Chapter III

EXPERIMENTAL PROCEDURE

Exposure Arrangement

The nuclear emulsion plates of the type Ilford K2, 400 micron thick and of the size 7.5 X 5.0 cm^2 were exposed to cosmic rays at the Physics Building I, Chulalongkorn University, for 78 days from January 29, 1963 to April 16, 1963, under lead absorber of thickness 0, 1, 2, 3, 5 and 10 cm. The total number of plates was 18. Under each absorber there were three plates. Each group of three plates was wrapped with black paper and wrapped again with soft paper and then was placed inside a thin walled zinc box. The surfaces of the plates were placed vertically and along east-west direction. The arrangement of the plates and absorber are shown in Fig I. The direction of AB is along the north-south direction.

Development

All plates were developed on April 16, 1963, under the temperature method of Dilworth et al.[1] Unfortunately, a plate without absorber was defective.

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

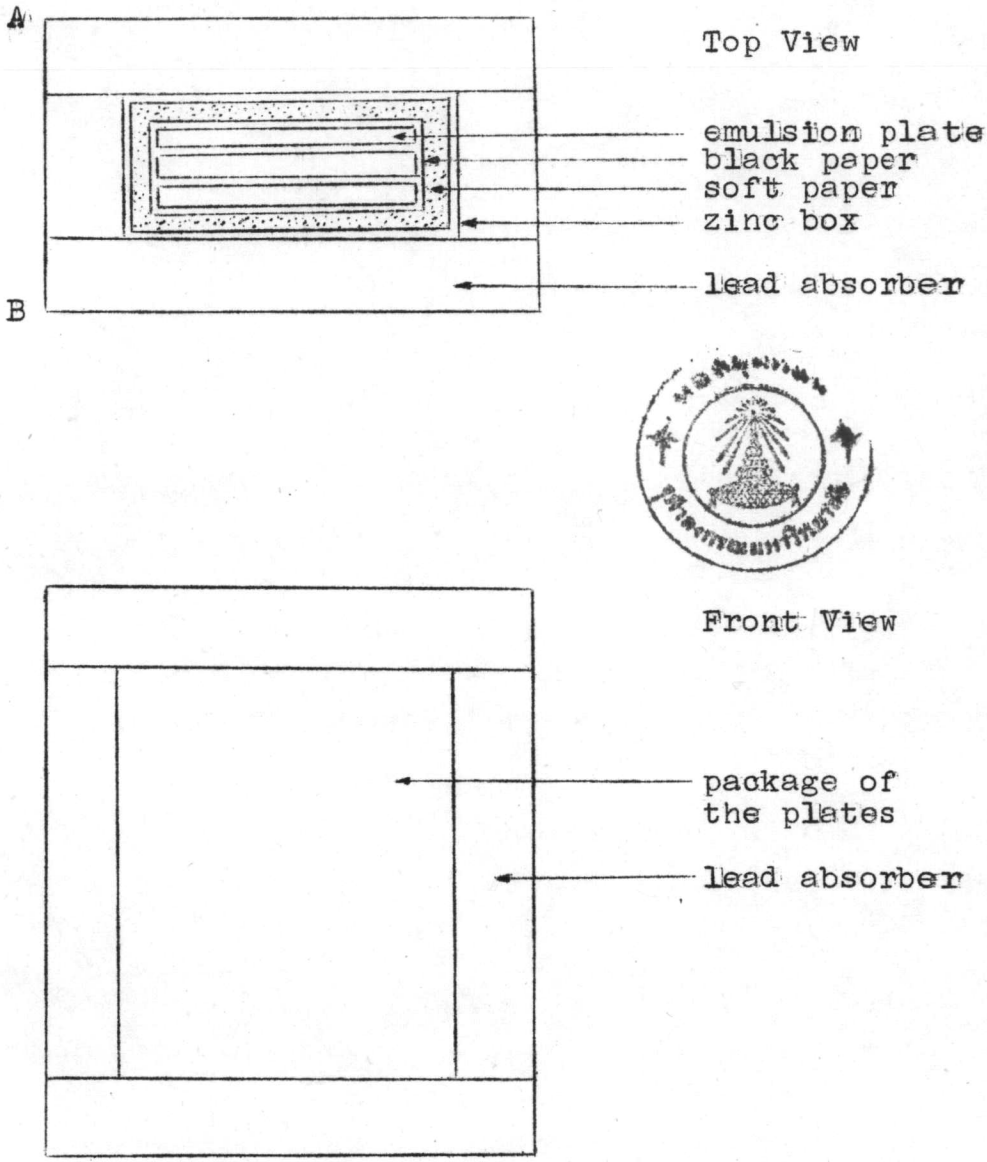

Fig I. The arrangement of the plates and absorber.

Scanning

The plates under the 0, 1, 2, and 3 cm lead absorbers were volume scanned. The scanned volume was of the size 7.5 X 5.0 X 0.04 cm^3 per plate, i.e. over all the volume of nuclear emulsion in each plate. The microscope used in scanning was the Universal Cooke, Troughton and Simms microscope No. M40364. A pair of Kellner eyepieces 10X with graticule type B was used. For low power magnification, i.e. for scanning, an objective 10X was used. In grain counting the high power oil immersion objective 45X was used.

The tracks having their ends in the emulsion were grain counted. These tracks are produced not only from outside emulsion but also created by stars and collisions of neutral particles. The criterion adopted here was that each chosen track should be at least as long as 2000 microns which should make the tracks flat, i.e. they should have the dip angle less than 11°. Hence the correction of the range due to dipping would be negligible.

The scanning efficiency can be calculated by the method used in Barkas's Nuclear Research Emulsion.[2] In finding the events of a certain type according to the criteria above, one uses the method of double scanning and calculates the efficiency by using the formula

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[2] Walter H. Barkas, Nuclear Research Emulsion (New York: Academic Press, 1963), p. 251.

$$E = \frac{2N_{12}}{N_1 + N_2},$$

where E is efficiency of scanning,

N_1 is the number of events in the first scanning,

N_2 is the number of events in the second scanning,

N_{12} is the number of common events in the two scannings.

The Method of Grain Counting

The method of the range and grain density is used in identification of mass. For each range the grains are counted in the interval of 100 microns. The grain density per 100 microns is averaged over the length of 1000 microns since within this length the change in grain density is less than 10 per cent. The ranges of the average grain density are determined from the lower interval of the length 1000 microns.