MORPHOLOGICAL CHARACTERISTICS OF LUNAR CRATERS WITH MODERATE DEPTH/DIAMETER RATIO. II ($0.12 < d/D < 0.15$)

M. MOUTSOULAS and P. PREKA
University of Athens, Greece

(Received July 7, 1982)

Abstract. The morphological characteristics of craters, the depth/diameter ratio of which is between 0.12 and 0.15, are discussed. Many small secondary craters belong to that class – results of low velocity impacts – as well as young craters created by low angle impacts. Revised values for the craters' selenographic coordinates are also presented.

Lunar craters, the depth/diameter ratio of which are between 0.12 and 0.15, are, in general, either the result of low velocity or low angle impacts, or have suffered a small scale erosion since their creation. Their distribution is presented in Figure 1.

Ptolemaeus M ($l = -3.4$, $b = -9.4$; $d/D = 0.41/3.41$) is a young circular crater, the result of a secondary impact on the floor of Ptolemaeus.

Stöfler N ($l = 6.6$, $b = -41.9$; $d/D = 1.66/13.80$) is the result of a relatively recent impact on the southern part of the floor of Stöfler, just outside Faraday's wall. It is difficult to define its precise depth; the value $d = 1.66$, resulting from the length of the morning shadow is an overestimate.

The irregular shape of Polybius K ($l = 24.3$, $b = -24.3$; $d/D = 1.94/16.10$) is the cause of disagreement in calculations of its dimensions. The value $D = 14$ km corresponds to a better fit.

Kelvin G ($l = -33.9$, $b = -26.2$; $d/D = 0.34/2.82$) is an elongated small crater on the floor of Mare Humorum, very close to Pr. Kelvin. The values given for d and D should be used cautiously.

Although Fracastorius C ($l = 34.6$, $b = -24.6$; $d/D = 2.09/17.33$) is not a very young crater – as indicated by several impacts on its rim – it has a very easily defined circular rim which appears to correspond closely to the initial shape of the crater.

Baumont M ($l = 28.6$, $b = -19.4$; $d/D = 1.25/10.35$) has been formed by two impacts – very close to each other – and has, therefore, an elongated rim. The value $D = 10.35$ km corresponds to the southern component of this double crater. The same is true in the case of Catharina D ($l = 21.4$, $b = -16.8$; $d/D = 1.15/9.42$) the value $D = 9.42$ of which corresponds to the part which is closer to Catharina.

Purbach M ($l = -4.4$, $b = -24.8$; $d/D = 1.99/16.48$) is an old crater, west of Purbach and on the rim of Thebit P. Albategnius G ($l = 1.9$, $b = -9.4$; $d/D = 1.75/14.46$) has similar shape.

Agatharchides R ($l = -30.7$, $b = -18.3$; $d/D = 0.63/5.21$) is, also, a rather old crater at the edge of the highland terrain, north of Agatharchides. The shape of Boscovich D

The Moon and the Planets **27** (1982) 111–130. 0165–0807/82/0271–0111$03.00.

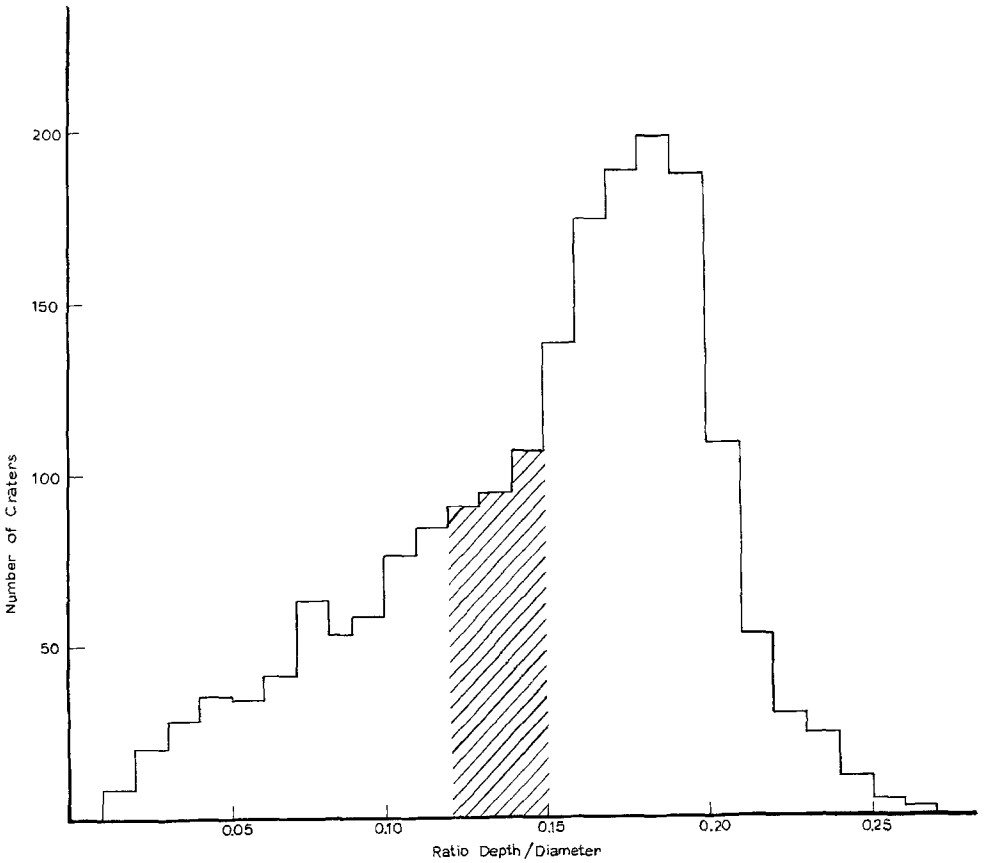

Fig. 1. Distribution of the studied craters with respect to the ratio depth/diameter.

($l = 12.2$, $b = 9.0$; $d/D = 0.55/4.54$), a much younger crater in the, relatively, smooth highland area west of Julius Caesar is similar.

Although Copernicus BB ($l = -23.3$, $b = 7.3$; $d/D = 0.42/3.46$) cannot be measured very well in Orbiter IV imagery, since half of it appears on Photo No. 126-H2, and the other half on Photo No. 126-H1, it can be easily observed that it is a young crater, apparently younger than the Copernicus event.

Pictet C ($l = -7.7$, $b = -42.7$; $d/D = 0.84/6.92$) is an old crater having a very irregular shape, on the rim of Pictet. The figures given for d and D should be used cautiously.

Walter S ($l = 0.6$, $b = -36.4$; $d/D = 1.40/11.54$) is older than many other craters in its vicinity; it preserves, however, its well defined rim, and a shape which corresponds to a moderate-energy impact. On the other hand, Albategnius S ($l = 6.1$, $b = -13.3$; $d/D = 0.77/6.34$) which is a young crater, but in a rough highland terrain, does not possess an equally regular rim.

Manilius A ($l = 9.1$, $b = 17.6$; $d/D = 1.10/9.06$) is a very young crater, created by a low-energy impact. It is remarkable that Lubbock D ($l = 39.1$, $b = -4.5$; $d/D = 1.52/12.48$) has the same shape on entirely different soil.

Parry D ($l = -15.7$, $b = -7.9$; $d/D = 0.34/2.80$) is, also, a young circular crater on the floor of Parry.

Davy YD ($l = -5.9$, $b = -10.7$; $d/D = 0.44/3.62$) is the largest component of a series of craters which had created to observers using lower resolution photography, the impression of a river, and was named Rima Davy I. That feature should be associated with the Davy G event.

Neander HB ($l = 40.7$, $b = -32.6$; $d/D = 1.63/13.38$) is an old crater on heavily eroded highland ground.

Euclides CA ($l = -29.1$, $b = -13.1$; $d/D = 0.35/2.87$) is a small circular crater in Mare Cognitum.

Although the diameter of Pons M ($l = 24.1$, $b = -27.1$; $d/D = 1.39/11.37$), a crater which is not very young, can be defined precisely, the same is not true for its depth, since there are considerable differences in the height of its rim, caused by the uneven surroundings – the northern half of the crater is surrounded by highland ground while outside the southern part of its rim we have mare terrain.

Wurzelbauer EA ($l = -15.8$, $b = -35.5$; $d/D = 0.62/5.06$), the result of a relatively recent moderate-energy impact, is a circular crater with easily defined rim, on the outer rim of Wurzelbauer.

Copernicus L ($l = -17.0$, $b = 13.5$; $d/D = 0.52/4.24$), is a young circular crater, typical example of a large number of craters having diameters shorter than 10 km and similar morphological characteristics, which appear in the surroundings of Copernicus; it should be noted that although all those craters are definitely associated with the Copernicus event – in fact, they result from secondary impacts – they do not bear in most cases the name of their principal companion, Copernicus, but the names of other large craters in their vicinity, having nothing or little to do with the Copernicus event.

Römer D ($l = 35.8$, $b = 24.5$; $d/D = 1.32/10.76$) is elongated like Römer TA ($l = 35.4$, $b = 23.6$; $d/D = 1.08/10.42$), along the E-W direction. An inconsistency in the measurements is, however, apparent. In the case of Römer TA the value $D = 10.42$ corresponds to the longest diameter of the crater, while measurement of the diameter along the longest axis for Römer D would give a value, D, larger than 13 km.

Milichius C ($l = -29.4$, $b = 11.2$; $d/D = 0.41/3.34$) is a young shallow circular crater, the result of a low energy impact.

Airy TA ($l = 9.0$, $b = -19.0$; $d/D = 0.51/4.15$) is the result of an impact on the rim of Airy T. In spite of the uneven surrounding area, the rim of Airy TA is circular and morphological characteristics of this young crater can be easily defined.

Wilkins H ($l = 18.5$, $b = -28.6$; $d/D = 0.77/6.27$) is also surrounded by uneven terrain – a mare-like land towards the north and a cratered highland area towards the south. In this case, the original circular rim has been altered by later impacts in the crater's vicinity, and, therefore, its diameter cannot be defined with high precision.

Gruithuisen ($l = -39.7$, $b = 32.9$; $d/D = 1.87/15.21$) is a very young circular crater on mare ground between Oceanus Procellarum and Mare Imbrium. It has a diameter of just over 16 km in the E-W direction. The low, for the crater's age, value of d/D as well as the lack of evidence of ejecta around it, suggest that it is the result of a low energy impact.

Werner F ($l = 0.8$, $b = -25.8$; $d/D = 1.25/10.17$) is a, relatively, old – for its d/D ratio – crater, on highland terrain between Purbach and Blanchinus.

Doppelmayer T ($l = -43.2$, $b = -25.9$; $d/D = 0.38/3.09$) is a young crater, slightly elongated in the E-W direction, on the floor of Mare Humorum.

Maurolycus K ($l = 12.6$, $b = -41.9$; $d/D = 1.02/8.29$) is a rather old depression, adjacent to the rim of Maurolycus; it cannot be much younger than Maurolycus. It is elongated, in the direction of Maurolycus radius, and its rime has been compressed by later impacts; therefore, a ten-metre accuracy in the expression of its diameter is unrealistic.

It is difficult to define the precise value of Birt E ($l = -9.6$, $b = -20.7$; $d/D = 0.60/4.87$) which is on rima Birt I.

Gassendi M ($l = -39.0$, $b = -18.6$; $d/D = 0.38/3.08$) is a very young circular crater inside Gassendi. On the other hand, Regiomontanus Y ($l = -1.6$, $b = -30.1$; $d/D = 0.57/4.62$) which presents the same ratio d/D, is an old crater on highland terrain. The depth of Regiomontanus Y has, apparently, been overestimated.

Although the eastern part of the rim of Stöfler H ($l = 1.7$, $b = -40.3$; $d/D = 2.97/24.06$) which is very sharp, suggests that the crater is young, its general shape is very irregular. More recent investigators consider the value $D = 27$ km to be a better estimate for its diameter.

Gambart R ($l = -20.8$, $b = -0.6$; $d/D = 0.44/3.56$) is a circular crater, in an area which has been covered with Copernicus ejecta. The low – for the crater's general characteristics – ratio d/D, should be attributed to partial filling during the Copernicus event.

Abulfeda J ($l = 10.0$, $b = -15.6$; $d/D = 0.57/4.61$) is one of several craters in the highland area between Mare Nubium and Mare Nectaris, which presents similar morphological characteristics. It is interesting to notice that the shapes of Abulfeda J, Abulfeda JA, and Abulfeda JB, which are located on a straight line, indicate impacts of the same energy, and they might, therefore, have common origin.

Tycho F ($l = -13.1$, $b = -40.9$; $d/D = 2.03/16.41$) is an old crater, covered completely with Tycho ejecta. The value $d = 2.03$ is an overestimate, caused by the fact that a mountain at the crater's eastern side casts a long shadow on the Orbiter IV imagery.

Ariadaeus A ($l = 17.5$, $b = 4.6$; $d/D = 1.04/8.40$) has been partly destroyed by an impact which created Ariadaeus later. It is not, however, a very old crater, and more than half of its circular rim is very well preserved.

Poisson O ($l = 9.1$, $b = -35.0$; $d/D = 0.53/4.28$) and Andel E ($l = 12.2$, $b = -12.0$; $d/D = 0.81/6.54$) have morphological characteristics comparable to those of Abulfeda J ($l = 10.0$, $b = -15.6$; $d/D = 0.57/4.61$).

Rabbi Levi M ($l = 23.2$, $b = -35.2$; $d/D = 1.32/10.62$), a well defined circular crater on the floor of Rabbi Levi, presents similar morphological characteristics with Rabbi Levi

A and Rabbi Levi D. Rabbi Levi A and Rabbi Levi M seem to be of the same age, while small crater counts and the morphology of the rims indicate that Rabbi Levi D is slightly younger than its neighbour Rabbi Levi M. Further north-west – in the same heavy cratered highland region – we find Pontanus N ($l = 13.8$, $b = -24.6$; $d/D = 1.27/10.20$) which has the same morphological characteristics.

Heinsius C ($l = -17.9$, $b = -40.6$; $d/D = 2.74/21.99$) is a circular crater which has destroyed part of the rim of Heinsius. The uneven ground on which it has been formed is responsible for a slight deviation of its rim from an exactly circular shape; that creates differences of the order of 1 km among various definitions of its diameter. Moreover, the crater has been close enough to the Tycho event – its rim bears evidence of low velocity impacts.

Sosigenes B ($l = 17.2$, $b = 8.3$; $d/D = 0.44/3.53$) is a small circular crater – created by a low energy impact – similar to several craters at the western edge of Mare Tranquillitatis. Mercenius CE ($l = -43.0$, $b = -19.8$; $d/D = 0.45/3.60$) in Mare Humorum is another similar case.

Palisa T ($l = -8.2$, $b = -8.2$; $d/D = 1.55/12.43$) is, also, the result of a low-energy impact at the edge of a mare region – this time at the eastern side of Oceanus Procellarum.

Pontanus D ($l = 13.2$, $b = -25.9$; $d/D = 2.50/20.02$) has internal characteristics of a rather high energy impact. However, there is no sign of ejecta around it.

Walter J ($l = -1.5$, $b = -34.4$; $d/D = 0.87/6.95$) appears to be a crater which was formed at the same time as Walter K. The morphological characteristics indicate that both impacts were of about the same mass and had the same velocities. A slight difference in the depths of the two craters should be attributed to the uneven surroundings – both craters are on the rim of Walter and not far from each other, but the ground at the eastern side of Walter J is elevated and therefore, the morning shadow of the rim in this case is longer than that of Walter K.

We find a similar situation on the highland region east of Mare Humorum, where Loewy H ($l = -31.9$, $b = -22.8$; $d/D = 0.57/4.55$) presents the same morphological details with Loewy G ($l = -31.9$, $b = -23.0$; $d/D = 0.61/4.78$).

It is very difficult to define the diameter and depth of Ritchey J ($l = 9.9$, $b = -12.3$; $d/D = 2.07/16.51$). The accuracy of 10 m in the values given for its depth and diameter is deceptive. The general morphology of the crater does not allow definition of these quantities with an error smaller than 10%.

Gauricus G ($l = -11.0$, $b = -33.9$; $d/D = 2.16/17.21$) is a, relatively, young circular crater on the rim of Gauricus. Although its diameter can be defined quite precisely, the elevated highland terrain at its eastern side leads to larger values for the crater's depth whenever the morning shadows are measured, and smaller values whenever evening shadows are used for the depth calculation.

Pontanus R ($l = 15.6$, $b = -28.1$; $d/D = 0.84/6.96$) is an old crater, obviously associated with many other craters of the same age which can be detected in that part of highland area, east of Pontanus. The shape of Pontanus R is not regular enough to allow the definitions of its morphological elements with the precision claimed in the values recorded for its depth and diameter.

The ground surrounding Licetus J ($l = 3.2$, $b = -44.2$; $d/D = 1.45/11.54$) is rather uneven, as always happens whenever we have a crater created in a highland region and close to the rim of a large crater. However, in this case, the values given for the crater's depth and diameter should be considered as representative of its morphological elements. The case of Purbach O ($l = -3.8$, $b = -24.7$; $d/D = 0.64/5.09$), on the rim of Purbach, is similar.

Manilius B ($l = 7.3$, $b = 16.6$; $d/D = 0.71/5.65$) has characteristics similar to those of small craters in the Manilius area, like Manilius U ($l = 10.8$, $b = 13.8$; $d/D = 0.45/3.56$) and Manilius T, which are definitely younger than Manilius. All those small craters appear to be results of low-energy impacts.

Stöfler U ($l = 9.6$, $b = -40.1$; $d/D = 0.82/6.52$) is an old crater having a very irregular shape. That is why in the values of its diameter presented by various investigators there appear differences as high as 1.5 km.

Letronne C ($l = -38.5$, $b = -10.7$; $d/D = 0.53/4.21$) is a very young circular crater, like several others that we find in Oceanus Procellarum.

Fracastorius J ($l = 37.4$, $b = -20.8$; $d/D = 1.55/12.31$) at the southern edge of Mare Nectaris, is not a very young crater. However, it has a well defined circular rim; its general characteristics correspond to a low energy impact.

Regiomontanus M ($l = -2.1$, $b = -29.6$; $d/D = 0.65/5.16$) is an old circular crater on a part of highland terrain between Deslandres and Regiomontanus. The rough terrain makes difficult the definition of the precise values for the crater's depth and diameter.

Lepaute ($l = -33.6$, $b = -33.3$; $d/D = 2.07/16.38$) is an elongated crater on highland terrain at the western edge of Palus Epidemiarum. We should notice that the value $D =$ 16.38 km corresponds to its longest axis – along the N–S direction; its W–E axis is smaller than 13 km.

Censorinus W ($l = 37.5$, $b = -1.0$; $d/D = 1.20/9.47$) is a circular crater created by a low energy impact on the rather even highland terrain, south of Mare Tranquillitatis.

Pytheas ($l = -20.6$, $b = 20.5$; $d/D = 2.54/20.04$) is a very young crater. Although its rim is not exactly circular, it is so sharp and well defined that enough points can be measured very precisely to define a circle that fits best. The same is not true for the crater's depth; the floor of the crater is rather uneven – characteristic of the very young craters – and, therefore, the crater's depth cannot be defined very accurately.

Cassini X ($l = 6.9$, $b = 43.9$; $d/D = 0.55/4.33$) is a, relatively, young crater on the highland terrain, east of Montes Alpes.

Herschel H ($l = -3.4$, $b = -6.3$; $d/D = 0.65/5.11$) is the result of a, relatively, recent impact on the highland region between Ptolemaeus and Flammarion; it could be a secondary of Herschel.

Brenner S ($l = 36.2$, $b = -38.1$; $d/D = 0.84/6.60$) is a circular crater on uneven highland terrain; its similarity to several other craters of that area is remarkable.

Tobias Mayer R ($l = -26.4$, $b = 11.6$; $d/D = 0.60/4.71$), a young crater in the vicinity of Copernicus, has been formed after the Copernicus event; it is one of few craters which appear to be younger than the Copernicus ejecta.

Another circular crater in the vicinity of a young large crater is Bullialdus G ($l = -23.6$, $b = -23.2$; $d/D = 0.51/4.00$). In this case, however, it is obvious that the small crater was formed before the time the Bullialdus ejecta had covered the surrounding area.

Copernicus DA ($l = -23.4$, $b = 11.0$; $d/D = 0.42/3.29$) should be associated with the Copernicus ejecta.

Poisson N ($l = 8.4$, $b = -30.7$; $d/D = 0.52/4.07$) is a very young crater on heavily cratered mare-like terrain.

The shape of the rim of Rabbi Levi D ($l = 22.8$, $b = -35.4$; $d/D = 1.30/10.17$) indicates that it is younger than Rabbi Levi M ($l = 23.2$, $b = -35.2$; $d/D = 1.22/7.77$), while its general characteristics are similar to those of Rabbi Levi A ($l = 22.7$, $b = -34.3$; $d/D = 1.36/12.08$).

The irregular shape of Fracastorius Y ($l = 32.0$, $b = -24.8$; $d/D = 1.63/12.74$), an elongated crater on the rim of Fracastorius, does not permit an accurate determination of its geometrical elements; the second-decimal accuracy which appears in the data is deceptive.

Anděl G ($l = 12.4$, $b = -11.0$; $d/D = 0.47/3.67$) has, also, been formed on the rim of another crater; the determination of its geometrical shape is equally difficult.

Walter WA ($l = -3.5$, $b = -32.6$; $d/D = 0.36/2.81$) is an old circular crater on the heavily eroded floor of Deslandres.

Zagut H ($l = 20.7$, $b = -29.9$; $d/D = 0.77/6.01$) is the result of several impacts in the same area; its shape is, therefore, very irregular. The value $D = 6.01$ corresponds to its smallest diameter.

Cassini W ($l = 4.3$, $b = 42.3$; $d/D = 0.71/5.53$) is a small circular crater in Mare Imbrium, comparable in age to Cassini E ($l = 7.3$, $b = 42.9$; $d/D = 1.42/11.02$), as well as to several other craters of the Cassini region. It is interesting to notice that several craters having ratios $d/D \simeq 0.129$ can be located on the rims of large craters.

Busching C ($l = 19.6$, $b = -37.2$; $d/D = 0.94/7.32$) is an old crater on the rim of Busching. Its irregular rim does not allow a precise determination of the crater's geometrical elements.

Wilkins B ($l = 18.9$, $b = -29.5$; $d/D = 0.97/7.54$), on the rim of Wilkins, is much younger; its shape, however, is equally irregular, due to the uneven terrain on which it has been formed.

Faraday A ($l = 9.7$, $b = -41.5$; $d/D = 2.70/20.96$) is a, relatively, old, elongated crater on the rim of Faraday. The existence of several small impacts on its rim should be mentioned.

Saussure B ($l = -3.9$, $b = -42.2$; $d/D = 0.62/4.81$) is a small circular crater outside the rim of Saussure. Its small size does not allow observation of noticeable shape characteristics. The same is true for Thebit T ($l = -6.0$, $b = -20.7$; $d/D = 0.37/2.87$), a small circular crater on mare floor.

Geber A ($l = 14.5$, $b = -21.8$; $d/D = 1.74/13.49$) is a, rather, old crater, the rim of which has been partly destroyed by the Geber C event. Since, moreover, it has been formed on uneven highland terrain, it is difficult to define its precise morphological characteristics.

Pitatus V ($l = -11.7$, $b = -28.9$; $d/D = 0.64/4.95$) is a very small young circular crater outside the rim of Pitatus. Similar in shape is Cauchy M ($l = 35.1$, $b = 7.6$; $d/D = 0.61/4.71$) on Mare Tranquillitatis.

Piccolomini N ($l = 26.2$, $b = -27.3$; $d/D = 1.33/10.26$) is a young crater on mare floor east of Rupes Altai. Its elongated – along the East–West direction – shape is the cause of differences in the values presented for its diameter; in more recent measurements the value $D = 9$ km appears. Moreover, the irregular shape of the shadow on its floor makes difficult the precise definition of its depth.

Dawes ($l = 26.4$, $b = 17.2$; $d/D = 2.33/17.97$) is a typical example of a recent low-velocity impact on young mare terrain. A peak on its eastern wall, which is more than 300 m higher than the rest of the wall, is the cause of slightly exaggerated value for its depth calculated from shadow measurements on Orbiter-IV imagery. It is remarkable that in the same terrain, at a distance of 70 km SE of Dawes, Jansen EB ($l = 27.0$, $b = 14.8$; $d/D = 0.55/4.21$), although it is more than four times larger than Dawes in diameter, presents identical morphological characteristics. To prevent confusion we should point out a misidentification appearing on the plate 78-1 (page 98) of the 'Atlas and Gazetteer of the Near Side of the Moon' (Gutschewski *et al.*, 1971), where the name Jansen EB is given to a different crater.

Gambart K ($l = -14.2$, $b = 3.9$; $d/D = 0.54/4.15$) is a small circular crater on mare floor within the vicinity of the Copernicus ejecta.

Wilhelm W ($l = -20.3$, $b = -42.5$; $d/D = 0.69/5.30$) has a very irregular shape. The calculation of its depth, based on Orbiter-IV imagery cannot be considered very reliable.

Birt G ($l = -8.2$, $b = -23.1$; $d/D = 0.31/2.38$) is too small, and its shape is not so well defined on the Orbiter photograph; therefore, the study of its morphology cannot lead to further information. It is much easier to study Gould Z ($l = -15.1$, $b = -19.5$; $d/D = 0.31/2.28$), although it has geometrical elements identical to those of Birt G, since it appears on a photograph of much higher quality; that small circular crater of Mare Nubium appears to be slightly older than several other small craters in its vicinity.

Pitatus E ($l = -10.1$, $b = -28.9$; $d/D = 0.77/5.91$) has an elongated and very irregular shape; it is, apparently, an old depression.

Cyrillus G ($l = 26.6$, $b = -15.6$; $d/D = 0.95/7.28$) is a young circular crater on very old highland terrain. Recent measurements lead to a slightly larger value for its diameter.

Parrot FA ($l = 0.8$, $b = -16.1$; $d/D = 0.47/3.60$) is a young circular crater on the very old highland terrain east of Alphonsus.

Catharina A ($l = 22.3$, $b = -20.2$; $d/D = 1.81/13.85$) is a, relatively, young circular crater on very old highland terrain, between Catharina and Rupes Altai. Weiss A ($l = -18.6$, $b = -30.5$; $d/D = 0.54/4.12$), at the edge of Mare Nubium, is, also, a young circular crater.

Santbech Q ($l = 39.0$, $b = -23.2$; $d/D = 1.55/11.80$) is an old crater on heavily cratered highland terrain; events, which have occurred after the crater's formation, have changed its original shape.

Reaumur B ($l = 0.9$, $b = -4.2$; $d/D = 0.61/4.64$) is one of the youngest craters in an area covered by ejecta of earlier large impacts.

Birt J ($l = -9.4$, $b = -23.0$; $d/D = 0.27/2.05$) is a small circular crater on the floor of Mare Nubium. It should be noticed that Purbach D ($l = -1.6$, $b = -22.8$; $d/D = 1.61/12.22$), at a distance of 200 km, presents the same morphological characteristics, although it has been formed on an entirely different terrain. It is most likely that both craters have been formed simultaneously, when a swarm of bodies collided with the Moon.

Gemma Frisius Q ($l = 14.8$, $b = -35.8$; $d/D = 1.20/9.09$) presents a remarkably regular circular shape, although it has been formed on the irregular edge of Gemma Frisius A.

Capuanus L ($l = -26.3$, $b = -38.3$; $d/D = 1.48/11.21$) is one of several circular young craters in the area south of Palus Epidemiarum. All these craters are, apparently, results of relatively recent impacts.

Conon Y ($l = 1.9$, $b = 22.3$; $d/D = 0.56/4.24$) is a circular crater having characteristics similar to those of several small impact craters in the region of Montes Apenninus.

Sacrobosco O ($l = 16.0$, $b = -21.1$; $d/D = 0.74/5.60$) is an old crater in the highland region between Mare Nubium and Mare Nectaris. Although its neighbour Fermat B ($l = 21.1$, $b = -23.0$; $d/D = 1.38/10.4$), presents an almost identical depth/diameter ratio, there is no reason to relate those two craters; the value $d = 1.38$ for the depth of Fermat B, which has been obtained from shadow measurements on Orbiter IV imagery is much larger than the crater's real depth, and is due to the fact that the crater is located at the western side of a mountain (Rupes Altai).

Although Alexander C ($l = 14.9$, $b = 38.5$; $d/D = 0.62/4.68$) appears very much like several other small circular impact craters in its vicinity (Callipus E, Alexander B etc) it should, rather, be associated to a chain of smaller craters running along the NE–SW direction (parallel to the northern part of Rima Callipus).

Ptolemaeus KB ($l = -4.3$, $b = -8.1$; $d/D = 1.14/8.60$) has been formed on the rim of Ptolemaeus, and, therefore, its shape, is not very regular and the values of its geometrical characteristics are not very reliable. The same is true for Ptolemaeus X ($l = 0.3$, $b = -10.9$; $d/D = 0.94/7.02$). Hipparchus CA ($l = 9.1$, $b = -7.8$; $d/D = 0.63/4.75$) has, also, been formed on uneven terrain and has irregular shape. The general morphology of a crater having ratio $d/D = 1/7.5$ is better studied on Hipparchus H ($l = 2.3$, $b = -5.4$; $d/D = 0.61/4.57$).

Gauricus R ($l = -13.3$, $b = -34.8$; $d/D = 0.84/6.33$) is a young circular crater on the rim of Gauricus. It should be associated with Gauricus M and Gauricus L. Polybius G ($l = 22.7$, $b = -22.5$; $d/D = 0.66/4.90$), Polybius R ($l = 27.3$, $b = -25.6$; $d/D = 1.06/7.98$) and Polybius TA ($l = 25.2$, $b = -25.6$; $d/D = 1.10/8.24$) are circular craters in the heavily cratered area east of Rupes Altai. We point out that a better definition of the rim of Polybius R gives $D = 7.4$.

Flammarion X ($l = -3.0$, $b = -2.9$; $d/D = 0.36/2.71$) is a young small crater on the floor of Flammarion.

Abulfeda X ($l = 14.0$, $b = -15.0$; $d/D = 0.90/6.76$) is a member of a chain of craters

aligned along the NW–SE direction, which begins at the SW side of Abulfeda and ends at the northern end of Rupes Altai. The crater's slightly elongated shape is the cause of disagreement about its exact diameter – the value $D = 6.76$ has been measured along its longest axis.

Nicollet ($l = -12.5$, $b = -21.9$; $d/D = 2.03/15.23$) is a very young circular crater in Mare Nubium. It is remarkable that two other similar craters, Orontius D ($l = -6.2$, $b = -39.4$; $d/D = 1.99/14.93$) and Thebit A ($l = -4.9$, $b = -21.5$; $d/D = 2.72/20.35$) although they have been formed on entirely different ground, they present identical geometrical characteristics.

The value $d = 1.99$ obtained from shadow measurements of Agatharchides E ($l = -32.9$, $b = -20.7$; $d/D = 1.99/14.90$) is largely exaggerated, due to an elevation at the crater's eastern side.

Werner B ($l = 0.7$, $b = -26.2$; $d/D = 1.84/13.73$) is the result of an impact, which has also created a small central peak and an elevated rim.

Lassell T ($l = -8.8$, $b = -17.1$; $d/D = 0.32/2.38$) and Stöfler X ($l = 5.5$, $b = -40.5$; $d/D = 0.35/2.60$), are small circular craters on young mare ground.

Piccolomini A ($l = 30.4$, $b = -26.4$; $d/D = 2.15/15.99$) is an old crater, the original rim of which has been partly destroyed by more recent impacts like the one that has created Piccolomini O ($l = 30.5$, $b = -26.6$; $d/D = 1.58/10.92$). In this case, the two craters present the same general morphology, and the difference in the ratios d/D corresponds to difference in age.

Pickering A ($l = 7.1$, $b = -1.5$; $d/D = 0.65/4.82$) is almost idenitical to Hipparchus H in morphology, a typical example of a small circular crater having ratio $d/D \simeq 1/7.5$.

Airy H ($l = 5.8$, $b = -18.7$; $d/D = 1.37/10.17$) is a depression on the rim of Airy, caused by an old impact; its elongated – along the N–S direction – shape causes disagreements in the definition of its diameter; the value $D = 10.17$ corresponds to its longest axis.

Copernicus G ($l = -21.5$, $b = 5.9$; $d/D = 0.54/4.00$) is a young circular crater on ground that has been previously smoothed by the Copernicus event ejecta.

Manilius Z ($l = 11.7$, $b = 16.4$; $d/D = 0.43/3.18$) is a small young circular crater on mare ground.

Poisson B ($l = 10.9$, $b = -30.8$; $d/D = 1.51/11.16$) is a very old crater inside Poisson; since almost half of the rim of Poisson B coincides with Poisson's rim which is higher, the value $d = 1.51$ obtained from shadow measurements is not representative of the crater's depth.

Sina G ($l = 34.3$, $b = 9.6$; $d/D = 0.66/4.87$), Archimedes Z ($l = 1.4$, $b = 26.8$; $d/D = 0.37/2.73$), Alexander K ($l = 19.3$, $b = 40.5$; $d/D = 0.54/3.98$), Copernicus E ($l = -22.7$, $b = 6.4$; $d/D = 0.54/3.98$) and Copernicus CA ($l = 16.0$, $b = 7.1$; $d/D = 0.50/3.68$) are small circular craters, which, although they have entirely different origin and have been formed on different terrains, they possess remarkably similar morphological characteristics.

Wurzelbauer Z ($l = -14.9$, $b = -32.2$; $d/D = 1.59/11.73$), Rabbi Levi O ($l = 25.2$; $b = -35.7$; $d/D = 0.91/6.71$), Eudoxus D ($l = 13.2$, $b = 43.3$; $d/D = 1.30/9.58$), Riccius

C ($l = 28.8$, $b = -36.2$; $d/D = 2.35/17.31$), Riccius J ($l = 26.0$, $b = -40.7$; $d/D = 1.80/13.21$) and Riccius N ($l = 27.6$, $b = -41.1$; $d/D = 1.82/13.28$) have the common characteristic that they are not very young depressions on highland ground and have no exterior walls; their rim is not exactly circular. The overall impression is that they have been created by low energy impacts, most likely by secondary impact events.

Gambart BA ($l = -10.3$, $b = 2.1$; $d/D = 0.89/6.55$) can be associated with Gambart B ($l = -11.5$, $b = 2.2$; $d/D = 2.17/11.49$), in spite of the fact that the shadow measurement has produced a considerable difference between the d/D ratios of those neighbouring craters; it is obvious that the elevation of the eastern rim of Gambart B has caused that difference.

Wöhler B ($l = 30.8$, $b = -37.2$; $d/D = 1.11/8.17$) has been created like Wöhler C ($l = 30.6$, $b = -36.7$; $d/D = 1.54/15.30$) and Stiborius B ($l = 33.5$, $b = -37.3$; $d/D = 1.32/9.65$) by a low angle impact, and, therefore, it presents, too, a very elongated shape along the NNW–SSE direction. The value $D = 8.17$ corresponds to its minor axis.

Herigonius ($l = -33.9$, $b = -13.3$; $d/D = 2.10/15.45$) is a young crater of Oceanus Procellarum; its floor is flat and does not appear to be much younger than the surrounding mare floor.

Albategnius N ($l = 4.5$, $b = -9.8$; $d/D = 1.24/9.11$) is a secondary crater on the floor of Albategnius and very close to its northern wall; it has characteristics of a low velocity impact.

Proclus C ($l = 43.6$, $b = 12.9$; $d/D = 1.33/9.77$) has, also, characteristics of low velocity impact, like several other similar craters in the area of Palus Somnii (Proclus A, F, G, etc).

Helikon BA ($l = -20.6$, $b = 36.6$; $d/D = 0.41/3.01$) is an example of many small circular craters of Mare Imbrium, which appear very young, and, therefore, their low d/D ratio should be attributed to the low velocity of the impact.

Eudoxus J ($l = 20.2$, $b = 40.8$; $d/D = 0.69/5.06$) looks very much like its neighbour Alexander K, which, as we have discussed already, belongs to a large family of craters having more or less identical morphological characteristics, although they entirely differ in origin.

Heis ($l = -31.9$, $b = 32.4$; $d/D = 1.91/14.01$) has many common characteristics with its neighbour C. Herschel ($l = -31.2$, $b = 34.5$; $d/D = 1.85/13.38$); it is most likely that they have been created at the same time by impacts of identical velocity.

Copernicus D ($l = -24.7$, $b = 12.2$; $d/D = 0.73/5.35$) is a small crater created, apparently, at the time of the Copernicus event by a low velocity secondary impact.

Agatharchides B ($l = -31.6$, $b = -21.5$; $d/D = 0.96/7.00$) is similar in morphology to Agatharchides F ($l = -31.8$, $b = -20.3$; $d/D = 1.14/22.60$); it is most likely that they were created at the same time. The considerable difference between their d/D ratios is due to the fact that the surrounding the craters terrain is very anomalous and, therefore, rim shadow measurements cannot give a precise value for the depths of the craters.

Descartes A ($l = 15.2$, $b = -12.1$; $d/D = 2.11/15.38$) is a young circular crater on highland terrain.

Erosion on Herschel F ($l = -3.4$, $b = -5.8$; $d/D = 0.91/6.62$) indicates that it is not a very young crater – it looks to be slightly older than Herschel.

Lassel K ($l = -8.9$, $b = -15.1$; $d/D = 0.61/4.43$) belongs to a cluster of craters created at a part of Mare Nubium which is covered by highland deposits. It should, therefore, be studied in connection with Lassel G ($l = -9.0$, $b = -14.8$; $d/D = 1.16/6.67$).

Theon Junior C ($l = 14.7$, $b = -2.3$; $d/D = 0.60/4.36$) is a, relatively, old small circular crater.

Maurolycus FA ($l = 12.6$, $b = -41.2$; $d/D = 0.73/5.30$) is a secondary impact at the northern part of the floor of Maurolycus, which is covered by the debris of Maurolycus F event.

Müller O ($l = 2.4$, $b = -7.9$; $d/D = 1.45/10.50$) is a smooth depression, similar to Hipparchus J and Müller A. It should be pointed out that in earlier publications the name Müller A has been used for Müller. To prevent further confusion we give the selenographic coordinates of the centres of the craters of the Müller region: Müller ($l = 2.1$, $b = -7.6$), Müller A ($l = 2.1$, $b = -8.2$), Müller F ($l = 1.5$, $b = -7.8$), Müller O ($l = 2.4$, $b = -7.9$).

Sasserides D ($l = -6.5$, $b = -36.7$; $d/D = 1.45/10.50$) is an old crater on highland ground in the neighbourhood of Deslandres. Saunder B ($l = 9.8$, $b = -3.9$; $d/D = 0.82/5.94$) has similar morphological details.

Barocius GA ($l = 20.6$, $b = -42.1$; $d/D = 0.79/5.92$) is one of many old craters having diameters of the order of 5 km, which can be found in the neighbourhood of Barocius.

Arzachel H ($l = -2.0$, $b = -18.7$; $d/D = 0.68/4.92$) is a very interesting feature; it is the largest component of a pair of craters which form an extention of Arzachel's central peak towards the south; it has been formed by collapse rather than impact.

Gauricus K ($l = -13.9$, $b = -33.3$; $d/D = 0.73/5.28$) is a circular crater on the rim of Gauricus. It is not very clear whether it belongs to the Gauricus L-M-R family, although the first impression is that it lies, too, on the same arc.

Hainzel Z ($l = -35.4$, $b = -37.7$; $d/D = 0.73/5.28$) is an old crater on highland ground. It is not as deep as the shadow measurement indicates; it should be noticed that its eastern wall is part of the wall of a larger crater and, therefore, eastern shadow measurements are misleading.

Fra Mauro HB ($l = -14.8$, $b = -5.0$; $d/D = 0.33/2.38$) is a young small circular crater on mare ground.

Pallas B ($l = -2.5$, $b = 4.2$; $d/D = 0.53/3.82$), a circular crater on mare ground, too, bears the signs of slight erosion, which are apparent in the area of Pallas.

Cichus H ($l = -22.4$, $b = -32.8$; $d/D = 0.99/7.13$) is a very young circular crater; all indications converge to the conclusion that it was created by an impact similar to the one that has created Cichus C ($l = -21.8$, $b = -33.5$; $d/D = 1.26/11.12$). The relatively low value of the ratio d/D of Cichus C is due to the fact that the crater has been formed on the western wall of Cichus, and, therefore, the eastern part of its rim is lower than the rest.

G. Bond ($l = 36.2$, $b = 32.4$; $d/D = 2.78/20.01$) is a circular crater with flat floor comparable to the mare floor of the near-by Lacus Somniorum.

Tobias Mayer A ($l = -28.3, b = 15.3; d/D = 2.21/15.9$) is a typical example of a cone shaped circular crater; it is one of the youngest craters in the neighbourhood of Tobias Mayer. A comparison between Tobias Mayer A and Purbach B ($l = -4.2, b = -26.9; d/D = 2.25/16.18$) is very useful because it demonstrates the significant differences which can be found in the shape and general morphology of two craters possessing the same ratio d/D.

Hell QB ($l = -4.6, b = -33.2, d/D = 0.53/3.81$) is a young circular crater on the very heavily cratered terrain of Deslandres.

Alphonsus A ($l = -2.3, b = -14.8; d/D = 0.60/4.31$) is a small circular crater, on the mare-like floor of Alphonsus.

Manilius W ($l = 12.9, b = 13.4; d/D = 0.62/4.45$) is a circular crater with regular outline and very smooth shape. The same is true for Manilius X ($l = 13.4, b = 14.4; d/D = 0.46/3.23$) a smaller crater about 40 km further north.

Anděl C ($l = 11.2, b = -9.0; d/D = 0.48/3.34$) is a shallow circular crater having the typical shape of a low velocity impact.

The elevated rim of Hippalus C ($l = -30.5, b = -24.1; d/D = 0.49/3.51$) indicates a higher than the average velocity impact.

Wurzelbauer HA ($l = -16.4, b = -34.8; d/D = 0.50/3.58$) is a circular crater, slightly deformed by a secondary crater at its eastern rim; it is one of many similar craters in that very heavily cratered terrain, south of Mare Nubium.

Kunowsky H ($l = -30.0, b = 1.1; d/D = 0.46/3.29$) is a young small shallow circular crater, having characteristics of low velocity impact. Mersenius CC ($l = -44.7, b = -21.1; d/D = 0.46/3.29$) has identical shape.

Fracastorius N ($l = 34.0, b = -23.2; d/D = 1.50/10.72$) is a, relatively, young crater on the rim of Fracastorius.

Palisa W ($l = 6.3, b = -9.1; d/D = 0.62/4.43$) is a young circular crater on highland terrain, west of Ptolemaeus.

Riccius M ($l = 26.4, b = -37.8; d/D = 1.90/13.57$) is the youngest of the impacts, which have partly destroyed Riccius.

Pontanus RA ($l = 15.3, b = -27.8; d/D = 0.72/5.14$) is a young crater on the rim of Pontanus; it might be connected with the events that have created several features following a N–S direction in that area.

South of Stiborius several craters having diameters of the order of 10 km, present the same ratio d/D, which implies that they have common origin. Among those are Stiborius M ($l = 32.8, b = -35.5; d/D = 1.06/7.56$), Stiborius F ($l = 32.4, b = -35.7; d/D = 1.17/8.26$) and Stiborius G ($l = 35.7, b = -37.3; d/D = 1.35/9.53$); they are circular craters the close-sections of which are smooth curves, implying that they were created by low velocity impacts.

There are many more smaller craters, having diameters of the order of 3 km in the southern part of Mare Vaporum, which are very young and present similar morphological characteristics; typical examples are the craters Ukert X ($l = 1.9, b = 9.2; d/D = 0.44/3.13$) and Ukert K ($l = 3.7, b = 6.5; d/D = 0.54/3.77$). Most of the small

young craters of that area, however, possess higher d/D ratios and will be discussed later.

Vitello D ($l = -41.0$, $b = -33.2$; $d/D = 2.40/17.50$) is a young crater on highland terrain; its rim has, therefore, irregular shape. A characteristic it has in common with other craters in its vicinity is the flat mare-like floor; we observe similar floors in Vitello A ($l = -41.9$, $b = -34.1$; $d/D = 2.11/21.40$), Vitello C ($l = -42.5$, $b = -32.4$; $d/D = 1.74/14.44$) and Vitello H ($l = -43.0$, $b = -32.8$; $d/D = 1.30/12.10$). There is an obvious differentiation between the walls and the floors of those craters.

Cassini Z ($l = 2.3$, $b = 43.4$; $d/D = 0.56/3.98$) is a, relatively, young impact crater in the Montes Alpes area – it is, however, much older than Cassini G.

Regiomontanus Z ($l = -3.0$, $b = -37.5$; $d/D = 0.78/5.56$) is, apparently, the result of low velocity impact, and, therefore, it appears as a smooth depression.

Macrobius X ($l = 42.2$, $b = 32.0$; $d/D = 0.61/4.33$) is one of the oldest craters in its area and its shape has been smoothed by erosion; the definition of its geometry with use of shadow measurements is not very reliable.

In spite of the fact that Bernham T ($l = 9.6$, $b = -14.7$; $d/D = 0.56/3.96$) has been formed on very uneven highland terrain, it has a symmetrical circular shape and very easily measurable geometrical elements; it is a very young crater.

Goodacre H ($l = 16.1$, $b = -32.8$; $d/D = 0.58/4.10$) is a young circular crater on highland terrain, having the typical well-defined regular shape of a number of similar craters in that highland area; another example of that type of crater is Goodacre E ($l = 15.5$, $b = -32.9$; $d/D = 0.91/6.24$). Haidinger P ($l = -25.6$, $b = -38.5$; $d/D = 0.63/4.45$) is an example of the same type of young cone-craters on old terrain, and Gambart BB ($l = -11.4$, $b = 2.5$; $d/D = 0.48/3.39$) a similar example, but on young mare ground. This group of craters is not the only one supporting the conclusion that the morphological characteristics of craters appear, in most cases, to be independent of the structure of their area, and, therefore, they cannot be of internal origin.

Regiomontanus B ($l = -3.7$, $b = -29.0$; $d/D = 1.41/9.96$) is a, relatively, young crater on the rim of Deslandres; it bears evidence of slight erosion, and, therefore, it cannot be very young.

Abenezra A ($l = 10.5$, $b = -22.8$; $d/D = 3.31/23.36$) is the result of one of the most recent events in the very old highland area between Mare Nubium and Mare Nectaris. Its rim presents an elongation towards the SW. That can be the result of either a low angle impact or of the non-symmetrical shape of the impact. Another interesting feature of that crater is its uneven floor; there is a peculiar elevation on the floor following a N–S direction. Similar patterns appear on the floor of Abenezra also, but in no other crater of that area. The irregular borderline of the rim's shadow on the uneven floor makes the precise definition of the crater's depth very difficult.

Pontanus F ($l = 13.2$, $b = -25.2$; $d/D = 1.45/10.22$) is an elongated crater between mountains. Its main characteristic is the differentiation in structure between its walls and its mare-like flat floor.

Pitatus P ($l = -10.9$, $b = -31.0$; $d/D = 2.20/15.49$) is a part of a chain of craters

having, apparently, common origin; all these craters have very irregular shapes and it is difficult to define precisely their dimensions. Notice should be taken of the flat mare-like floor of Pitatus P.

Davy GB ($l = -5.1$, $b = -11.2$; $d/D = 0.61/4.29$), a young circular crater north of Alphonsus, appears to be part of an arc starting at Davy F and crossing the western wall of Alphonsus. Although the shadow measurements of Ptolemaeus P ($l = -3.2, b = -11.4$; $d/D = 0.61/4.21$) give a shape identical to that of Davy GB, the two craters present entirely different morphological elements. In fact, Ptolemaeus P is a much older crater and not as deep as Davy GB; while, in the case of Davy GB we measure the shadow of a regular circular rim, in the case of Ptolemaeus P we measure the shadow of a hill at its east.

The uneven surrounding terrain causes the great differences in the lengths of the shadows of Rhaeticus DA ($l = 6.0$, $b = 0.6$; $d/D = 0.58/4.08$), Rhaeticus D ($l = 6.2$, $b = 0.9$; $d/D = 1.29/7.21$) and Rhaeticus G ($l = 6.4$, $b = 1.0$; $d/D = 1.10/5.94$). The three craters are comparable in shape and age. However, the high ground at the east of Rhaeticus D and Rhaeticus G adds a couple of hundred metres to their depth, whenever that is calculated from morning shadow measurements.

Dollond ($l = 14.4, b = -10.4$; $d/D = 1.58/11.11$) is a very young crater on the western rim of a very old crater which had never been detected from Earth-based observations.

Wallace T ($l = -5.1$, $b = 21.9$; $d/D = 0.43/3.02$) is a very young small crater on the young ground of Mare Imbrium. In the same area, Pytheas G ($l = -17.7$, $b = 21.6$; $d/D = 0.49/3.44$), Pytheas L ($l = -16.9$, $b = 18.6$; $d/D = 0.46/3.22$) and Archimedes X ($l = -8.0, b = 31.0; d/D = 0.40/2.80$) have similar d/D ratio.

Abenezra H ($l = 12.8$, $b = -21.1$; $d/D = 0.58/4.07$) is a young crater on the outer side of Abenezra's wall having d/D ratio close to that of several other craters in that region.

Ramsden H ($l = -32.4$, $b = -35.7$; $d/D = 1.46/10.24$) is a, relatively, old crater and its rim has suffered considerable deformations from more recent events; the d/D ratio cannot be representative of the crater's type.

Encke Y ($l = -36.4$, $b = 5.9$; $d/D = 0.47/3.29$) is a small circular crater within the range of the Kepler ejecta. It is, obviously, associated with the Kepler event. Sommering A ($l = -11.1$, $b = 1.1$; $d/D = 0.47/3.22$) has almost identical shape and is within the range of the Copernicus ejecta. Both craters must have been created from impacts having the same low velocity.

Copernicus J ($l = -23.9$, $b = 10.1$; $d/D = 0.62/4.33$) however, although it might be related dynamically with the two previous craters, having similar origin, should be studied separately, since it is located in the rough terrain close to Copernicus and has a rather irregular shape. The same is true for Hell X ($l = -9.1$, $b = -32.0$; $d/D = 0.57/3.98$) a small crater in the vicinity of Hell ($l = -7.8, b = -32.4; d/D = 2.20/33.34$).

Silberschlag E ($l = 12.8$, $b = 5.2$; $d/D = 0.51/3.56$) is in an area where there is an alignment of several features along a NW–SE direction; any suggestions about its origin should be made, therefore, very cautiously.

Thebit U ($l = -5.8, b = -20.3; d/D = 0.52/3.63$) has, also, a moderate d/D ratio and shape comparable to that of craters created by low velocity impacts.

Klein B ($l = 1.8, b = -12.5; d/D = 0.81/5.65$) is one of the youngest craters on the uneven terrain outside the wall of Albategnius and Klein.

Vitello N ($l = -36.1, b = -32.1; d/D = 0.93/6.48$) is a young cone-crater on the very uneven highland terrain south of Vitello.

Catharina L ($l = 24.3, b = -20.0; d/D = 0.67/4.66$) and Catharina M ($l = 20.7, b = -19.2; d/D = 0.88/6.12$) are two young craters on highland terrain; there is no apparent connection between those two craters, although they are not very far from each other and possess exactly the same d/D ratio; while Catharina L has no apparent connection with other craters in its area, Catharina M should be discussed in connection with Tacitus H, Tacitus G, Tacitus F, Almanon C, Almanon K, Abulfeda X and Abulfeda T, since all those craters have been formed on a straight line and are, obviously, results of the same event.

Marco Polo T ($l = -1.0, b = 13.6; d/D = 0.45/3.13$) is a circular crater, like several others on the young terrain of Montes Apenninus. At the same latitude, but further west and within the range of the Copernicus ejecta, Gay Lussac F ($l = -20.0, b = 14.0; d/D = 0.76/5.28$) presents the same d/D ratio.

Riccius G ($l = 24.4, b = -39.9; d/D = 1.85/12.84$) is an elongated along the N–S direction relatively young crater, it is, probably, the result of low velocity impact.

Pitatus HA ($l = -11.7, b = -28.3; d/D = 0.57/3.95$) is an impact crater inside the wall of Pitatus X; a crater having floor similar to that of the near-by Mare Nubium.

Jansen T ($l = 33.5, b = 11.4; d/D = 0.69/4.78$) has the characteristic shape of a low velocity impact crater; the shape of Sinas H is similar ($l = 33.5, b = 10.0; d/D = 0.82/5.56$) 400 km south of Jansen T.

Neander H ($l = 42.4, b = -33.0; d/D = 1.89/13.09$) is a, relatively, young crater in an area covered with several low velocity impact craters.

Capuanus A ($l = -25.6, b = -34.7; d/D = 1.94/13.42$) is a very young crater, the circular rim of which is several hundred metres higher than the surrounding area.

Pallas C ($l = -1.1, b = 4.5; d/D = 0.84/5.81$) is a circular crater on the mountainous area S–E of Pallas ($l = -1.6, b = 5.5; d/D = 1.27/49.57$); it looks like Pallas H ($l = -1.5, b = 4.6; d/D = 0.19/5.34$). We wish to add to our earlier comments (Moutsoulas M. and Preka P., 1979) that there is apparently an error in the measurement of Pallas H; although the shadow cast by a mountain range at its east makes the depth calculation from morning shadow measurement rather unreliable, it is obvious that the value of $d = 0.19$ is an underestimate for its depth.

Gambart AC ($l = -20.3, b = 2.5; d/D = 0.41/2.82$) is the largest component of a twin crater 150 km south of Copernicus; it is, probaly, the result of a secondary impact. Further north, at a distance of 42 km from Timocharis, Timocharis AA ($l = -14.9, b = 25.5; d/D = 0.40/2.75$) is, probably, the result of an impact that followed the Timocharis event.

Just outside the wall of Riccius, Riccius O ($l = 27.8, b = -3.62; d/D = 1.29/8.86$) is a

rather old crater – as the erosion on its rim indicates – slightly younger than Riccius A, the rim of which it has partly destroyed.

Conon Z ($l = 2.4$, $b = 19.3$; $d/D = 0.37/2.54$) is a young circular crater in highland ground, south of the Montes Apenninus; it has a remarkable regular rim almost a hundred metres higher than the surrounding rough terrain.

Although the Orbiter IV image is slightly overexposed around Herschel J ($l = -4.3$, $b = -6.4$; $d/D = 0.74/5.08$), it is obvious that the uneven surrounding terrain is the cause for the irregular shape of its rim, and, therefore, for an uncertainty of the order of 100 m in the measurement of its depth. At a distance of 40 km N–W of Herschel J. Lalande NB ($l = -5.3$, $b = -5.2$; $d/D = 0.54/3.70$) presents the same cross-section, although it was formed on entirely different ground at lower level.

In the NW part of Mare Tranquillitatis Ross H ($l = 21.8$, $b = 10.2$; $d/D = 0.71/4.87$) has a smooth cross-section and a circular rim, typical of a low velocity impact. At a distance of 200 km NE of Ross H, Jansen EA ($l = 27.1$, $b = 13.8$; $d/D = 0.56/3.82$) has an, almost, identical general shape, while a craterlet on its western rim indicates that the crater is not very young.

On mare ground between hills of the Montes Haemus area, Menelaus A ($l = 13.4$, $b = 17.1$; $d/D = 1.00/6.85$) is a young circular crater with a small central peak.

Haidinger B ($l = -24.4$, $b = -39.2$; $d/D = 1.50/10.27$) is one of the youngest craters of the highland region south of Palus Epidemiarum; it has the shape of a shallow cone-crater. Similar is the shape of Cichus AA ($l = -22.5$, $b = -35.0$; $d/D = 0.69/4.71$) in the same highland area.

Not very far from the eastern edge of Mare Serenitatis, Littrow BC ($l = 30.7$, $b = 21.2$; $d/D = 0.62/4.24$) is one of the youngest craters of the Littrow area; it has characteristics of a low velocity impact. The morphological elements of Ariadaeus F ($l = 18.0$, $b = 4.4$; $d/D = 0.49/3.35$) are similar.

Since Ball E ($l = -8.1$, $b = -36.5$; $d/D = 0.73/4.79$) has been formed on the rim of Ball ($l = -8.4$, $b = -35.9$; $d/D = 2.81/39.51$) the calculation of its depth from shadow measurement cannot be very reliable. It is interesting to notice, that there are several other small craters along the rim of Ball, as well as on the rim of the near-by Ball A. The case is the same with Regiomontanus W ($l = -1.4$, $b = -29.5$; $d/D = 0.50/3.41$) at the other side of Deslandres on the rim of Regiomontanus and with Purbach P ($l = -3.7$, $b = -26.4$; $d/D = 0.71/4.83$) further north and on the rim of Purbach.

In the north of Mare Nubium Opelt K ($l = -17.1$, $b = -13.6$; $d/D = 0.69/4.71$) is a young circular crater having the lowest ratio among many craters of comparable size in that area.

Shadow measurements of the rim of Wolff B ($l = -8.7$, $b = 16.0$; $d/D = 1.37/9.35$) cannot give a good value for its depth; the crater is surrounded by the uneven ground of Montes Apenninus.

Mösting BA ($l = -7.4$, $b = -3.0$; $d/D = 1.37/9.35$) is one of the very young circular craters of the Mösting family; it presents however, a rather low d/D ratio in comparison to its larger neighbours.

North-east of the Apollo-11 landing site in Mare Tranquillitatis, Sabine E ($l = 25.1, b = 1.5$; $d/D = 0.67/4.57$) – now called Armstrong – is another typical example of the circular low velocity impact craters of Mare Tranquillitatis the d/D ratio of which is close to 0.15.

West of Euler in Mare Imbrium, Brayley F ($l = -34.0$, $b = 21.1$; $d/D = 0.84/5.72$) is a very young crater the circular rim of which has been slightly deformed by a more recent impact at its northern part. Although the elements of Stadius R ($l = -15.2$, $b = 12.2$; $d/D = 0.84/5.72$) are identical, there is no relationship between those two craters. It is obvious that Stadius R is related to the Copernicus event, like several other craters circling Copernicus at a distance of 3 Copernicus-radii.

Hainzel R ($l = -36.4$, $b = -38.7$; $d/D = 2.79/18.95$) is a young crater in the highland area south of Palus Epidemiarum, having a rather irregular rim. On similar ground at the eastern side of the Moon Piccolomini Q ($l = 36.4$, $b = -30.8$; $d/D = 2.04/13.84$) presents comparable morphological characteristics, although it is obvious that it is much older. At the same latitude, Lindenau D ($l = 24.9, b = -30.4$; $d/D = 1.50/10.15$) has also a rim, the irregular shape of which makes difficult the precise definition of its diameter.

Arzachel B ($l = -2.9$, $b = -17.0$; $d/D = 1.13/7.65$) is comparable in morphology with Alphonsus H ($l = -0.5$; $b = -15.6$; $d/D = 1.38/2.75$) and Parrot KA ($l = 2.1, b = -13.5$; $d/D = 1.70/11.47$) with which it is aligned; its shape is not affected very much by the fact that it has been formed on the rim of a large crater.

Although the area of D'Arrest A ($l = 13.7$, $b = 1.9$; $d/D = 0.63/4.26$) is covered with noise on the Orbiter IV imagery, the general shape of the crater looks like a classical case of low velocity impact. Similar is the case of Silberschlag G ($l = 13.8$, $b = 5.7$; $d/D = 0.48/3.22$) on the same Orbiter IV frame.

Maskelyne N ($l = 30.3$, $b = 5.4$; $d/D = 0.79/5.34$) is a young circular crater in Mare Tranquillitatis.

On a flat area, which can be considered as an extension of Mare Nectaris towards the SW rather than as a highland area, Beaumont C ($l = 28.9, b = -20.2$; $d/D = 0.98/6.62$) is a circular crater, the rim of which has been broken at its northern side by a more recent impact. Further North–West on that highland area and very close to Tacitus, Tacitus N ($l = 19.4, b = -16.9$; $d/D = 1.05/7.09$) has a very well defined circular shape.

Thebit K ($l = -3.7$, $b = -23.1$; $d/D = 0.76/5.13$) is an old depression having an elongated, along the N–S direction, shape. The coincidence of its d/D ratio with that of Thebit CB ($l = -3.1$, $b = -21.2$; $d/D = 0.50/3.37$) does not bear any physical significance; Thebit CB is a very young circular crater having a well defined rim, while the rim of Thebit K, has suffered considerable erosion.

Wilhelm DA ($l = -17.9$, $b = -42.5$; $d/D = 1.02/6.88$) has many characteristics in common with Thebit K, although it is, definitely, a much younger crater and is much easier to differentiate and estimate the particular types of later events, that are responsible for the deviation of its shape from its original form.

At the same latitude, but further east, Maurolycus S ($l = 17.1, b = -42.0$; $d/D = 0.99/6.67$) presents similar d/D ratio, although it is much younger than the previous two craters and its rim has not been subject to erosion.

Poisson L ($l = 8.2$, $b = -32.7$; $d/D = 2.37/15.97$) is an old crater, the rim of which bears the signs of many later impacts, while the near-by Poisson K ($l = 9.6$, $b = -32.7$; $d/D = 1.96/13.18$) is one of the youngest craters in the area. The similarity in the ratios d/D of those two craters leads to the conclusion that the erosion process on the Moon, caused by small impacts, might destroy parts of large craters but does not move enough material to change their general shape.

Gauricus AB ($l = -14.1$, $b = -36.3$; $d/D = 0.77/5.18$) is a case similar to that of Thebit CB, which we have discussed already, although it looks to be the result of a slightly older impact. Dollond MB ($l = 16.9$, $b = -9.6$; $d/D = 0.54/3.63$) is one of several circular young craters, of the same type and size that appear in that area of large old impacts. It is interesting to study comparatively Dollond MA ($l = 17.3$, $b = -9.4$; $d/D = 0.75/3.62$), Dollond MB, Bollond T ($l = 15.0$, $b = -9.4$; $d/D = 0.53/3.32$) and Dollond U ($l = 16.0$, $b = -7.3$; $d/D = 0.53/3.22$).

Hainzel X ($l = -36.8$, $b = -36.7$; $d/D = 0.76/5.11$) is a very young cone-crater.

Müller F ($l = 1.5$, $b = -7.8$; $d/D = 0.96/6.45$) is one of the craters aligned between Müller A ($l = 2.4$, $b = -8.2$) and Ptolemaeus G ($l = 0.1$, $b = -7.1$).

Walter F ($l = 2.1$, $b = -33.1$; $d/D = 0.82/5.51$) is a young circular crater – result of one of the youngest impacts – on the floor of Walter.

Hortensius DD ($l = -32.8$, $b = 5.1$; $d/D = 0.45/3.02$) and Hortensius DC ($l = -32.8$, $b = 5.7$; $d/D = 0.50/3.20$) are two young circular craters of Oceanus Procellarum, within the range of the Kepler ejecta.

Orontius C ($l = -4.1$, $b = -37.9$; $d/D = 2.20/14.76$) is one of the youngest craters on a relatively old terrain; its sharp rim helps us to define very precisely its shape. A couple of craterlets on the rim indicate that Orontius C must be older than its neighbour Lexell A.

Lalande E ($l = -10.7$, $b = -3.4$; $d/D = 0.53/3.55$) is a circular crater within the range of the Lalande ejecta. We should point out the remarkable similarity which exists between Lalande E and the craters Turner M ($l = -11.8$, $b = -4.2$; $d/D = 0.59/3.55$), Turner N ($l = -12.0$, $b = -2.9$; $d/D = 0.58/3.49$) and Turner K ($l = -13.4$, $b = -3.8$; $d/D = 0.68/3.55$).

Another case of similarity between neighbouring craters is that of Beaumont B ($l = 26.8$, $b = -18.6$; $d/D = 2.44/16.38$) and Beaumont C, a considerably smaller crater with slightly lower d/D ratio. Beaumont B is one of the smallest craters on the floor of which a central peak is clearly visible.

Sulpicius Gallus A ($l = 8.9$, $b = 22.1$; $d/D = 0.62/4.15$) is a young impact at the edge of Mare Serenitatus, north of Montes Haemus and east of Montes Apenninus; its rim is slightly distorted at its NE side, and, therefore, the depth measurement from the morning shadow is not very accurate.

Lade V ($l = 9.4$, $b = -0.2$; $d/D = 0.55/3.68$), which in several maps appears at the center of the crater Lade C, and Lade W ($l = 8.6$, $b = 0.2$; $d/D = 0.56/3.74$) are, obviously, the result of two simultaneous impacts of a pair of bodies having the same dimensions and velocities. The fact that both craters present the same morphological elements leads

to the conclusion that the structure of lunar material inside and outside the "Crater" Lade C is the same, and, therefore, the geology of the area and the definition of crater boundaries should be re-examined.

Le Verrier S ($l = -40.6$, $b = 38.9$; $d/D = 0.45/3.01$) is a small circular crater in Mare Imbrium, south of Le Verrier. It presents one of the lowest d/D ratios among all craters of similar type which exist in the area.

Rabbi Levi N ($l = 23.7$, $b = -36.1$; $d/D = 1.18/7.89$), a young crater on highland terrain, is in a heavily cratered area, where craters of many types can be found; having been formed at the top of a hill it gives the impression of a volcano caldera. Gemma Frisius T ($l = 16.4$, $b = -34.9$; $d/D = 1.31/8.75$) has been formed on similar terrain and, in spite of the uneven surroundings, it has a well defined circular rim, which is broken only at its SW side by a younger impact.

Heinsius K ($l = -18.5$, $b = -38.5$; $d/D = 0.73/4.87$) has been formed on the rim of Heinsius, and, therefore, the height changes along its rim, make difficult the precise definition of its depth. That applies, also, to Albategnius J ($l = 6.2$, $b = -11.1$; $d/D = 0.97/6.47$) a young circular crater on the wall of Albategnius; this case is, in fact, more complicated, since, in addition to the difficulty in the definition of the level of the crater's rim, the crater is shadowed in the early morning by the higher parts of the wall of Albategnius.

In papers which will follow we will discuss cases of typical lunar craters, the depth/diameter ratios of which are larger than 0.15.

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