COMPARATIVE ANALYSIS OF MORPHOLOGICAL FEATURES OF MERCURY CRATERS IN TWO INDEPENDENT CATALOGUES Zh. F. Rodionova [1], E. A. Feoktistova [1], A. Yu. Zharkova [1,2], A. A. Kokhanov[2],
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Introduction: The Morphological Catalog of the craters of Mercury is the first part of the Global Mercury Crater Catalog, created by the Sternberg Astronomical Institute (SAI) and MIIGAiK. Currently, the Global Mercury Crater Catalog includes > 27,000 craters, diameters ~ 12,000 of which ≥ 10 km [1]. Our catalog was created using the CraterTools module in the ArcGIS software. We compare the data of this catalogue with the Global Database of impact craters of Mercury made by Herrick et al [2].

New morphological catalog of craters of Mercury: To create the Morphological catalog of the craters of Mercury (MCM), the technique developed at the SAI MSU was applied. To describe the crater in this method, in addition to the coordinates and diameter of the crater, nine morphological features are used (Table 1). Each of these features includes a number of sub-features: degree of rim degradation (5 classes: from 1 (high preserved) to 5 (wholly degraded rim)); terraces and faults (from 0 (no terraces, no faults) to 6 (many terraces and fault); character of rim (from 0 (no rim) to 3 (massive rim)); character of central feature (from 0 (no peaks, hills or ridge on the crater floor) to 14 (ridge and many peaks)); chains of craters and fissures (from 0 (no fissures and no chains in the crater) to 7 (fissure and many chains)); character of the crater floor (1(uncertainly), 2 (flat floor), 3 (rough floor)); lava on the crater floor (from 0 (no lava) to 3 (the whole bottom is flooded with lava)); presence of ray system (from 0 (no ray system) to 2 (ray system)); local terraine (1 (plain), 2 (highland), 3 (transitional zone)).

A number of new features were added to the description: the ellipticity of the crater shape, the presence of an annular ridge, the presence of pits on the bottom, crossing the crater by a scarp, the presence of a dark or light halo around the crater.

Table 1. Percentage of Mercury's craters with different morphological features according to (MCM).

Morphological features	Designation	Percentage of craters
1. Rim degradation	1	2,4
	2	15,6
	3	38,6
	4	31,3
	5	12,1
2. Terraces and faults	0	1,9
	1	32
	2	22,6
	3	14,1
	4	2,4
	5	25,2
	6	1,8
3. Rim	0	1,9
	1	7,3
	2	79,7
	3	11,1
4. Central uplift (peaks, hills and ridges)	0	13,5
	1	46,6
	2	5,4
	3	21,3
	4	2
	5	0,9
	6	4,5
	7	0,8
	8	0
	9	3,1
	10	0,9
	11	0,1
	12	0,6
	13	0
	14	0,1
5. Chains and fissures	0	5,8
	1	53,5
	2	18,5
	3	21,8
	4	0,2
	5	0,2
	6	0,1
	7	0
6. Lava on the crater floor	0	1
	1	50,3
	2	37,1
	3	11,5
7. Ray system	0	98,5

	1	0,8
	2	0,7
8. Local terrain	mare	18,3
	highland	35,6
	transitional zone	46,1
9. Escarp	no	98,9
	escarp	1,1
10. Pit	no	99,8
	pit	0,2
11. Halo	no	99,8
	dark halo	0,2
	light halo	0,01

The lack of images for some areas of the surface of Mercury leads to the fact that for some craters the presence or absence of certain morphological features remains unrecognized.

Global Database of Impact Craters on Mercury with diameters greater than 5 km. A database of Mercury craters with a diameter> 5 km [2] has already been created. This database contains information on more than 31,600 craters, 17,000 of which have diameters more than 10 km. At the same time, obvious secondary craters are not included in the database. For the morphological description of craters in this catalog, 6 main morphological features are used (Table 2): filled, degradation state, rim and wall structure, interior shape, ejecta and miscellaneous attributes. Degradation state includes three sub-features: (fresh (f), standart (s), degraded (d)), presence of the ray system and other features. To describe the walls of the crater, the following sub-features characteristics were used: circular (c), scalloped (s) and terraced (t).

The description of the interior shape of the crater included the following features: simple (s), flat-floored (f), central peak (cp), central ridge (cridge), multiple peaks (mp), ringed peak cluster (rpc), protobasin (pb) and peak ring basin (pr). Four sub-features are used to describe ejecta: bright-rayed deposits (r), forbidden zone (fz), butterfly ejecta (b) and dark ejecta (d). In addition, the morphological description of the features of craters includes: elliptic shape (e), pits on the bottom of the crater (p), bright interior deposits (r), hollows deposits (h), dark interior deposits (d), shadowed interior (s), central-structure summit pit (spc), central-structure floor pit (cfp).

Table 2. Percentage of Mercury's craters with different morphological features according to Global Database of impact craters of Mercury.

Morphological features	Designation	Percentage of craters
Degradation state	f	1,5
	s	13,1
	d	10,2
Rim and Wall Structure	c	4,2
	s	8,4
	t	12,1
Interior Shape	s	4
	f	4,1
	cp	12,5
	cridge	0,01
	mp	3,2
	rpc	0,3
	pb	0,1
	pr	0,4
Ejecta	r	0,4
	fz	0
	b	0
	d	0,2
	d,r	0
Miscellaneous attributes	e	0,1
	p	0,3
	h	0,7
	b	0,5
	d	0
	s	0,4
	csp	0,1
	cfp	0

Comparison of the morphological parameters of the craters of Mercury according to the data of (MCM) and Global Database of Impact Craters on Mercury

When comparing the data from the both catalogs, it can be seen that most of the craters of Mercury belong to the medium state of preservation ("s" and "d" accordingly to [2] and 3 and 4 degree of rim degradation accordingly to [1]. According to [2] the proportion of craters with terraces in our catalog is 12.1% of the total number of craters. According to [1] this value is much higher: 22.6% of craters have one terrace on the slope, and 25.2% of craters have several terraces on the slope (Table 1). Global Database of Impact Craters does not contain specific information on the presence of slope collapses. According to both catalogs, a significant part of Mercury's craters has central peaks at the floor (12,5% accordingly to Global Database of Impact Craters on Mercury and 11,4% accordingly to (MCM)). According to [1] the number of craters with an annular ridge reaches 0.7%, and according to [2] this value does not exceed 0.01%. Only 0.4% of craters on Mercury have a ray system [2]. According to (MCM) [1], their share reaches 0.7%.

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References: [1] Feoktistova E.A. et al. (2020) Abstract book 11th Moscow Solar System Symposium (11MS3 –MN-03) [2] Herrick R.R. et al. (2018) JGR, 123, 2089-2109, https://doi.org/10.1029/2017JE005516