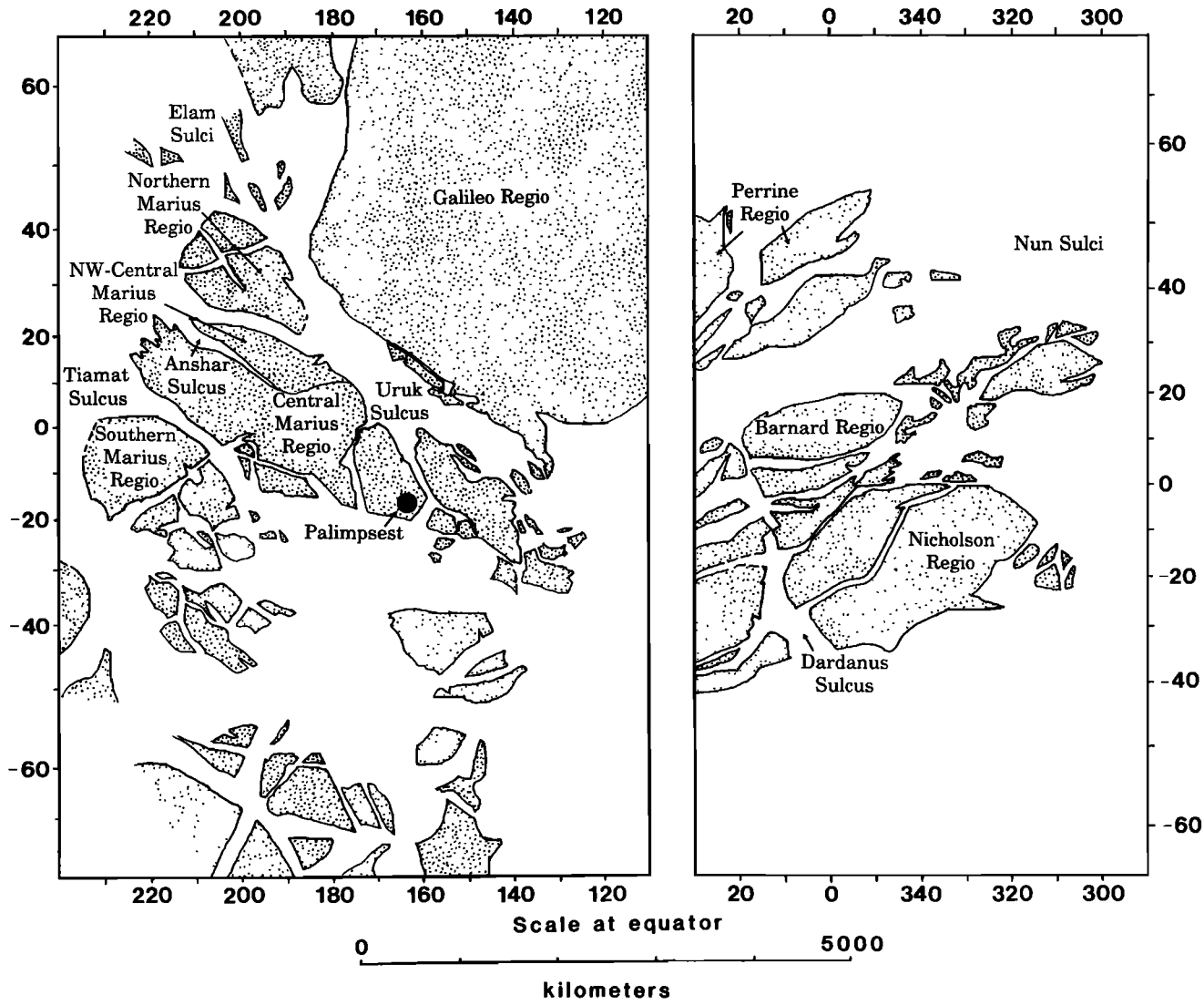

Fig. 1. Geographic features discussed in the text.

have gross similarities, these fundamental differences suggest important distinctions in the histories of the two types of structures.

Several models of arcuate furrow origin have been proposed by various investigators. *Smith et al.* [1979*b*], *McKinnon and Melosh* [1980], *Passey and Shoemaker* [1982], *Shoemaker et al.* [1982], and *Schenk and McKinnon* [1987] have interpreted the system I arcuate furrows to be ring graben formed by a giant impact. *Murchie et al.* [1988] also interpreted system I and system III furrows to have originated as impact-generated, multiringed structures, but inferred that the observed troughs are the result of extensional tectonic reactivation and volcanic modification of the primary impact structures. They cited as evidence for this hypothesis large regional variations in furrow crater age, possibly up to 2-3 x 10^8 years, regional variations in the crosscutting relations of the arcuate and radial furrows, and the observed close association of furrows with deposits of dark smooth material. *Casacchia and Strom* [1984] and *Croft* [1987] also advocated a major role of endogenic tectonism in furrow formation.

A third set of furrows (system II), younger than the system I and III arcuate and radial furrows, has been recognized in the anti-Jovian hemisphere (Figure 4) [*Shoemaker et al.*, 1982; *Casacchia and Strom*, 1984; *Murchie and Head*, 1986*b*, 1987; *Murchie et al.*, 1988]. System II contains linear troughs commonly 500-1000 km long that are arranged approximately radially to a point east of central Marius Regio.

Several recent studies have provided evidence that different classes of light grooved material are quite thin, underwent only minor extension, and inherited older structures. *Schenk and McKinnon* [1985] found that light terrain craters $\geq$10 km in diameter commonly have dark ejecta similar in color to dark terrain, and interpreted this observation as evidence that the average thickness of light material is only 1-2 km. *Golombek* [1982] and *McKinnon* [1982] used groove morphology and the size of the largest dark terrain blocks undeformed by grooves to place an upper limit of about 1% on the total global expansion that accompanied grooved terrain formation. *Murchie and Head* [1985] defined two main classes of sets of parallel grooves, elongate, riftlike "groove lanes," and "grooved polygons" which typically occupy blocks outlined by groove lanes or throughgoing grooves. These investigators also found that on a regional scale grooves are most commonly oriented parallel to one or another of the furrow sets, and they interpreted this observation