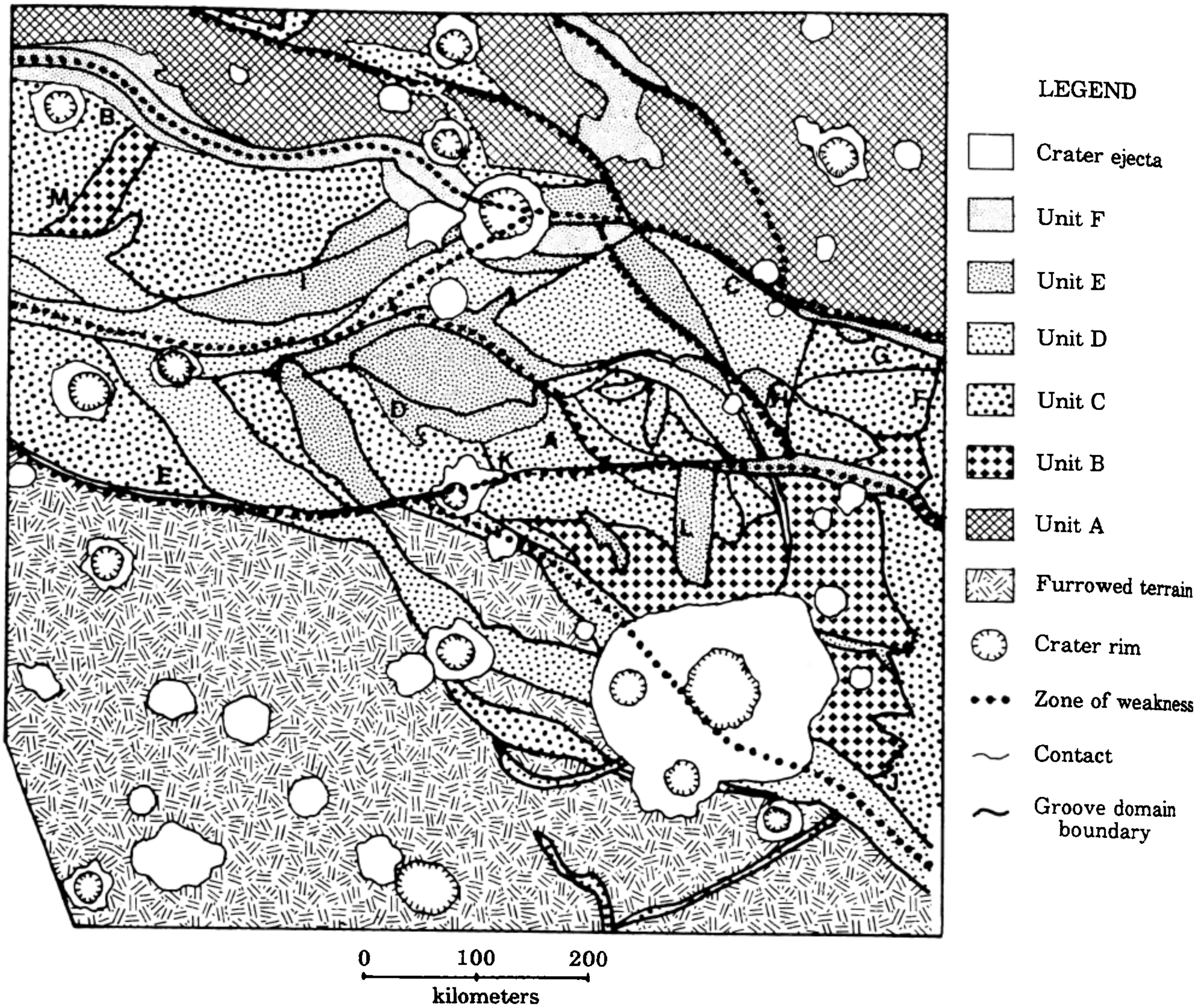

Fig. 9. Map of relative age units in central Uruk Sulcus. Unit A is the oldest grooved terrain type, and unit F is the youngest. Letters "A" through "M" mark sites shown in Figures 3 and 10 and discussed in the text. North is up.

Lithospheric thickness and structural fabric. *McGill and Stromquist* [1979] have shown that spacing of graben is related to the thickness of the elastic layer in which they form. This relationship is applicable to estimating the thickness of Ganymede's elastic lithosphere, because both furrows and many grooves have been interpreted to be graben [*McKinnon and Melosh*, 1980; *Parmentier et al.*, 1982]. In previous studies of the spacing of furrows and grooves, *Fink and Fletcher* [1981], *Golombek* [1982], and *Golombek and Banerdt* [1986] have shown that the elastic lithosphere was thinner at the time of groove formation than at the time of furrow formation. Variations in groove spacing between the groove lanes and grooved polygons support the suggestion, in our model, that younger groove lanes developed in a thickening lithophere. *Grimm and Squyres* [1985] noted that groove spacing within groove sets varies locally by a factor of 2 or more, and suggested that laterally varying amounts of lithospheric thinning may have been responsible for this variation. *Golombek* [1982] also noted that grooves are more closely spaced in grooved polygons (his "tertiary grooves") than in groove lanes (his "primary grooves" and "secondary grooves"), implying a thinner lithosphere during formation of the grooved polygons. This difference in groove spacing is apparent in Figures 5 and 7. These results of previous studies, integrated with determinations of relative age from this study, yield the following history of lithospheric deformation and thickness: (1) furrow formation in a thick lithosphere, (2) formation of grooved polygons in a thinned lithosphere, and (3) formation of groove lanes in a thickening lithosphere.

The results of the geologic mapping also underline the importance of relict zones of weakness in the emplacement of grooved terrain. The dominant groove orientations in both the groove lanes and the grooved and reticulate to hummocky polygons are parallel and perpendicular to furrows in nearby dark furrowed terrain, suggesting that groove orientations are controlled by furrow-related zones of weakness. Lineaments interpreted to be reactivated throughgoing zones of weakness act both as limits to the propagation of groove sets in grooved polygons and as preferred sites of groove lane formation. These lineaments locally are parallel to furrow sets, but on a regional scale have northwest-southeast orientations regardless of which of the furrow sets they parallel. This orientation is consistent with that of a global system of relict northwest-southeast and northeast-southwest zones of weakness distinct from furrows, recognized by *Thomas et al.* [1986] on the basis of the orientation of