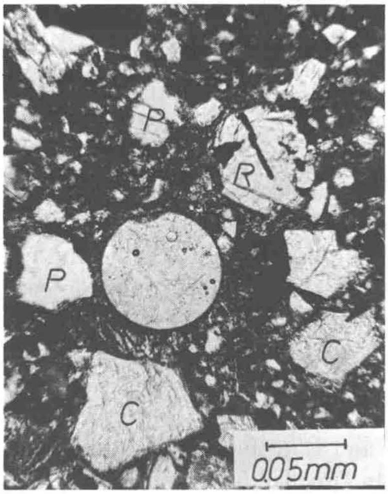

Fig. 1. Breccia with fragments of clinopyroxene (C), plagioclase (P), ilmenite (black), basaltic rock (R) and a yellow-brown glass-sphere embedded in a fine grained matrix. Plane light. (10027-11—M55a).

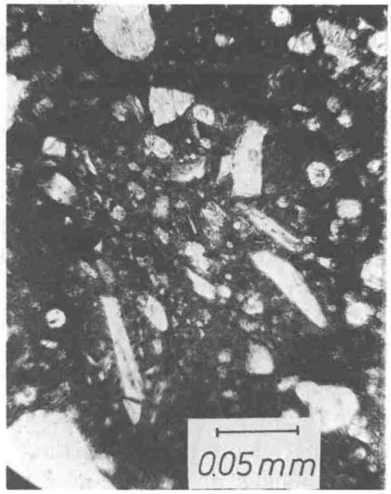

Fig. 2. Vesicular breccia with a glassy matrix including an older breccia fragment of the same type. Fragments and spheres of glass are absent. Plane light. (10085-25—M9).

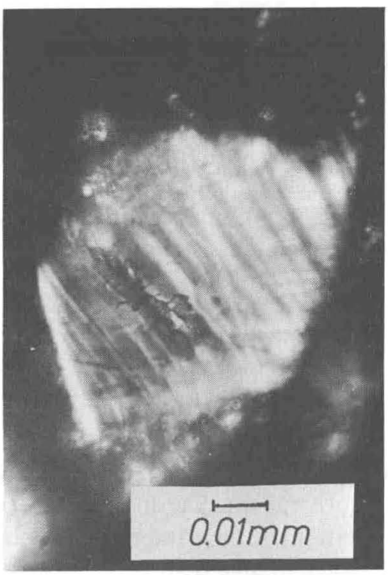

Fig. 3. Deformation lamellae in plagioclase. Crossed nicols (10059-41).

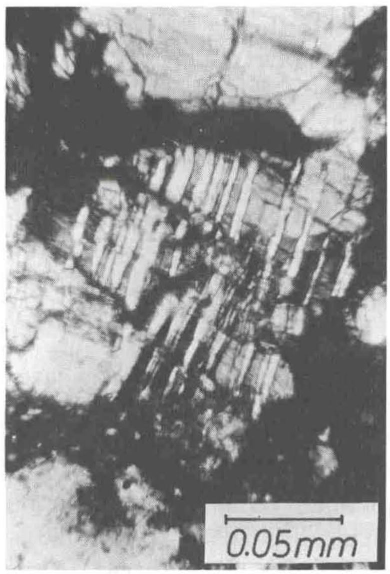

Fig. 4. Deformation lamellae in clinopyroxene of a shocked basaltic rock. Areas appearing dark are diaplectic plagioclase glass. Crossed nicols. (10085-25—M13).

The mineralogical composition of the grain size fractions is not uniform. Between 0·125 and 0·020 mm feldspar decreases, pyroxene and glass increase with decreasing grain size.

SHOCK EFFECTS

Deformation structures

(a) *Plagioclase*. Shock-induced deformation lamellae of low refractive index and low or no birefringence are frequent in plagioclase (<55 mole % An) from breccias of terrestrial impact craters (several papers in FRENCH and SHORT, 1968). In these rocks plagioclase grains with such lamellae always coexist with partially or completely isotropic plagioclase. Shock experiments carried out in this Institute with andesine and labradorite bearing rocks have shown that these lamellae are produced in the peak pressure range between about 250 and 300 kbar.

In two fragments of basaltic rocks from lunar soil (10085-25) we have found transition zones between regions with birefringent and isotropic plagioclase. Contrary to terrestrial shocked plagioclase no deformation lamellae have been observed in these rocks.

In soils and breccias we have very rarely found isolated plagioclase grains with deformation lamellae (Fig. 3). In these grains the regions between the lamellae show a decrease of birefringence and refractive index and locally total isotropization. Measurements on two grains (9 lamellae) have shown that the lamellae are not parallel to low index planes. The chemical composition of these plagioclase grains with deformation lamellae has not yet been determined.

The reason for the scarcity of plagioclase with deformation lamellae in the Apollo 11 samples is not yet understood. One reason may be the high anorthite content of lunar plagioclase. The terrestrial observations and experimental results refer to plagioclases with much lower anorthite content.

(b) *Clinopyroxene*. Some clinopyroxene fragments from breccias and soil as well as grains in shocked crystalline rocks contain one, seldom two sets of lamellae. They differ in optical orientation from the host crystal (Fig. 4), but seem to have the same refractive index and birefringence. Their average thickness is about 2–10 μm. Most grains contain only a few thin lamellae. In some grains, however, the thickness of lamellae equals their separation from one another. The stereoplot of Fig. 5 shows the poles of 14 lamellae from 12 grains. In two grains (No. 1 and 6; in Fig. 5) additional closely spaced planar structures have been observed which are nearly perpendicular to the lamellae. They are not resolvable under highest magnification and may be submicroscopical lamellae.

Undulatory extinction and mosaicism limited the accuracy of measurement. In spite of this uncertainty it is obvious that the majority of lamellae and planar structures are not parallel to {001} or {100}, the usual orientations of twin and exsolution lamellae of rock forming clinopyroxene. Also in static and dynamic deformation experiments lamellae with orientations other than {100} and {001} have not yet been observed. In diopside twin lamellae parallel to {100} and {001} have been experimentally produced by static deformation (RALEIGH and TALBOT, 1967) and parallel to {001} by shock (SCLAR, 1970).