

Newhik  
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HIGH ALTITUDE OBSERVATORY  
of the  
University of Colorado

Solar Research Memorandum No. 75

From: Gerard Wlerick

Subject: Solar granulation studies. Effect of the photographic printing.

W. A. Miller has suggested that visual measurements of granule diameters yield different results when they are made on the original negative or on prints (obtained by contact or by enlargement). Following a suggestion of Miller and W. O. Roberts, G. W. Curtis and I began last year a series of measurements with the H.A.O. microphotometer to see if microphotometric tracings of the original and of the prints show, or do not, show the same structure. The results, reported in Solar Research Memo No. 45, were not decisive. As we explained in the conclusion of that memo, the microphotometer was not, at that time, sensitive enough to give all the information contained in the original plate. A large part of this information was lost in the electrical noise of the instrument.

I resumed the same study in November 1955 under better experimental conditions. Four improvements were made:

- (1) W. A. Miller provided me with an original plate having a greater contrast than the plate that we had used before.
- (2) Improved comparison wedges for the microphotometer had been prepared meanwhile by D. E. Billings and R. Cooper.
- (3) The time constant of the instrument was greatly increased by R. H. Lee.
- (4) I succeeded in scanning practically the same path on the original plate and on a contact print.

The plate used was taken by W. A. Miller on the 11th of August 1955. The contact print was made on Kodalith type 2 by R. Cooper who used Dektol as developer. To obtain the same path, special marks were put on the edges of the original that reproduced nicely on the contact print.

Procedure:

- (a) I used the same comparison wedge in the microphotometer for the original and the print. As the print is quite contrasty, it would have been better to use a more contrasty comparison wedge for it but none was available at that time.
- (b) Thus to obtain about the same deflections for the negative and for the print, I set the instrument at its maximum sensitivity for the original and at its minimum sensitivity for the print. Still the deflections were a little bit larger for the print.

(d) The slit used was the same in each case: 18 microns x 24 microns, corresponding to 225 km x 300 km on the sun. In the case of the contact print, made on Kodalith, one must verify that the grain of the plate does not show on the tracing with such a small slit. For this verification, I made with the help of Robert Cooper a test plate uniformly exposed and developed also in Dektol. I found that local differences in densities between successive maxima and minima due to graininess were of  $\approx 0.02$  when Dektol was used as developer (they are noticeably larger with D19). The graininess was easily detectable when the instrument was used at maximum sensitivity, while it disappeared completely when the sensitivity was set minimum, as it was actually for the contact print of granulation.

(d) The original plate being scanned at maximum sensitivity, I used a time constant large enough to cut down the noise due to the electronics. The same time constant was used for the print.

(e) The length scanned was equivalent to about 625,000 km on the sun. The speed of the recorder was not exactly but very nearly the same for the original and the print: one cm of record corresponds to  $\approx 2''$  of arc or 1450 km on sun.

#### Results:

All the details of the original plate reproduced very nicely on the contact print, as it appears on Figure 1 which represents only one small part of the records. The agreement was as good on the totality of the length scanned.

I turned one of the records upside down and checked that the features matched quite well with those of the other tracing.

Thus it does not seem that the printing process introduces much distortion.

245 maxima of brightness were visible on both records. That corresponds to a "cell" size of 2,550 km or 3.50 of arc. According to the definition of Plaskett that corresponds to a "granule" size of 1.75" of arc, which does not disagree with some of the values quoted in literature. In Solar Research Memo 45, Curtis and I had found a much smaller value with the contact print. We were working at that time with a rather high sensitivity for the contact print that we used and the grain was apparent: we made then the mistake of counting some grains maxima of brightness.

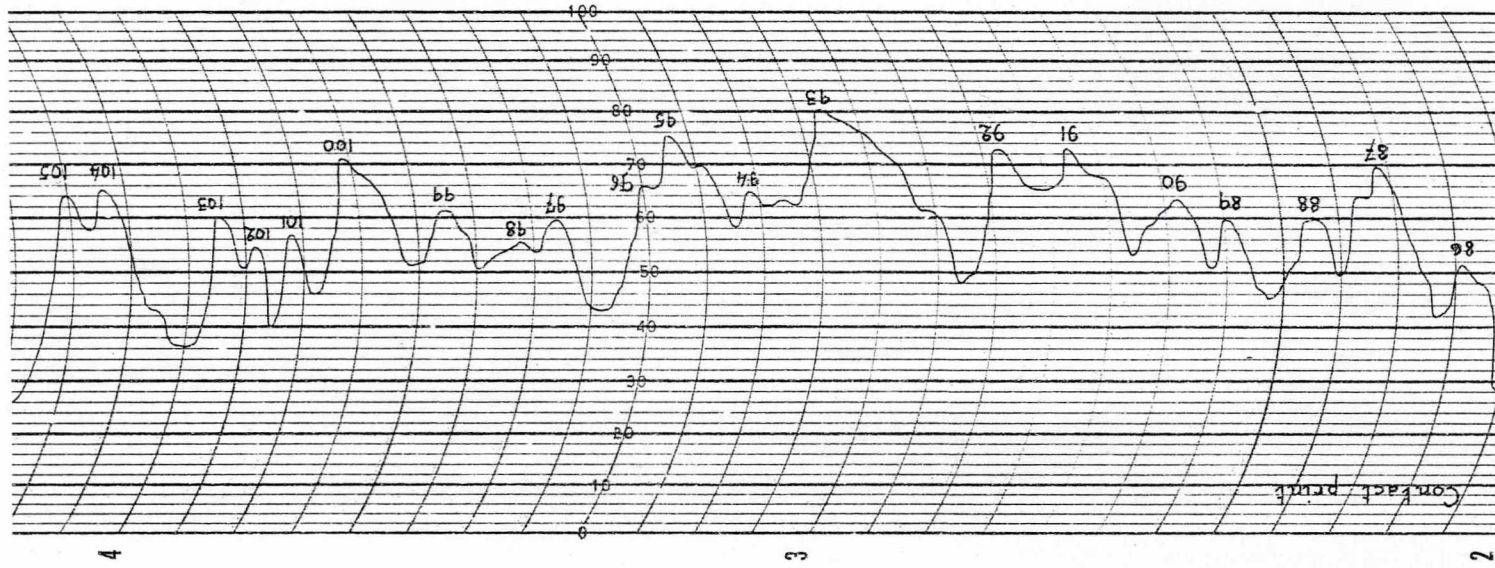
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Figure 1 attached.

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Figure 1

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