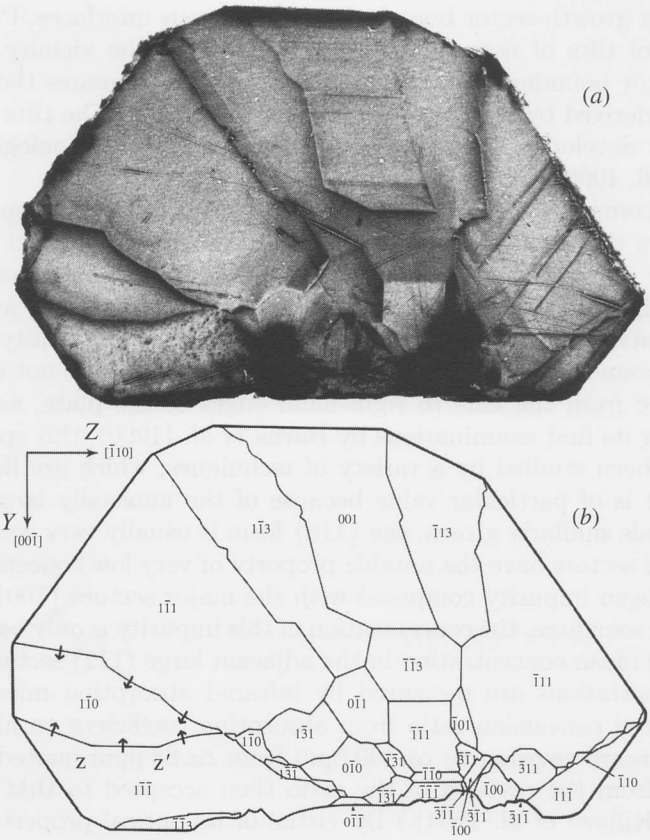

Figure 1. Synthetic diamond crystal plate cut and polished parallel to (110), 0.7 mm in thickness, overall dimensions 5.0×3.2 mm^2. (*a*) Synchrotron X-ray back-reflection topograph of the surface indexed (110). Reflecting plane $(33\bar{1})$, $2\theta_B = 135°$, dominant wavelength 0.151 nm. Plane of incidence vertical, viewing direction of the crystal makes *ca.* 9° with the surface normal. Specimen-to-plate distance 60 mm. Differences between this image and that recorded with CuKα_1 radiation (Lang *et al.* 1991, fig. 6*a*) arise from use of synchrotron radiation in the present case and some change in the diffraction geometry. Extra diffracted intensity (extra darkness on image) arises from local deformations, principally at growth-sector boundaries, inclusions large and small, burring around the plate periphery, and occasional surface scratches. (*b*) Map of growth sectors intersected by the polished (110) surface imaged in (*a*). In each sector, the labelling identifies the local direction of growth, normal to the facet specified by the crystallographic indices. The right-handed Cartesian axes used in the present work take the plate-normal [110] as the positive X-direction; the crystallographic directions of the Y- and Z-axes are identified. The $(1\bar{1}0)$ growth sector has surface dimensions approximately 0.7 by 1.7 mm. Arrows crossing the $(1\bar{1}0)$ growth-sector boundaries schematically indicate the local direction of tilt (dip) of near-surface (110) lattice planes into the body of the $(1\bar{1}0)$ sector. The boundary segment between the letters z and z′ is very close to (001) orientation and was the focus of the X-ray reticulographic measurements to be described in part II.

as those performed on the single-crystal plate shown here in figure 1 (Lang *et al.* 1991; Lang & Pang 1998). In the work now reported, part I analyses the elastic problem outlined above and includes calculations that can provide guidance concerning possible errors in lattice-parameter measurements on plate-shaped specimens con-