Preliminary report on the amounts of iron dust which daily fall on the surface of the earth

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Summary : (Özet) Yer yüzüne, hergün, çıplak gözle görülemiyecek kadar küçük, demir tozlarının düşeüğü rasat edilmiştir. Ayrıca bu parçacıkların menşelerinin tayini kısa ve uzun terimli «günlük miktarlar» değişimleri incelenmiştir. (kısa terimli değişimler=bir veya bir kaç günlük değişim ; uzun terimli değişmeler=mevsimsel değişim)

Eğer bu demir tozları metotlarla ilgili ise, demir parçacıklarının günlük miktarlarının kısa ve uzun terimli değişimleri, meteorlar için yapılan rasatlara uygun olacaktır. Fakat hüküm verebilmek için rasatların kapladığı zaman henüz kısadır. Bununla beraber her kısa ve uzun peryod değişimlerinin tetkikinden, kısa peryodlardan bazılarının muhtemelen meteor yağmurlariyle ilgili olduğu görülür. Rasatlara ait dağılım üzerinde bir işleme yapılmamıştır Yağışlar ve diğer bazı sebeplerin dağılım üzerine tesir edeceği düşünmek yerinde olur.

1. — Introduction

In the beginning of February 1954, on the advice of Prof. Dr. E.A. Kreiken I placed a table with a large horizontal plate of glass (surface $2m^2$), which had carefully been cleaned, in the court of the Faculty. After 24 hours I collected the snow which had gathered on the glass, and evaporated it in a glass vessel.

The chemical analysis of the sediment, obtained in this way, showed the occurrence of iron. I repeated the same experiment with snow, collected on Dikmen hill and at other places around Ankara. In every sample iron occurred but no Ni, Co or Mg could be detected. We know that meteors, falling in big pieces on the earth's surface, are composed of % 92 Fe, % 5 Ni and % 3 Co, Mg and other metallic compounds.

On the days without rain I used a horse-shoe magnet to collect the iron. I attached a small rectangular collector plate (also of glass) to the poles of the magnet and moved it back and forth over the horizontal glass plate until the whole surface of the latter had been covered.

Then I examined the collector plate with a microscope. There were particles on the plate which had a metallic appearance and some of them moved when brought into the field of a magnet. Their forms were irregular, and they had a length varying between 0.1 — 0.001 mm.

From photographs also the impression is obtained that we have to deal with small crystalline iron particles. (See fig. 1) After separating them with a magnet from non metallic particles, I have at different times analysed them chemically. I always found Fe but no Ni, Co, or Mg.

2. — Systematic Observations.

In order to determine the quantitative variance of the particles, I began to count them from February 23rd 1954 onward. Thus I tried to fix the number of iron particles falling daily on the horizontal glass. I plotted a curve which represents the change in number of these particles day by day. (fig. 2). It was easiest to count the particles as observed through a lens. Later on, in order to obtain greater completeness, I also counted them when observed through a microscope, starting from May 16th, 1954 (fig. 3). On some days we were confronted by the difficulty that at the usual time of observation, due to rain or snow, the table was wet. The points in the graph, corresponding to these days, are left blank. If, after a rainy day at the time of observation the table was dry, the counts were carried out, but obviously little weight can be attached to the numbers obtained on such days

In order to detect possible relations between the number of particles and the atmospheric circumstances, I daily recorded the data given by the meteorological station. In the figures 2 and 3 only the wind velocity has been indicated, but no direct relation is apparent.

Anyhow it is better to postpone a numerical determination of the coëfficient of correlation until statistically more complete data are available.

3. — Origin of the iron dust.

The origin of the iron dust may be either terrestial or extraterrestial. The probability of purely terrestial origin cannot be discarded. On the Anatolian plateau many rock formations occur

which contain magnetites. So on this dry plateau through the erosion of wind and sand the air may become polluted with crystalline iron particles, which are magnetic. These light particles can be carried through the air over large distances, but ultimately must again fall on the surface of the earth. In small quantities iron in oxydised forms is present almost at any place on the surface of the earth, but we do not need to consider this. Such iron has lost its magnetic properties.

Another possibility is, that the air has become polluted by the smoke emitted through the chimneys of factories, while this smoke contains iron particles. This possibility however also can be discarded, because in this case the daily amounts of iron dust which are collected would systematically depend on the direction of the wind. Of such an effect no trace can be found.

So the only possibilities which we have to consider:

a) the iron dust originates from erosion;

b) the iron dust is of extra — terrestial origin and is related to the meteors.

4. — Results of observations.

Whatever their origin may be, small metallic particles — invisible to the naked eye — are steadily falling on the earth's surface.

As appears from their magnetic properties these metallic particles are iron particles. From the graphs in figures 2 and 3 the following conclusions are apparent.

a) There appears to be a strong seasonal variation. It seems that the observations have been started around a time of minimum activity (February). From then on the daily numbers of particles steadily increase until at the beginning of July a maximum is reached. Afterwards a slow decrease seems to occur.

The curve of the seasonal variation has not been observed over a sufficiently large period, definitely to determine its shape. Observations for the months September — February are still completely lacking. Therefore, as yet no comparison can be made between this curve and the one which gives the seasonal changes of the meteor numbers.

b) In the curve, indicating the seasonal variations many maxima and minima occur. Many of these are not real.

The short arrows at the top of the graph indicate the

occurrence of rainfall on this day. It is evident, that the minima mostly occur during or shortly after times of rainfall and it can hardly be doubted that the majority of these minima is spurious. Judging from appearances I would estimate that the observed numbers remain incomplete until a few days after the rainfall. For a complete statistical evaluation of the curve it will be necessary exactly to determine for how many days this influence continues. This could be effectuated by counting for a large number of cases the daily number of particles shortly before and after rainfall. With large numbers of observations the daily numbers should be equal in the mean. The duration of the influence of the rain could be fixed by determining the period of time which elapses before the daily numbers after rainfall are again equal to those before rainfall Obviously accidental differences will cancel only when sufficiently large numbers of observations can be used and at present this is not the case. Therefore, at present only the directly observed numbers have been plotted. It is better to postpone the determination of the influence of both the rainfall and of personal errors until the observations have been completed.

c) In the curve, giving the seasonal change, several pronounced maxima occur. At present it is of course impossible to say whether these maxima are recurrent or not. This can be established only through continued observations. Several of the maxima occur on or near days on which meteor showers are observed. In figures 2 and 3 the dates on which meteor showers have been observed are indicated by small black dots. It would appear that there might be some relation between our maxima and the meteor showers. Several of our observed maxima might be spurious, especially those which occur between two periods of rainfall. It is better not to make any definite conclusions before additional observations have been secured.

a (40)

b (40)

c (60)

d (60)

Fig. 1. Fotographic reproduction of iron particles. The numbers at the bottom indicate enlargement. *c* and *d* are in a magnetic field

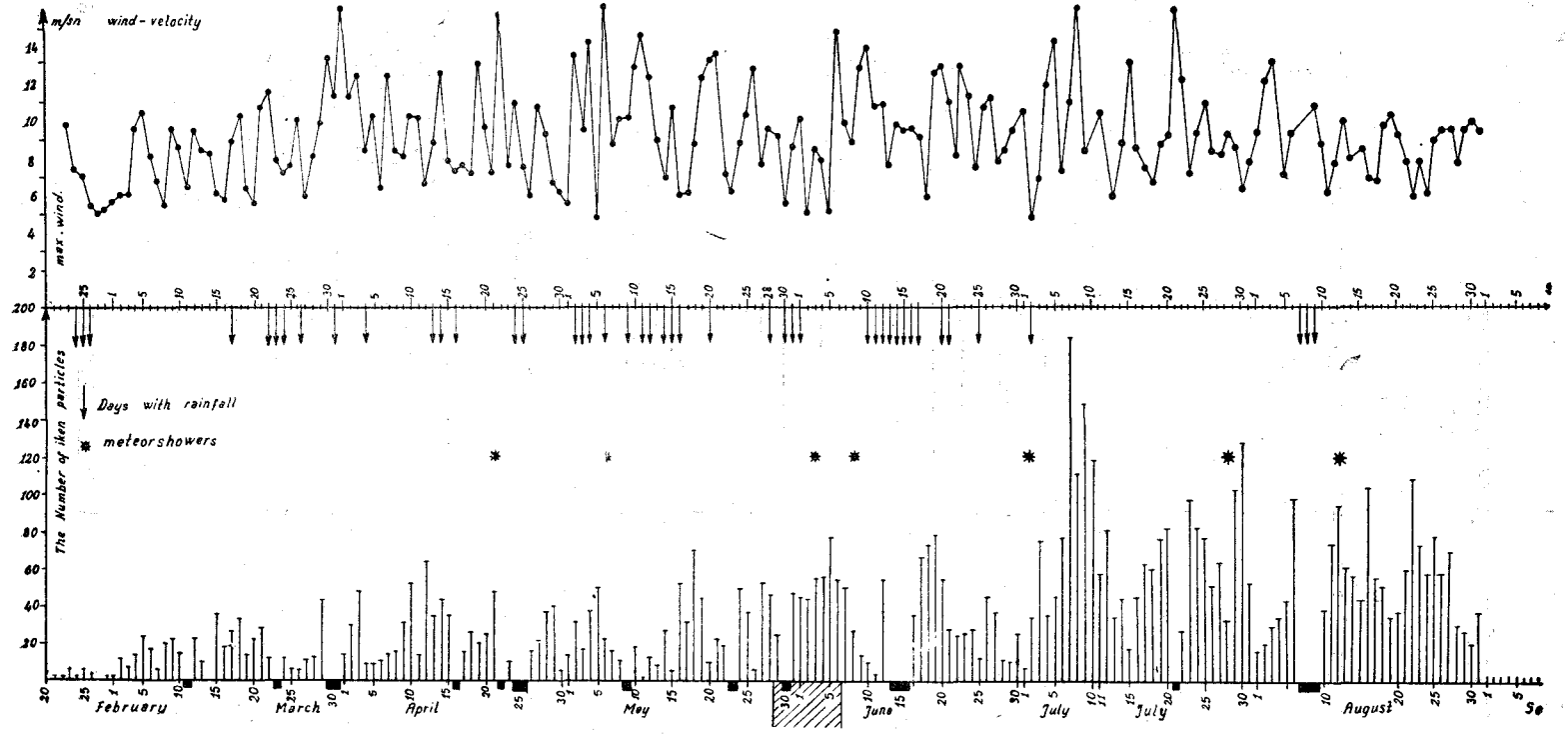

Fig. 2. Daily numbers of iron particles as observed through a lens. Length of arrows are proportional to the observed numbers. Arrows at top indicate days of rainfall. Upper part of figure indicates wind velocity on day of observation.

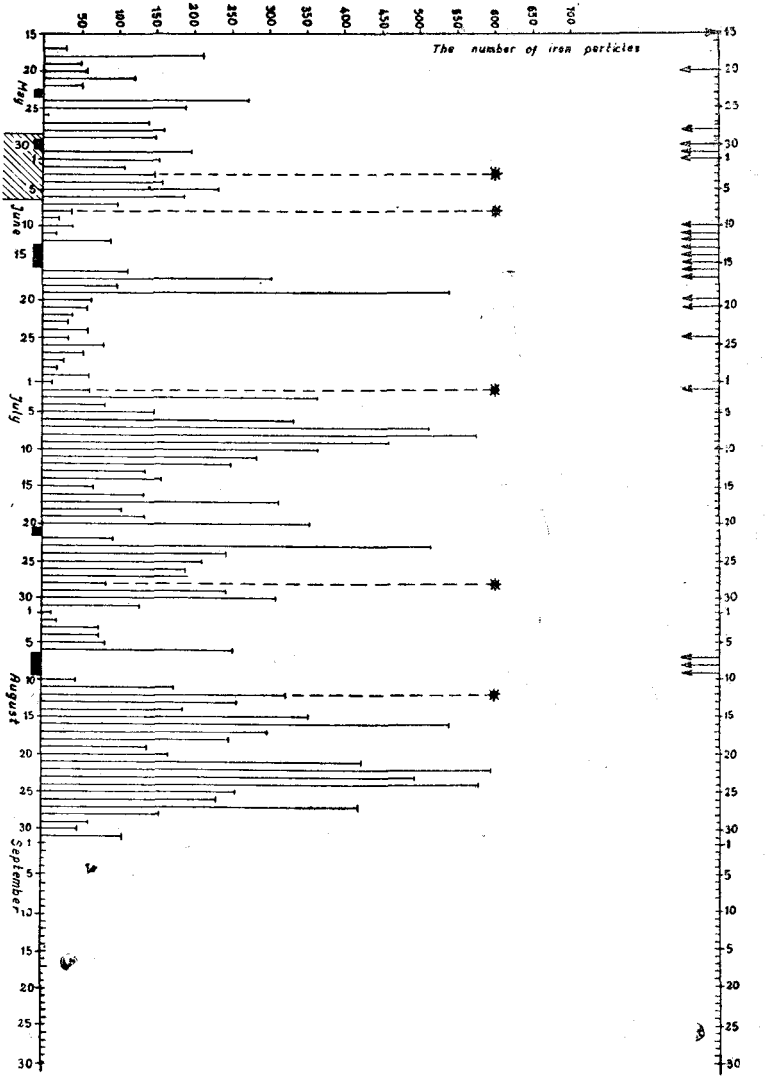

Fig. 3. Numbers of iron particles as observed through microscope

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