CHAPTER IV

EXPERIMENTAL DETAILS

IV.1 Detection of Ground Level Cosmic Ray Stars by Nuclear Emulsions under Various Thicknesses of Lead Absorbers.

Nuclear emulsion plates used in this research were of the type Ilford K2, 400 microns thick, with date of manufacture 14 November 1962. The size of a plate is 7.5 x 5.0 cm^2. The area scanned for each plate is 6.0 x 3.5 cm^2, smaller than the size, but is at middle of the total area to avoid the unequal thickness and distortion near the edge of the emulsion.

The total number of the exposed plates was 20, in which two of them were used as background plates, and were developed on 29 April 1963. The rest of the plates were divided into three groups of 6 plates each. The plates of each group were exposed for 76 days under different thicknesses of lead absorbers up to 10 cms. The three plates of each group was under 0,1,2,5,8 and 10 cms of lead.

IV.2 Arrangement of Exposing.

The exposure was arranged as follows. The plates were wrapped with black paper and then wrapped again with soft paper. Then, the plates were placed vertically inside a zinc box of thin wall. Care must be taken to maintain the plates fix in the zinc package. A screen , 3 cm thick, build up of lead bricks was placed on every side of the plates.(See Fig.X). The plane AB of the plates were placed along north-south direction. The thickness of the absorber, t , was varied from 1 cm up to 10 cms.

IV.3 Developmental Process.

The method of development used is based on temperature development of Dilworth*, Occhialini and Payne by using "Brussels Amidol" developer as follows.

1) Soaked in distilled water at 5°C	75 min
2) Soaked in "Brussels Amidol" developer	75 min
3) By using "hot stage method" the developing agent was warmed up to 20°- 25°C	60 min
4) Cold down in refrigerator to 5°C	30 min
5) Transferred to stop bath at 5°C	60 min
6) Wash in slow running water at 5°C	60 min
7) Fixing at 10°- 15°C	12 hr
8) Wash in slow running water at 10°- 15°C	24 hr
9) Soak in 2% glycerine	45 min
10) Dry	1 week

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* Dilworth,C.C., Occhialini,P.S., and Payne,R.M. Nature 162,102(1948).

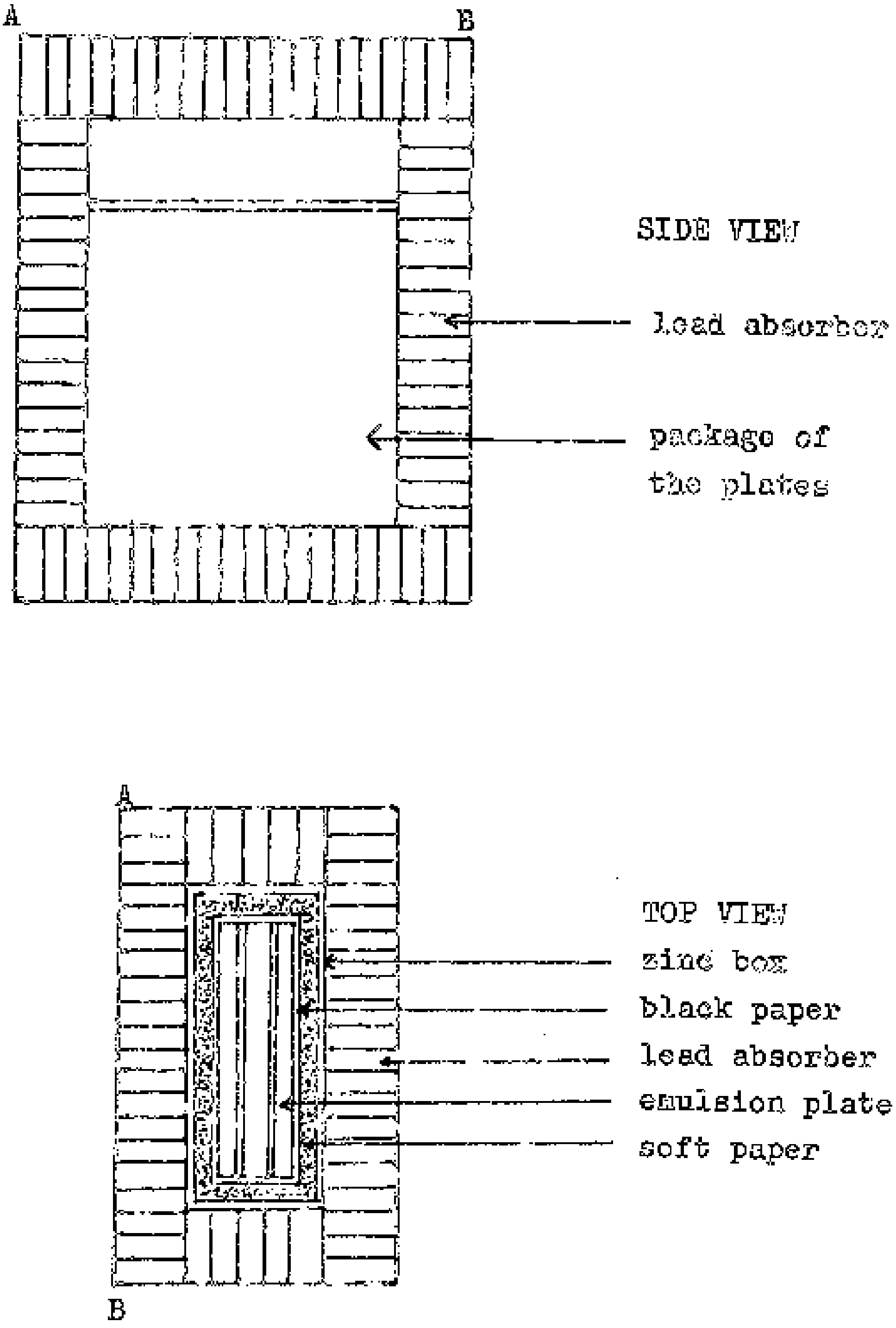
A
B
SIDE VIEW
lead absorber
package of the plates
A
B
TOP VIEW
zinc box
black paper
lead absorber
emulsion plate
soft paper

Fig.X Shows three plates of each group under lead absorber at all sides.

IV.4 Optical Instrument.

The microscope used in this research is Cooke-Troughton Nuclear Emulsion Microscope type M4000. A low power objective of x10 magnifications with a pair of x15 compensation eye-pieces were used in the scanning. To analyse the individual tracks of stars , we used a higher power objective of x40 magnifications.

The plate was placed upon the stage of the microscope and was brought into focus by the motion which raised and lowered the stage. At first we must adjust the microscope in a correct setting by considering illumination, sharpness of the image, and can be able to scan deeply into the lowest level of the emulsion. The microscope must be placed on an unvibrating place to avoid the vibration during the scanning.

IV.5 Scanning Procedure.

The stage of the microscope can be moved along X and Y perpendicular directions by means of the two screw gauges below the stage . By this way, we can scan the plate along X and Y axis. To scan deeply into the emulsion, i.e., Z axis, we use the fine focusing adjustment screw gauge which move the objective up and down. The scale of X and Y controlling screw gauges can be read in millimetres with the vernier scales. The fine focusing adjustment screw gauge can be read in microns, i.e., 1 division to 1 micron. The co-ordinates of events were recorded to avoid repeating the same event more than once. The plate was scanned by fixing the X-axis to a fix point and vary the Y-axis. We must scan along X-axis of every field of view. All the plates were scanned with great care in order to avoid the loss of the stars.

The number of 2-prong stars, 3-prong stars and so on were counted. The image of big stars were sketched. The volume and area scanned of each plate are 0.69 cm^3 and 21 cm^2 respectively. The results are shown in table 1 to 9 in the next chapter.