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DIAMETER-DEPTH RELATIONSHIP OF CRATERS ON MARS

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Some Mariner VI and VII photographs of Mars, which were obtain-
ed last summer during the close approach of the spacecrafts to
this planet, show very well a great number of craters. The craters
on Mars are features the sizes and shapes of which are similar to
those of lunar craters. The majority of large craters are very
shallow and they look like the flooded lunar craters. Smaller cra-
ters are deeper and they seem to be "fresh".

In some pictures obtained from Mariner VI during its approach
(of about 3450 km) to Mars on July 30, 1969, it was possible to
measure not only the diameters of craters, but also the lengths of
their shadows. The depths of craters may be easily determined from
these lengths of shadows. The measured apparent diameters of cra-
ters and lengths of their shadows must be, of course, corrected;
the foreshortening and the spherical form of the photographed area
must be taken into account. The photographs from Mariner VII are
not too convenient for the determination of the depths of craters
while a few features only could be measured here.

The frames 070 - 074 (see for instance /1/) are favourable abo-
ve all for the determination of diameters and depths of craters.
The local solar time of these frames varied between 3^h30^m p.m. and

5^h00^m p.m., the Sun's height above the local horizon decreased during this period from 38°.5 to 16°.5. Areocentric declination of the Sun was -8°.1.

The present writer measured the diameters and depths of 281 craters on the mentioned frames from Mariner VI. The logarithmic diameter-depth relationships of these craters are shown in Fig. 1.
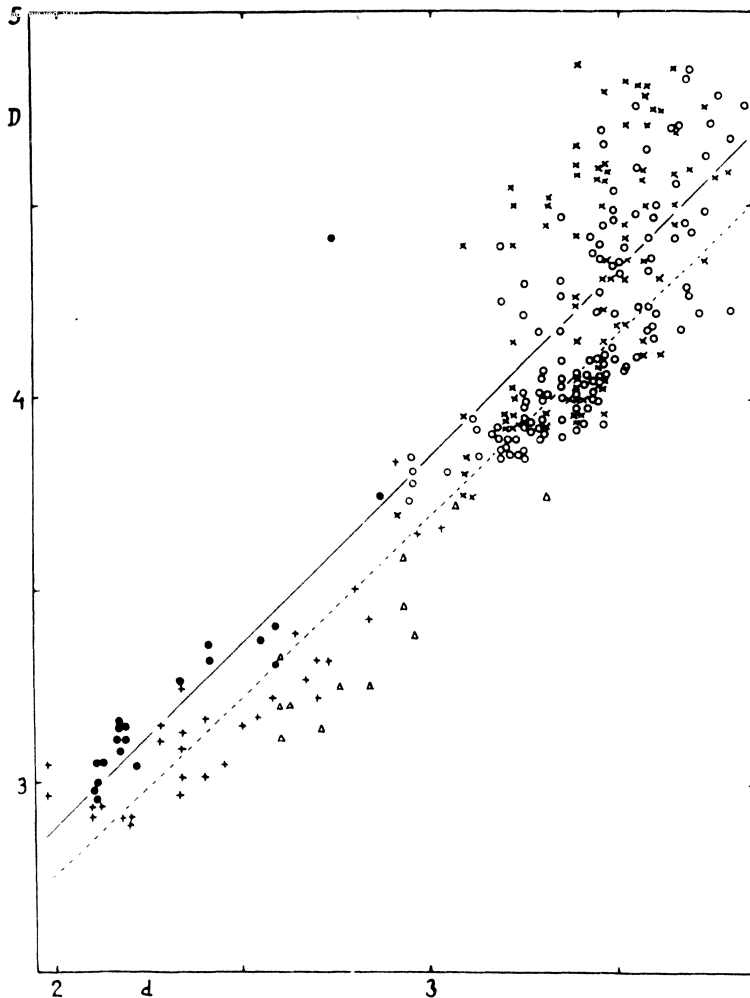

Fig. 1. Logarithmic diameter D versus logarithmic depth d (both in m) from Mariner VI photographs. Frames 070 (△), 071 (x), 072 (+), 073 (o) and 074 (●).

(The logarithmic diameter D and the logarithmic depth d are both expressed in meters.) It is evident that there are two types of craters on Mars. Some of the larger craters and all the small ones show practically linear relationship D versus d (dotted line) like the lunar craters /2/ (full line). The diameter-depth relationships of these craters on Mars may be represented by the equation

$$D = 0.93 \ d + 0.88$$

The second term is somewhat different for craters measured on individual frames (frame C70: 0.60, frame 072: 0.88, frame 074: 0.98), which may be caused by different physical properties of surface material.

The diameter-depth relationships of many large craters are not so conspicuous as for the smaller ones. Nearly all small craters are "fresh", while the large craters show various degrees from "fresh" to "old". It seems also that there are more significant differences in shapes of both types of these craters on Mars than on the Moon.

The results obtained show also that the craters on Mars, or at least the majority of them, may probably be of impact origin.

References

/1/ Icarus 11, 225 (1969).
/2/ Bouška J., Acta Univ. Carol. Prague 2. 45 (1968) = Publ.
        Astr. Inst. Univ. Prague 55 (1968).