PARTICLE TRACK DATING OF MECHANICAL EVENTS, R.L. Fleischer, H.R. Hart, Jr., and G.M. Comstock, General Electric Research and Development Center, Schenectady, New York 12301.

"Dating" of mechanical events by deformation-induced erasure of particle tracks is made possible by virtue of the fact that natural, fine scale plastic deformation can fragment pre-existing charged particle tracks in lunar crystals, as sketched in Figure 1. Many examples of such effects have been identified in electron micrographs of etched lunar soil grains. In one case, sample 12028, 111, 30.3, 2, slip lines cover the field of view and are correlated with the track lengths: Where the slip spacing is relatively wide ($\approx$0.7 microns) the tracks are typically $\sim$0.7 microns long; where the slip spacing is reduced to $\sim$0.07 microns, the track length is correspondingly less. In the light microscope (Leitz Ortholux at 1350X magnification) no tracks are visible in the region of fine slip, and recognizably short tracks are just discernible in the region of coarser slip. Superimposed on the approximately $3 \times 10^8/cm^2$ short tracks are $\sim 3 \times 10^5$ longer tracks that are uniformly distributed with no differences between the regions of fine and coarse slip. These longer tracks presumably correspond to irradiation of the sample by cosmic rays subsequent to the event which fragmented the

original tracks and hence should allow the deformation history to be inferred.

Since deformation markings are abundant features in lunar soil, their effects provide a powerful tool for constructing deposition histories for stratified soil samples. When many crystals are examined in a given soil layer, it is likely that several of these have been "reset" by the impact that laid down that layer. If we assume that the lowest track density observed in a layer came from near the bottom of that layer, we can compute a surface exposure time. For the long Apollo 12 core (12025 + 12028), we compute intervals ranging from 2 to 60 million years for various sublayers, with an accumulated time of 220 million years for samples for which Arrhenius et al[1] inferred a 310 million year surface exposure. The difference may be attributed to Arrhenius et al's using the lower quartile of their track density distribution instead of the lowest track density observed. Their assumption of no predepositional surface residence for these samples yields a higher age. A similar analysis, assuming that Apollo 11 core 10005 is composed of three layers, gives an integrated surface age of 40 to 75 million years for its 10.5 cm depth.

1. G. Arrhenius, S. Liang, D. Macdougall, L. Wilkening, N. Bhandari, S. Bhat, D. Lal, G. Rajagophalan, A.S. Tamhane, and V.S. Venkatavaradan, Geochim. Cosmochim. Acta Suppl. 2, 3, 2583 (1971).

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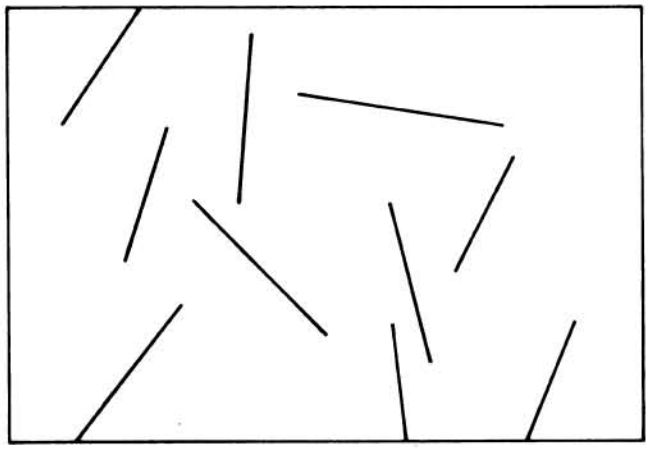
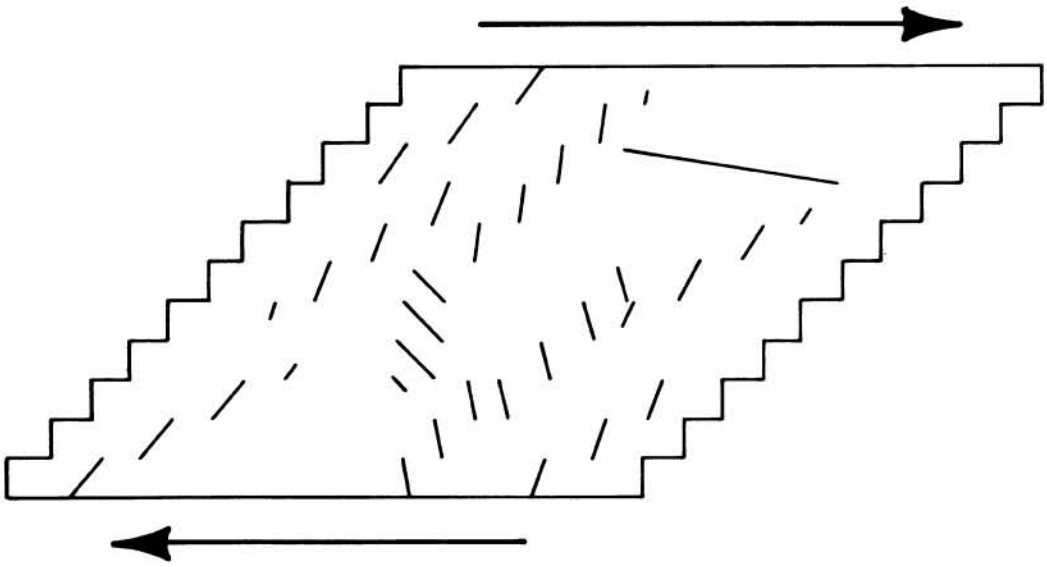


CRYSTAL WITH TRACKS



CRYSTAL WITH TRACKS AFTER DEFORMATION