NOTES AND NEWS

DESCRIPTION OF AN ABNORMAL SURFACE STRUCTURE OF A CRYSTALLINE QUARTZ LENS

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ABSTRACT

An investigation of the cause of an unusual background effect on some photomicrographs taken with an ultra-violet microscope showed that the effect was caused by stepwise discontinuities of the convex surface of the bottom element of the particular crystalline quartz ocular used.

In the course of making some photomicrographs by the use of an ultra-violet microscope an unusual background effect on the finished negative was noticed. This consisted of a series of zig-zag lines, roughly parallel to each other, covering closely the whole field. Figure 1 shows this effect clearly. After checking through the optical system, the cause was isolated in a particular $7X$ crystalline quartz ocular used at the time of making these photomicrographs.[1]

With the cause of this background effect found to be in the ocular, its location was placed as at the bottom lens element, that being the only place it could be sufficiently in focus to be seen clearly without the use of an auxiliary lens. On inspecting the convex surface with incident illumination and the lens tilted so that the reflection of the light source was visible, surface irregularities were seen through a $10X$ magnifier. The shape of these irregularities is shown in figures 2 and 3. Referring to figure 1 again it will be noticed that these irregularities cover the whole surface in a rather regular pattern.

Although figures 2 and 3 give some idea of the relief of this formation a more complete inspection was necessary. The particular lens element was mounted on a universal stage under a binocular microscope.[2] With this arrangement, it was possible to study the third dimensional character of the discontinuities. This was

[1] While isolating the cause of these lines it was found that the type of illumination was very important. The beam of light used had to be reasonably free from "skew" rays, i.e., had to consist of central illumination. This condition obtained in the ultra-violet microscope.

[2] Twin lamps were placed in such position that a lamp reflection from the convex surface was visible in the center of the field of each ocular of the binocular microscope.

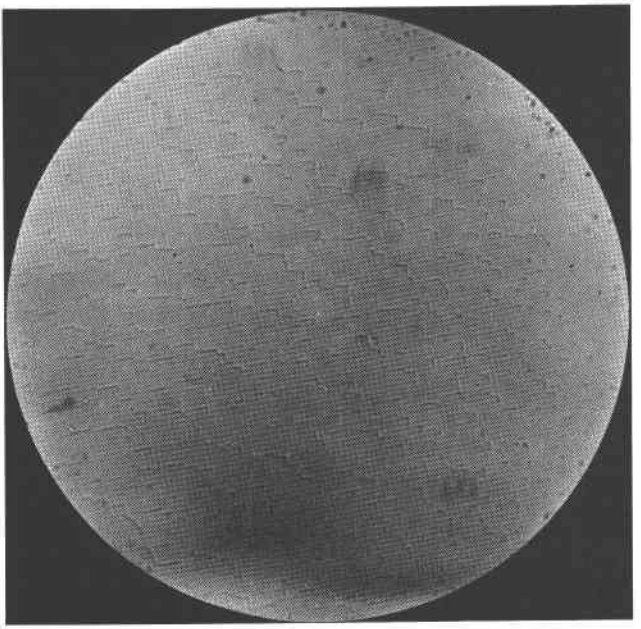

FIG. 1. Made with the ocular in its usual place in the microscope tube and the negative exposed as though making a photomicrograph with the use of illumination through a substage condenser. The light source consisted of a concentrated filament lamp focused at infinity.

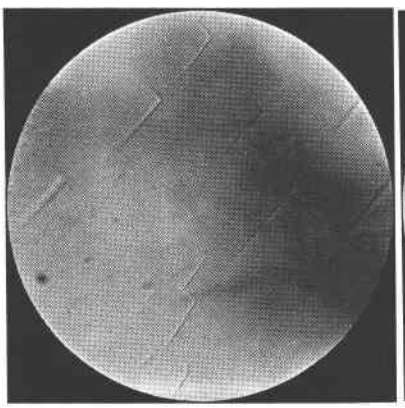

FIG. 2

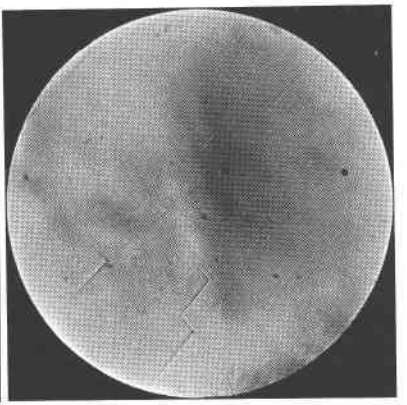

FIG. 3

Made with the lens tilted on the stage at such an angle that the image of the reflection of the lamp used in incident illumination filled the field of the ocular. Light from a condensed filament lamp was focused on the surface being photographed. Magnification 63*X*.

determined by its appearance to be a step and not a groove. Revolving the stage 180° changed the character of the image as it should for a step but not for a groove. As a check on this and to show the direction of the steps a traverse of the surface was made starting at one edge and passing across to the opposite edge in a direction at right angles to the general line of the zig-zags. Each step was tested by raising the microscope and observing the direction of movement of the "Becke-like" line according to the method of Short.[3] The conditions of reviewing each step were identical and in each case the bright line moved in the same direction indicating

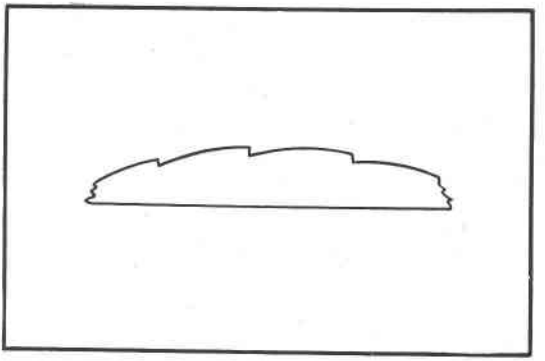

Fig. 4. Cross section of lens showing step-wise discontinuities.

that each step was in the same direction as every other step. Another check was made by repeating the operation on some of the steps with the stage and lens rotated 180° when the steps were again found to be all in the same direction and the reverse of that observed before being rotated. It should be noticed also that figure 1 shows all the lines as bright on the same side. From this it was concluded that the surface was as indicated by figure 4.

Additional data of an optical nature were obtained. By means of a petrographic microscope an optic axis figure was obtained and showed that the axis of the lens did not quite coincide with the optic axis. From observations both with convergent and parallel polarized light the crystal behaved as if quite normal and single and showed, as far as could be ascertained, an absence of twinning.

[3] Short, M. N., Microscopic Determination of the Ore Minerals: *U.S.G.S. Bull.* **825**, p. 37.

A possible explanation of these discontinuities is seen in the *lineage structure* of a crystal as described by Buerger.[4,5] This *lineage structure* is present in quartz crystals but just how the grinding of the lens would produce this irregularity is not clearly apparent to the writer although the zone of weakness caused by this structure would produce a location for these discontinuities. Measurements of the dimensions of the spacings of the steps show them to be of the order of magnitude of 0.1 mm. both between adjacent lines and between zig-zags along separate lines. These measurements agree somewhat with the dimensions of "Lineages."[5]

A combination of causes is the probable reason for these steps. It is probable that the blank lens was cut from an improper position, and perhaps from a physically imperfect crystal. It is possible also that the grinding of the lens might have been imperfect by performed in that instead of the proper random directions of stroking, the strokes might have been at least approximately unidirectional in character. Such a condition of grinding acting on the zones of weakness produced by "lineage boundaries" might result in action similar to that performed by glaciers passing over firmly anchored boulders or projecting rock masses, resulting in a smooth curve on the side of approach and a sharp step downward on the lee side.

Before concluding the author wishes to acknowledge the generous help given him by Prof. M. J. Buerger in supplying crystallographic data and information.

DISCUSSION OF THE PAPER "HEAVY MINERALS IN THE SYENITES OF PLEASANT MOUNTAIN, MAINE"[1]

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During the course of a study of a syenite stock W. F. Jenks examined the heavy minerals for the purpose of determining the characteristic heavy minerals of each syenite type, the variations in heavy minerals, the degree of constancy within a rock type, and the usefulness of this method of work in the correlation of

[4] Buerger, M. J., The Significance of "Block Structure" in Crystals: *Am. Mineral.*, vol. **17**, pp. 177–191, 1932.

[5] Buerger, M. J., The Lineage Structure of Crystals: *Zeit. Krist.*, vol. **89**, pp. 195–220, 1934.

[1] Jenks, W. F., Heavy Minerals in the Syenites of Pleasant Mountain, Maine: *Am. Mineral.*, vol. **19**, pp. 476–479, 1934.