Appendix

SCIENCE CONCEPT 1

No appendix material for Science Concept 1.

SCIENCE CONCEPT 2

Table A2.1 Pertaining to Science Goal 2a, lists all of the craters and basins which may contain lower crust in calculated uplifted peaks/rings. Where d_m is the maximum depth of melting, P_m is the proximity of melt to the upper crust – lower crust boundary, and P_e is the proximity of excavation to the lower crust-upper crust boundary. 'Peaks/Rings Calc' means those craters or basins identified to contain lower crust material in melt and central uplifts from calculations only. Preserved p/r identifies the peaks and rings which are well preserved as shown through verification with LROC Quickmap. The red color indicates those craters/basins which potentially contain lower crust material in ejecta.

Name	Lat°	Long°	Diameter (km)	dm	Pm	Pe	Peak/ ring calc	Preserved p/r
Chaffee F	-38.8	-152.5	35	5.1	-5.1	-3.1		
Warner	-4	87.3	35	5.1	-5.5	-3.5		
Haldane	-1.7	84.1	37	5.4	-5.7	-3.5		
Runge	-2.5	86.7	38	5.5	-5.6	-3.3		
Crommelin C	-66.4	-144.8	44	6.5	-5.3	-2.5	p	p
Numerov Z	-68.1	-160	44	6.5	-5.5	-2.7		
Stoney	-55.3	-156.1	45	6.7	-6.1	-3.3	p	p
Cabannes M	-64.2	-170.2	48	7.1	-6.6	-3.5		
Cabannes Q	-63.3	-174.5	49	7.3	-6.5	-3.3	p	p
Chaffee	-38.8	-153.9	49	7.3	-5.4	-2.2		
Borman	-38.8	-147.7	50	7.5	-6.1	-2.8	p	p
Karrer	-52.1	-141.8	51	7.6	-7.5	-4.1		
Boyle Z	-51.3	177.7	52	7.8	-6.6	-3.1		
Eijkman	-63.1	-141.5	54	8.1	-7.2	-3.5	p	p
Baldet	-53.3	-151.1	55	8.3	-8.2	-4.5		
Boyle	-53.1	178.1	57	8.6	-8.3	-4.4	p	p
Bel'kovich A	58.7	86	58	8.8	-5.6	-1.5		
Dawson V	-66.6	-137	58	8.8	-6.4	-2.4	p	p
Lyman T	-64.1	157.7	59	8.9	-5.2	-1		
Fizeau S	-58.7	-139.9	62	9.4	-7.8	-3.4		
Bellinsgauzen	-60.6	-164.6	63	9.6	-7.2	-2.7		
Bhabha	-55.1	-164.5	64	9.7	-7	-2.4	p	p
Cori	-50.6	-151.9	65	9.9	-9	-4.3		
Nishina	-44.6	-170.4	65	9.9	-5.2	-0.5		
Abbe	-57.3	175.2	66	10.1	-10	-5.3		
Alekhin	-68.2	-131.3	70	10.7	-6.6	-1.5		
Cajori	-47.4	168.8	70	10.7	-7.7	-2.5		
Finsen	-42	-177.9	72	11.1	-7.6	-2.3	p	p
Hess Z	-52	174	73	11.2	-9.9	-4.5		
Oresme	-42.4	169.2	76	11.7	-5.1	0.7		
Alder	-48.6	-177.4	77	11.9	-8.4	-2.5	p	p

Cabannes	-60.9	-169.6	80	12.4	-10.6	-4.5	p	p
Birkeland	-30.2	173.9	82	12.7	-5.2	1.2	p	p
Maksutov	-40.5	-168.7	83	12.9	-9.8	-3.3	p	p
Lyman	-64.8	163.6	84	13.1	-8.9	-2.3	p	p
Davisson	-37.5	-174.6	87	13.6	-10.1	-3.2	p	p
Chretien	-43.9	163.6	88	13.7	-5.4	1.6		
Hess	-54.3	174.6	88	13.7	-13.3	-6.2		
Hopmann	-50.8	160.3	88	13.7	-8.7	-1.7		
Bose	-53.5	-170	91	14.2	-11.6	-4.3	p	p
Lemaitre	-61.2	-149.6	91	14.2	-13.1	-5.8	p	p
Berlage	-63.2	-162.8	92	14.4	-12.6	-5.2		
Crommelin	-68.1	-146.9	94	14.7	-12.5	-4.9	p	p
Rumford T	-28.6	-172.1	108	17.1	-6.3	2.8	p	p
Fizeau	-58.6	-133.9	111	17.6	-12.7	-3.3	p	p
Numerov	-70.7	-160.7	113	18	-14.1	-4.5	p	p
Minkowski	-56.5	-146	113	18	-16.9	-7.2	p	p
Leeuwenhoek E	-28.2	-176.7	117	18.7	-7.9	2.2		
Thomson	-32.7	166.2	117	18.7	-5.8	4.3		
Thomson M	-35.7	166	119	19	-6.9	3.5		
Leeuwenhoek	-29.3	-178.7	125	20.1	-11.4	-0.4	p	p
Minnaert	-67.8	179.6	125	20.1	-17.5	-6.5		
Repsold C	48.9	-73.6	133	21.4	-5.1	6.8		
Neper	8.5	84.6	137	22.1	-8.8	3.5		
Babbage	59.7	-57.1	143	23.2	-5.5	7.6		
Antoniadi	-69.7	-172	143	23.2	-19.7	-6.7	p	p
W. Bond	65.4	4.5	156	25.5	-7	7.5		
Compton	55.3	103.8	162	26.5	-8.4	6.8	p	p
Riemann	38.9	86.8	163	26.7	-5.6	9.7		
Struve	22.4	-77.1	164	26.9	-8.1	7.4		
J. Herschel	62	-42	165	27.1	-10.1	5.6		
Hecataeus	-21.8	79.4	167	27.4	-5.2	10.7		
Gauss	35.7	79	177	29.2	-8.7	8.4		
Von Karman	-44.8	175.9	180	29.7	-25.8	-8.4		
Fabry	42.9	100.7	184	30.4	-8.4	9.4	p	p
Vertregt	-19.8	171.1	187	31	-6.5	11.8		
Petavius	-25.1	60.4	188	31.2	-6.3	12.1	p	p
Humboldt	-27	80.9	189	31.3	-11	7.5	p	p
Zeeman	-75.2	-133.6	190	31.5	-19.8	-1.2	p	p
Maginus	-50.5	-6.3	194	32.2	-8.7	10.4		
Einstein	16.3	-88.7	198	33	-6.1	13.5		
Janssen	-45.4	40.3	199	33.1	-9.2	10.5		
Schickard	-44.3	-55.3	206	34.4	-7.1	13.4		
Oppenheimer	-35.2	-166.3	208	34.8	-28.1	-7.3		
Schwarzschild	70.1	121.2	212	35.5	-12.6	8.8		
Bel'kovich	61.1	90.2	214	35.8	-14.6	7		
Von Karman M	-47.2	176.2	225	37.8	-33.3	-10.4		
Van de Graaff	-27.4	172.2	233	39.3	-20.4	3.5		
Harkhebi	39.6	98.3	237	40	-17.3	7.1		

Leibnitz	-38.3	179.2	245	41.5	-35.4	-10		
Clavius	-58.8	-14.1	245	41.5	-17.8	7.7		
d'Alembert	50.8	163.9	248	42	-5.2	20.6		
Deslandres	-33.1	-4.8	256	43.5	-21.9	5		
Gagarin	-20.2	149.2	265	45.1	-15.1	13		
Milne	-31.4	112.2	272	46.4	-19.3	9.7		
Bailly	-66.5	-69.1	287	49.2	-20	10.9		
Pingre-Hausen	-56	-82	300	51.6	-18.9	13.7	r	
Sikorsky-Rittenhouse	-68	111	310	53.5	-32.4	1.5	r	
Lorentz	32.6	-95.3	312	53.8	-26.6	7.6	r	
Schrodinger	-75	132.4	312	53.8	-35.5	-1.3	r	r
Mendeleev	5.7	140.9	313	54	-15.3	19.1	r	r
Planck	-57.9	136.8	314	54.2	-38.2	-3.7	r	
Poincare	-56.7	163.6	319	55.2	-42.8	-7.6	r	r
Amundsen-Ganswindt	-81	120	335	58.1	-35.6	1.7	r	r
Schiller-Zucchius	-56	-45	335	58.1	-29.5	7.8	r	
Birkhoff	58.7	-146.1	345	60	-26.3	12.4	r	
Humorum	-24	-39	425	75.2	-54.1	-4.4	r	
Korolev	-4	-157.4	437	77.5	-32.3	19	r	r
Coulomb-Sarton	52	-123	440	78.1	-42.4	9.4	r	
Moscoviense	26	148	445	79	-42.4	10	r	r
Balmer-Kapteyn	-15	70	500	89.6	-68.9	-8.6	r	
Keeler-Heaviside	-10	162	500	89.6	-57.7	2.7	r	
Werner-Airy	-24	12	500	89.6	-69.6	-9.3		
Apollo	-36.1	-151.8	537	96.8	-66.6	-1	r	r
Ingenii	-43	165	560	101.3	-82.3	-13.2	r	r
Flamsteed-Billy	-7	-45	570	103.2	-80.6	-10.1		
Marginis	20	84	580	105.2	-82.7	-10.8		
Al-Khwarizmi-King	1	112	590	107.1	-80.1	-6.7		
Hertzsprung	2.6	-129.2	591	107.3	-58.5	15.1	r	r
Freundlich-Sharonov	18.5	175	600	109.1	-63.4	11.5	r	
Grissom-White	-44	-161	600	109.1	-81.8	-6.9		
Insularum	9	-18	600	109.1	-93.1	-18.2		
Lomonosov-Fleming	19	105	620	113	-83.8	-5.9		
Mendel-Rydberg	-50	-94	630	115	-89.9	-10.5	r	
Humboldtianum	59	82	650	119	-95.7	-13.3	r	
Fecunditatis	-4	52	690	126.9	-105	-16.6		
Nubium	-21	-15	690	126.9	-103.6	-15.2		
Mutus-Vlacq	-52	21	700	128.9	-105.5	-15.6		
Tranquillitatis	7	30	700	128.9	-106.9	-17		
Tsiolkovsky-Stark	-15	128	700	128.9	-102.6	-12.7		
Smythii	-2	87	740	136.8	-113.7	-17.7	r	

Crisium	18	59	740	136.8	-120.1	-24.1	r	
Nectaris	-16	34	860	161	-141.6	-27	r	r
Australe	-52	95	880	165	-141.7	-24	r	
Serenitatis	26	18	920	173.1	-154.1	-30.1	r	
Orientale	-19	-95	930	175.1	-146.7	-21.1	r	r
Imbrium	35	-17	1160	222.4	-200.5	-37.9	r	

Table A2.2 An updated lunar pyroclastic database used in Science Goal 2b.

Name	Latitude (˚N)	Longitude (˚E)	Area (km2)	Reference
Aestatis	-15	-68.4	370	1
Alphonsus (C)	-13.7	-3.4	11	2
Alphonsus (E)	-12.5	-2	8	2
Alphonsus (E)	-12.5	-1.7	8	2
Alphonsus (E)	-12.6	-1.7	10	2
Alphonsus (E)	-12.8	-1.6	25	2
Alphonsus (E)	-13	-1.6	48	2
Alphonsus (E)	-13.5	-1.6	55	2
Alphonsus (S)	-14.4	-2	43	2
Alphonsus (W)	-13.6	-4.1	39	2
Alphonsus (W)	-13.5	-4.2	41	2
Alphonsus (W)	-13.7	-4.3	79	2
Anderson E	17.1	173.6	81	18
Anderson F	16.4	174.1	31	18
Apollo Basin (E)	-30	-153.1	69	2
Apollo Basin (W)	-30	-153.5	2	2
Archimedes	28	-4	8	3
Aristarchus	26.7	-50.5	37400	4,5
Atlas (N)	47.3	44.8	100	3
Atlas (S)	45.7	44.6	250	3
Autumni	-9.5	-82.2	330	1
Birt E	-20.9	-9.8	540	18
Buys-Ballot	19.6	175.4	440	18
Cavalerius	5.1	-66.9	880	1
Compton (SC)	54	105	24	6
Compton (SE)	54	106	45	6
Compton (SW)	54	104	5	6
Cruger (N)	-16.7	-66.7	120	1
Cruger (S)	-17.9	-66.7	760	1
Cruger (W1)	-16.7	-66.7	50	1
Cruger (W2)	-16.7	-66.7	50	1
Daguerre	-11.2	34	297	7,8

E. Mare Frigoris (E)	50.1	34.4	575	4
E. Mare Frigoris (W)	49.6	27.4	1000	4
Franklin	38.4	47.9	1000	4
Gambart	-1	-15.2	100	9
Gassendi N-E	-14.82	-37.71	250	22
Gaudibert	-11.1	37.7	40	7,8
Gaudibert B	-12.4	38.7	576	7,8
Gauss	36	77	350	4
Gay-Lussac N	14.9	-20.7	1400	18
Gay-Lussac NE	14.8	-18.4	760	18
Grimaldi	-5.2	-68.3	2100	3
Grimaldi F	-7.9	-66.2	90	1
Haldane	-1.6	83.7	85	10,11
Hedin (N)	2.2	-77	113	1
Hedin (NW)	2.2	-77	130	1
Hedin (W)	2.2	-77	150	1
Hevelius	2.2	-67.5	76	1
J. Herschel (C)	62	-36.9	120	12
J. Herschel (N)	61.4	-38	260	12
J. Herschel (S)	61	-37	60	12
Kiess	-6.5	84.1	1450	10,11
Kopff	-18	-89.8	1100	18
Lagrange C	-29.9	-65	1900	1
Lavoisier	38.5	-81.9	5	13
Lavoisier	38.3	-79.7	5	13
Lavoisier	37.6	-80.7	8	13
Lavoisier	38.2	-79.8	9	13
Lavoisier	37.8	-80.3	11	13
Lavoisier	37.5	-80.8	11	13
Lavoisier	38	-80.1	18	13
Lavoisier F	36.4	-76.4	3	13
Lavoisier H	38.2	-78.1	36	13
Lomonosov-Fleming	29.4	103.64	6875	19
Lomonosov-Fleming	20.71	98.97	2500	19
Lomonosov-Fleming	23.56	99.65	625	19
Lomonosov-Fleming	26.89	104.07	1250	19
Mare Humorum	-30	-40	3000	4
Mare Smythii (NNW)	2	83	590	10
Mare Smythii (SW)	-6	86	460	10

Mare Smythii (W)	1	85	245	10
Mare Smythii (WSW)	-4.5	81.5	355	10
Mare Vaporum	10	7	10000	4
McAdie	3.6	91.7	43	11
Mersenius (NW)	-21.5	-49.2	53	1
Mersenius (SW)	-21.5	-49.2	91	1
Mersenius (W)	-21.5	-49.2	76	1
Mersenius (WNW)	-21.5	-49.2	91	1
Messala	39	60	700	4
Montes Carpatus	15	-25	2500	4
Montes Harbinger	20	-42	5400	4
Moscoviense	25.7	154.3	1500	14
Moscoviense	23.6	147.7	3700	14
NE Lavoisier (N)	41.4	-80	36	13
NE Lavoisier (NW)	41.3	-80.6	68	13
NE Lavoisier (W)	40.9	-80.6	14	13
Oppenheimer	-35.8	-163.3	13	15
Oppenheimer	-37.5	-164.6	25	15
Oppenheimer	-34	-165.5	38	15
Oppenheimer	-37.1	-163.5	140	15
Oppenheimer	-37	-168.5	245	15
Oppenheimer	-34.8	-168.3	1300	15
Oppenheimer	-38	-166.8	1500	15
Orientale	-30.2	-97.4	3600	16
Pacificus	-28.5	-99	1600	1
Riccioli (N)	-2.5	-83	1400	1
Riccioli (NW)	-2.5	-83	150	1
Riccioli (SE)	-2.9	-83	20	1
Riccioli (SW)	-2.5	-83	50	1
Riccioli (W)	-2.5	-83	40	1
Riccioli (W-SW)	-2.5	-83	40	1
Rima Bode	13	-3	10000	4
Rima Fresnel	28.5	4	2120	3
Schluter A	-9.2	-82.2	40	1
Schluter	-5.2	-83	210	18
Schrodinger	-75	140	680	17
SE of Nectaris	-22.6	40.4	891	21
Sinus Aestuum	5	-7	30000	4
Sinus Aestuum	5.44	-15.06	10000	21

Sulpicius Gallus	20	10	6000	7,8
Taruntius	5.1	46	3	11
Taruntius	5.3	46.8	4	11
Tasso S	-2	92	250	10
Taurus-Littrow	20.1	30.1	4000	4
Tobias Mayer	19.2	-31.1	170	18
Tobais Mayer N	18.2	-28.8	680	18
Tobias Mayer	14	-30.7	370	18
Walther A	-32.4	0.7	660	18

Database compiled from the following sources: [1] Coombs and Hawke (1992), [2] Head and Wilson (1979), [3] Hawke *et al.* [1989], [4] Gaddis *et al.* (1985), [5] Lucey *et al.* (1986), [6] Lucchitta (1978), [7] Coombs *et al.* (1990), [8] Hawke *et al.* (1997), [9] Hawke *et al.* (1991), [10] Yingst and Head (1998), [11] Spudis (1990), [12] McCord *et al.* (1981), [13] USGS Moon Pyroclastic Volcanism Project, [14] Craddock *et al.* (1997), [15] Rosanova *et al.* (1998), [16] Bussey and Spudis (1997), [17] Shoemaker *et al.* (1994), [18] Gustafson *et al.* (2012), [19] Giguere *et al.* (2003), [20] Sunshine *et al.* (2010), [21] Gaddis *et al.* (2003) and [22] Giguere *et al.* (2007).

Table A2.3 Well identified and described lunar cryptomare deposits.

Cryptomare deposit	Latitude (˚N)	Longitude (˚E)	Reference
Australe (interior)	-41.9	96.1	1
Balmer-Kapteyn	-18.3	70	1,2,3,4,5
Copernicus	9.7	-20.1	2
Gassendi	-16.5	-43	1,3,6
Hercules	46.8	39.2	1
Humboldtianum	55.7	73.6	1
Humboldtianum	54.5	83.8	1
Korolev	-4.5	-157.3	1
Langemak	-11.3	119.4	1
Lomonosov-Fleming	20.3	107.4	1,3,4,6
Marginis (East margin)	12.4	93.9	1,6
Maurolycus	-37.1	16.6	1
Mendeleev	1.3	141.8	1
Mendel-Rydberg	-48.8	-95.5	1,3,4
Milne	-29.4	116.5	1
Moscoviense	21.4	148.3	4
Orientale (East)/ Procellarum (South-West margin)	-11.9	-61.7	1,7
Schiller-Schickard	-46.1	-51.4	1,2,3,4,10
Smythii	-4.5	93.4	1,4
South Pole-Aitken	-49.8	-160.6	1,8,9
South Pole-Aitken	-67.2	150.7	1,8,9
Taruntius	5.4	46.3	1
Tsiolkovskiy	-22.5	126.3	1

The data sources for this table are as follows: [1] Antonenko *et al.* (1999), [2] Bell and Hawke (1984), [3] Hawke *et al.* (2003), [4] Hawke *et al.* (2005a), [5] Hawke *et al.* (2005b), [6] Giguere *et al.* (2007) , [7] Campbell and Hawke (2005), [8] Pieters and Head (2001), [9] Pieters *et al.* (2001), [10] Blewett *et al.* (1995).

Table A2.4 Pertaining to Science Goal 2b, lists all of the craters and basins which may contain mantle material in calculated uplifted peaks/rings. Where d_m is the maximum depth of melting, P_m is the proximity of melt to the crust-mantle boundary, and P_e is the proximity of excavation to the crust-mantle boundary. 'Uplifted Rings Calc' means those craters or basins identified to contain mantle material in melt and central uplifts from calculations only. Preserved ring identifies the uplifted rings which are well preserved as shown through verification with LROC Quickmap. The red color indicates the two basins which potentially contain mantle material in ejecta, note that SPA basin also may excavate mantle.

Name	Lat°	Long°	Diameter (km)	dm	Pm	Pe	Uplifted Rings Calc	Preserved ring
Von Karman	-44.8	175.9	180	29.7	-7	10.4		
Sikorsky-Rittenhouse	-68	111	310	53.5	-7.3	26.6	r	
Oppenheimer	-35.2	-166.3	208	34.8	-8.2	12.7		
Amundsen-Ganswindt	-81	120	335	58.1	-9.6	27.7	r	r
Schrodinger	-75	132.4	312	53.8	-11.5	22.7	r	r
Moscoviense	26	148	445	79	-12.8	39.7	r	r
Coulomb-Sarton	52	-123	440	78.1	-13.4	38.4	r	
Von Karman M	-47.2	176.2	225	37.8	-13.7	9.2		
Planck	-57.9	136.8	314	54.2	-14.7	19.8	r	
Leibnitz	-38.3	179.2	245	41.5	-15.3	10.2		
Poincare	-56.7	163.6	319	55.2	-20	15.2	r	r
Hertzsprung	2.6	-129.2	591	107	-25.1	48.5	r	r
Humorum	-24	-39	425	75.2	-29	20.6	r	
Keeler-Heaviside	-10	162	500	89.6	-30	30.3	r	
Freundlich-Sharonov	18.5	175	600	109	-30.6	44.3	r	
Apollo	-36.1	-151.8	537	96.8	-39.1	26.6	r	r
Balmer-Kapteyn	-15	70	500	89.6	-44	16.3	r	
Werner-Airy	-24	12	500	89.6	-45.2	15.2		
Al-Khwarizmi-King	1	112	590	107	-53.8	19.6		
Grissom-White	-44	-161	600	109	-54.6	20.3		
Flamsteed-Billy	-7	-45	570	103	-54.8	15.7		
Lomonosov-Fleming	19	105	620	113	-56.3	21.6		
Marginis	20	84	580	105	-57.4	14.6		
Ingenii	-43	165	560	101	-58	11	r	
Mendel-Rydberg	-50	-94	630	115	-64.2	15.2	r	
Insularum	9	-18	600	109	-69	5.9		
Humboldtianum	59	82	650	119	-70	12.3	r	
Tsiolkovsky-Stark	-15	128	700	129	-76.1	13.8		
Nubium	-21	-15	690	127	-77.8	10.6		
Fecunditatis	-4	52	690	127	-79.7	8.7		
Mutus-Vlacq	-52	21	700	129	-80.1	9.9		
Tranquillitatis	7	30	700	129	-81.5	8.4		
Smythii	-2	87	740	137	-88.6	7.4	r	
Crisium	18	59	740	137	-97	-1	r	
Australe	-52	95	880	165	-116	1.6	r	

Nectaris	-16	34	860	161	-118	-3	r	r
Orientale	-19	-95	930	175	-120	5.9	r	r
Serenitatis	26	18	920	173	-130	-5.6	r	
Imbrium	35	-17	1160	222	-175	-13	r	

Table A2.5 Olivine detections by Kayuga-SELENE as described by Yamamoto *et al.* (2010).

Lat ˚	Long ˚	Region
32.5	143.5	Mare Moscoviense
28.1	145.3	Mare Moscoviense
21.2	147.5	Mare Moscoviense
22.9	148.8	Mare Moscoviense
22	146.7	Mare Moscoviense
21.4	148	Mare Moscoviense
23	139.8	Mare Moscoviense
13.4	49.2	Mare Crisium
12	65.5	Mare Crisium
14.3	66.1	Mare Crisium
8.4	58.7	Mare Crisium
23.9	54.4	Mare Crisium
12	52.4	Mare Crisium
19	50	Mare Crisium
10.1	-20.3	Mare Imbrium
44.9	-0.8	Mare Imbrium
14.3	-11.6	Mare Imbrium
48.2	-31.2	Mare Imbrium
23.3	-47.1	Mare Imbrium
-19.3	-47.2	Mare Humorum
-72.1	133.8	Schrodinger
-76.3	143.1	Schrodinger
-76.2	130.6	Schrodinger
52.9	39	Mare Frigoris
-14.5	30	Mare Nectaris
-11.3	26.3	Mare Nectaris
16.2	16.3	Mare Serenitatis
53	102.3	Mare Humboldtianum
-33.5	97.1	Mare Australe
-27.1	83.1	Mare Australe
33.9	-59.2	Western side of Ocean Procellarum
35.4	56.5	Geminus
-74.9	-134.1	Zeeman

Table A2.6 Ranked mare flow intersections as used by Science Goal 2b (in optimization 1).

Lat ˚	Long ˚	Rank number	Lat ˚	Long ˚	Rank number
41.029701	-56.098499	1	35.865299	-10.631699	53
44.044601	-53.6026	2	31.3693	11.3098	54a
54.207401	-52.168998	3	26.4295	18.687599	54b
49.1408	-43.819	4	25.9258	24.552	54c
44.4318	-59.169101	5	32.142398	1.44351	54d
32.943	-69.466697	6	49.564998	-56.977001	55a
37.382701	-61.103401	7	27.327499	-70.651397	55b
30.7539	-64.508499	8	-13.5703	-17.822799	55c
26.0872	-53.918899	9a	-15.969599	-25.715999	55d
35.009201	-46.961399	9b	3.786819	-39.4831	56
40.127498	-51.591999	10	56.331501	-74.017402	57
-1.914999	-43.623298	11	5.01025	-36.331199	58
12.7945	-39.5797	12	49.431098	-66.849296	59a
-1.407809	-59.595901	13	-8.240839	-48.112598	59b
37.321201	-66.136001	14	-0.737379	-10.663999	59c
54.766101	-58.5489	15	-15.712499	-5.18759	60
29.138799	-52.887298	16	54.961799	35.971298	61
4.977469	-48.468898	17	56.731098	-66.639099	62
3.09928	-30.1109	18	18.2998	32.210899	63a
25.091999	-64.113899	19	6.122839	18.2103	63b
30.938699	-16.398099	20	53.7523	1.77441	64
19.458099	-56.880901	21	25.5741	-59.970699	65
25.9575	-32.6763	22	2.81135	-55.200801	66
23.837699	31.5337	23	-19.319099	-36.845401	67a
2.65117	-44.051998	24	39.887199	-34.813701	67b
7.470089	-53.6721	25	61.6053	-2.048749	68
30.714899	-29.6608	26	17.322399	14.900799	69
27.089199	6.8547	27	61.618698	-42.1212	70a
23.5195	-45.7672	28	16.5988	2.145329	70b
31.7949	-59.2607	29	21.149999	-15.9251	71a
10.2817	-50.5424	30	-31.178199	97.607398	71b
9.965459	-34.132701	31	-53.745201	160.901	71c
23.027299	-68.566398	32a	59.433399	-49.7434	72a
19.3574	-39.8017	32b	-25.018899	-47.0587	72b
16.0956	-64.913497	32c	-27.399799	-24.503599	72c
-10.0656	-42.547199	32d	-23.7903	-6.12616	72d
16.6096	-32.327301	32e	23.303199	4.433559	72e
30.312299	-43.599399	32f	15.444499	26.7807	72f
29.0293	32.8413	33	19.999799	88.684097	72g
-19.734899	-14.636599	34	18.0501	80.9225	72h
-20.336099	-22.091899	35	-45.815399	83.871696	72i
35.784198	-24.3784	36	-20.226299	-90.519401	72j
51.895099	-20.163299	37	-16.945199	-98.413299	72k
-8.57425	-36.195301	38	39.695201	24.855199	73a
9.102009	-41.508499	39	12.052499	21.3292	73b

14.720899	-47.333198	40	8.989879	39.303298	73c
41.156799	-24.046699	41	5.94569	24.642099	73d
23.076299	11.9965	42	6.165279	30.639799	73e
61.5685	-19.7835	43a	2.383049	35.291099	73f
17.7924	22.2019	43b	41.1427	13.864999	74a
22.122299	17.083499	43c	58.0405	0.122056	74b
-5.169189	-52.674701	44	12.589099	33.858299	74c
-0.610279	-49.452499	45a	57.759998	84.904701	74d
-6.82001	-60.382099	45b	57.7388	76.343803	74e
49.564701	-24.883499	46	-50.507598	99.265602	74f
46.3931	-32.884998	47	-52.3936	92.847	74g
40.296001	-45.1819	48	-56.681701	97.334999	74h
34.024898	-36.4323	49	48.747001	-76.069702	75a
29.492799	152.239	50	41.638301	-73.779403	75a
26.4274	-25.9181	51	56.1735	8.942779	76a
56.795299	-19.884599	52a	34.418701	30.7203	76b
61.687999	-12.9849	52b			

The purpose of using mare flow intersections was to select locations where multiple mare basalts of a variety of ages could be sampled from one landing site. The ranking was done based on the number of flows which intersected at one place (*e.g.* sites where 2 flows intersected was given a score of 4, 3 flows a score of 3, 4 flows a score of 2 etc). The ages of the flows were then scored such that if the age range of all of the flows was >2.0 Ga the point was given score of 3, if the ages were between 1.5 to 2.0 Ga the point was given a score of 4, between 1.0 to 1.5 Ga a score of 5 etc etc… The scores were combined and then ranked with points sampling younger flows given higher priority than older flows. Notice that there are multiples of some ranks *e.g.* 52a and 52b this is because the two sites scored exactly the same scores and could not be separated by relative age.

Table A2.7 Data used to determine which Copernican craters would expose melt sheet in the Birkhoff and Mendel-Rydberg basins. Superscript notes are as follows: (a) Ages are based on Wilhelms (1987); (b) Basin diameters are from Spudis (1993); (c) Transient cavity diameter was calculated using Equation 5 from Kring (1995); (d) Regolith thickness was calculated using McGetchin *et al.* (1973) and Equation 1 from Kring (1995).

Age[a]	Basin Name	Center Latitude	Center Longitude	Diameter [b] (km)	Transient Cavity Diameter [c] (km)	Max. Impact Regolith Thickness [d] (m)	Nom. Impact Regolith Thickness [d] (m)	Min. Impact Regolith Thickness [d] (m)
Pre-Nectarian	Birchoff	59	-147	325	171	122	57	26
Nectarian	Mendel-Rydberg	-50	-94	420	217	299	196	130

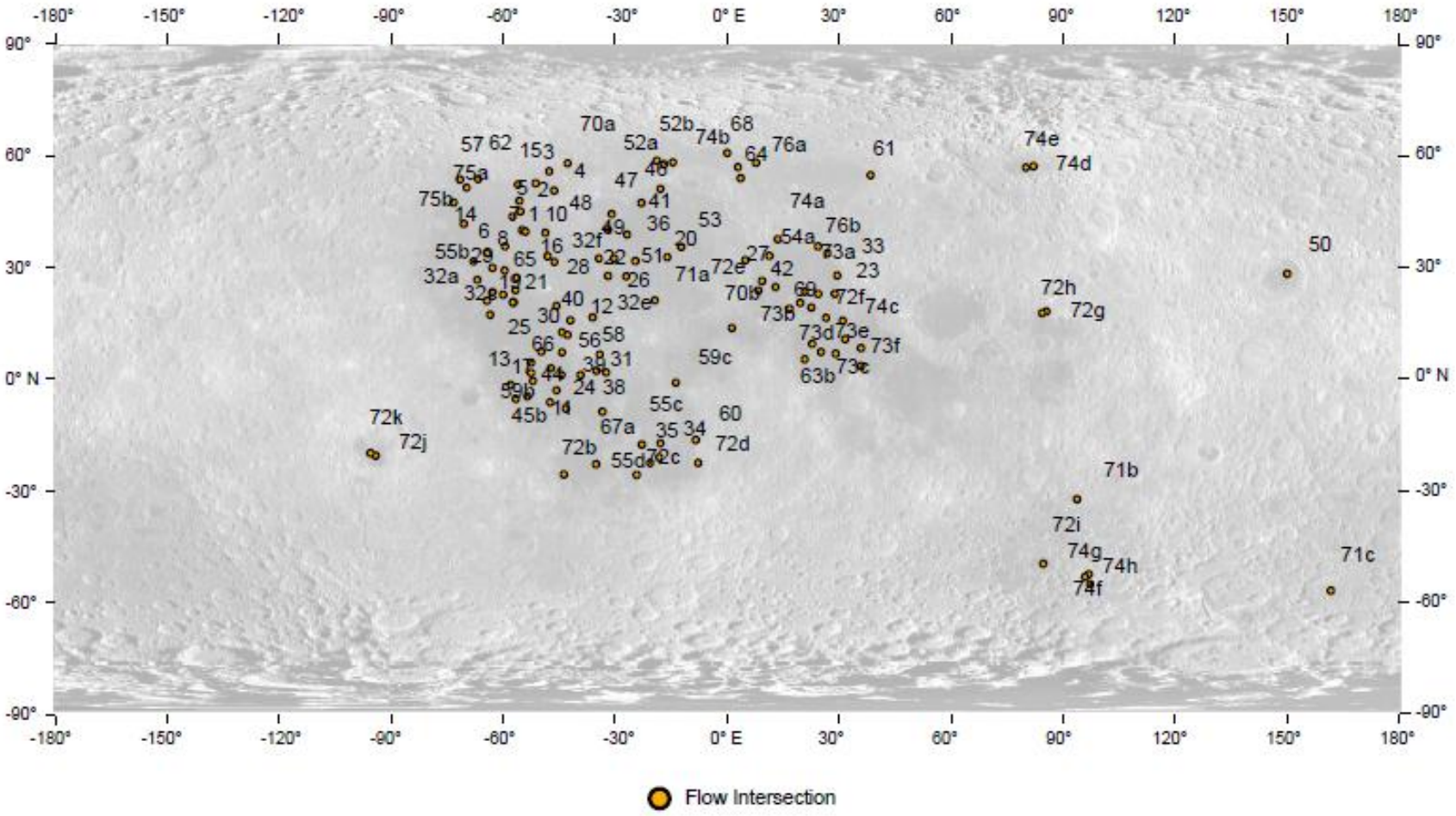


Figure A2.1 Pertaining to Science Goal 2b this map shows the locations of ranked mare intersections for optimization 1.

SCIENCE CONCEPT 3

Table A3.1List of PAN detections by SP onboard Kaguya (Ohtake *et al.*, 2009), from Earth-based observations (Hawke *et al.*, 2003) and with Clementine (Tompkins and Pieters, 1999). PAN detections from Ohtake (2010), realized with MI onboard Kayuga, were not available as a list of precise locations, and are therefore not detailed in the following Table.

Name	Lat (˚N)	Long (˚E)	Diam. (km)	Age	Geological province	Ohtake 2009	Hawke 2003	Tompkins 1999
Alphonsus	-14.00	-3.00	119.00	Nectarian	PKT			x
Anaxagoras	74.10	-8.90	50.00			x	x	
Appleton	40.00	158.00	63.00	Nectarian	FHTA			x
Aristarchus	23.50	-47.50	42.00	Copernican	PKT	x		
Atlas	47.00	44.40	87.00	Up. Imb.		x		
Belyaer	23.00	143.00	51.00		FHTA			x
Berkner	25.00	-105.00	95.00					x
Bernouilli	35.00	61.00	47.00	Up. Imb.				x
Bettinus	-64.00	-45.00	82.00					x
Bohnenberger F	-14.70	39.60	10.00				x	
Bridgman	43.50	137.00	94.00					x
Byrgius A	-24.10	-63.80	20.00			x		
Cantor	38.50	119.00	75.00	Up. Imb.				x
Carpenter	70.00	-50.50	60.00	Copernican				x
Cyrillus	-13.50	24.00	93.00	Nectarian				x
Daedalus	-5.50	180.00	100.00	Low. Imb.	FHTA			x
Damoiseau C	-6.40	-63.30	15.00		PKT		x	
Damoiseau D	-9.10	-62.50	17.00		PKT		x	
Delporte	-16.00	121.50	40.00		FHTA			x
Doppel-Mayer	-28.50	-41.00	65.00	Nectarian				x
Eichstadt	-22.00	-78.00	45.00					x
Einstein	17.00	-72.00	48.00		PKT			x
Fechner T	-59.00	122.00	18.00			x		
Gassendi E	-18.00	-44.00	9.00		PKT	x	x	
Gassendi K	-18.70	-43.60	6.00		PKT		x	
Geminus	34.50	56.70	86.00	Eratosth.			x	
Giordano Bruno	36.00	103.00	22.00	Copernican		x		
Goldschmidt	73.20	-3.80	113.00	Nectarian?			x	
Goltsyn	-27.10	-103.60	20.00			x		
Grimaldi (inner rim)	-5.50	-68.30	172.00		PKT		x	
Hahn	31.50	74.00	84.00	Low. Imb.				x
Helmholtz	-69.00	65.50	110.00					x
Hubble (Plutarch A)	22.50	87.00	82.00	Nectarian				x
Jackson	22.00	-163.00	71.00	Copernican	FHTA	x		
Janssen K	-46.20	42.50	15.00			x		
Joliot-Curie	26.00	93.50	143.00	Pre-Nect.				x

Name	Lat (°N)	Long (°E)	Diam. (km)	Age	Geological province	Ohtake 2009	Hawke 2003	Tompkins 1999
Kant	-11.00	20.00	33.00			x	x	
Keeler	-10.00	162.00	132.00	Low. Imb.	FHTA			x
King	6.00	120.50	77.00	Copernican	FHTA	x		
Kirkwood	69.00	123.00	70.00	Eratosth.				x
Korolev	-9.00	-157.00	57.00	Nectarian	FHTA			x
Leibnitz S	-39.60	172.00	2.00		SPA	x		
Leuschner	1.50	-109.00	42.00		FHTA			x
Liebig A	-24.30	-47.70	12.00				x	
Liebig B	-25.00	-47.10	9.00				x	
Lodygin	-18.00	-147.00	50.00		FHTA			x
Mach	18.00	-149.00	155.00		FHTA			x
Manilius	14.50	9.00	40.00	Eratosth.	PKT			x
Maurolycus	-42.00	13.50	137.00					x
Mendell	-51.00	-110.00	160.00					x
Mersenius C	-19.80	-45.90	14.00				x	
Miller	-39.00	1.00	68.00					x
Millikan	47.00	121.00	100.00	Nectarian				x
Milne N	-32.50	110.80	3.00			x		
Morse	22.00	-175.00	62.00	Eratosth.	FHTA			x
Nansen	81.00	95.00	116.00	Nectarian				x
O'Day	-31.00	157.00	71.00		SPA	x		x
Orientale (In. Rook massif)	-21.00	-86.00	327.00			x	x	
Orientale (In. Rook North)	-10.00	-96.00	327.00	Low. Imb.		x	x	
Paracelsus	-23.00	163.00	71.00		SPA			x
Petavius	-25.00	60.40	188.00			x	x	
Philolaus	72.50	-32.50	71.00	Copernican				x
Piccolomini	-29.50	32.00	88.00	Up. Imb.				x
Pitatus	-30.00	-13.50	101.00	Nectarian	PKT			x
Plana	42.00	28.50	44.00		PKT			x
Plinius	15.50	23.50	43.00	Eratosth.				x
Plutarch	24.50	79.00	68.00	Eratosth.				x
Posidonius	32.00	30.00	95.00	Up. Imb.				x
Proclus	16.00	46.60	28.00			x		
Pythagoras	64.00	-63.00	130.00	Eratosth.		x		
Robertson	22.00	-105.00	88.00	Copernican		x		
Rydberg	-47.00	-96.00	50.00	Eratosth.				x
Ryder	-42.00	143.00	17.00			x		
Schjellerup	70.00	157.00	68.00	Up. Imb.				x
Schorr	-19.50	90.00	48.00	Up. Imb.				x
Schrodinger	-73.00	135.00	312.00	Low. Imb.		x		
Slipher	50.00	160.00	87.00	Up. Imb.	FHTA			x
South Ray	-9.00	15.00	0.80			x		
Stiborius	-35.00	32.00	45.00					x

Name	Lat (˚N)	Long (˚E)	Diam. (km)	Age	Geological province	Ohtake 2009	Hawke 2003	Tompkins 1999
Theophilus	-11.40	26.40	110.00	Eratosth.			**x**	
Tsiolkovsky	-20.00	129.00	185.00	Up. Imb.	FHTA	**x**		**x**
Tycho	-43.00	-11.00	85.00			**x**		
Vavilov	-1.50	-139.00	99.00	Copernican	FHTA	**x**		**x**
Virtanen	16.00	177.00	40.00		FHTA	**x**		
Vitello	-30.40	-37.50	42.00	Low. Imb.			**x**	
Vlacq	-53.50	39.00	98.00					**x**
Wiener	41.00	146.00	131.00	Nectarian	FHTA			**x**

Table A3.2 List of all the craters that should have excavated lower crust (LCE) or mantle (ME) in the ejecta, or that should have lower crust (LCM) or mantle (MM) in their preserved central peak or uplifted rings.

Name	Latitude (°N)	Longitude (°E)	Diameter (km)	Age	LCE	LCM	ME	MM
Abbe	-57.30	175.20	66.00	Nectarian	x	x		
Alder	-48.60	-177.40	77.00	Low. Imb.		x		
Al-Khwarizmi-King	1.00	112.00	590.00	Pre-Nect.	x			
Amundsen-Ganswindt	-81.00	120.00	335.00	Pre-Nect.		x		x
Antoniadi	-69.70	-172.00	143.00	Up. Imb.	x	x		
Apollo	-36.10	-151.80	537.00	Pre-Nect.		x		x
Australe	-52.00	95.00	880.00	Pre-Nect.	x	x		x
Balmer-Kapteyn	-15.00	70.00	500.00	Pre-Nect.	x	x		x
Berlage	-63.20	-162.80	92.00		x			
Bhabha	-55.10	-164.50	64.00	Nectarian		x		
Birkeland	-30.20	173.90	82.00	Eratosth.		x		
Birkhoff	58.70	-146.10	345.00	Pre-Nect.		x		
Borman	-38.80	-147.70	50.00	Low. Imb.		x		
Bose	-53.50	-170.00	91.00	Nectarian		x		
Boyle	-53.10	178.10	57.00	Nectarian		x		
Cabannes	-60.90	-169.60	80.00			x		
Cabannes Q	-63.30	-174.50	49.00	Nectarian		x		
Compton	55.30	103.80	162.00	Low. Imb.		x		
Coulomb-Sarton	52.00	-123.00	440.00	Pre-Nect.		x		x
Crisium	18.00	59.00	740.00	Nectarian	x	x		x
Crommelin	-68.10	-146.90	94.00			x		
Crommelin C	-66.40	-144.80	44.00	Nectarian		x		
Davisson	-37.50	-174.60	87.00			x		
Dawson V	-66.60	-137.00	58.00			x		
Eijkman	-63.10	-141.50	54.00	Nectarian		x		
Fabry	42.90	100.70	184.00	Pre-Nect.		x		
Fecunditatis	-4.00	52.00	690.00	Pre-Nect.	x			
Finsen	-42.00	-177.90	72.00	Eratosth.		x		
Fizeau	-58.60	-133.90	111.00	Up. Imb.		x		
Flamsteed-Billy	-7.00	-45.00	570.00	Pre-Nect.	x			
Freundlich-Sharonov	18.50	175.00	600.00	Pre-Nect.		x		x
Grissom-White	-44.00	-161.00	600.00	Pre-Nect.	x			
Hertzsprung	2.60	-129.20	591.00	Nectarian		x		x
Hess	-54.30	174.60	88.00		x			
Humboldt	-27.00	80.90	189.00	Up. Imb.		x		
Humboldtianum	59.00	82.00	650.00	Nectarian	x	x		x
Humorum	-24.00	-39.00	425.00	Nectarian		x		x
Imbrium	35.00	-17.00	1160.00	Low. Imb.	x	x	x	x
Ingenii	-43.00	165.00	560.00	Pre-Nect.	x	x		x
Insularum	9.00	-18.00	600.00	Pre-Nect.	x			

Name	Latitude (˚N)	Longitude (˚E)	Diameter (km)	Age	LCE	LCM	ME	MM
Keeler-Heaviside	-10.00	162.00	500.00	Pre-Nect.		x		x
Korolev	-4.00	-157.40	437.00	Nectarian		x		
Leeuwenhoek	-29.30	-178.70	125.00	Nectarian		x		
Leibnitz	-38.30	179.20	245.00	Pre-Nect.	x			
Lemaitre	-61.20	-149.60	91.00	Nectarian	x	x		
Lomonosov-Fleming	19.00	105.00	620.00	Pre-Nect.	x			
Lorentz	32.60	-95.30	312.00	Pre-Nect.		x		
Lyman	-64.80	163.60	84.00	Up. Imb.		x		
Maksutov	-40.50	-168.70	83.00	Up. Imb.		x		
Marginis	20.00	84.00	580.00	Pre-Nect.	x			
Mendeleev	5.70	140.90	313.00	Nectarian		x		
Mendel-Rydberg	-50.00	-94.00	630.00	Nectarian	x	x		x
Minkowski	-56.50	-146.00	113.00		x	x		
Minnaert	-67.80	179.60	125.00		x			
Moscoviense	26.00	148.00	445.00	Nectarian		x		x
Mutus-Vlacq	-52.00	21.00	700.00	Pre-Nect.	x			
Nectaris	-16.00	34.00	860.00	Nectarian	x	x		x
Nubium	-21.00	-15.00	690.00	Pre-Nect.	x			
Numerov	-70.70	-160.70	113.00	Nectarian		x		
Oppenheimer	-35.20	-166.30	208.00	Nectarian	x			
Orientale	-19.00	-95.00	930.00	Low. Imb.	x	x		x
Petavius	-25.10	60.40	188.00	Low. Imb.		x		
Pingre-Hausen	-56.00	-82.00	300.00	Pre-Nect.		x		
Planck	-57.90	136.80	314.00	Pre-Nect.		x		x
Poincare	-56.70	163.60	319.00	Pre-Nect.	x	x		x
Rumford T	-28.60	-172.10	108.00			x		
Schiller-Zucchius	-56.00	-45.00	335.00	Pre-Nect.		x		
Schrodinger	-75.00	132.40	312.00	Low. Imb.		x		x
Serenitatis	26.00	18.00	920.00	Nectarian	x	x	x	x
Sikorsky-Rittenhouse	-68.00	111.00	310.00	Nectarian		x		x
Smythii	-2.00	87.00	740.00	Pre-Nect.	x	x		x
Stoney	-55.30	-156.10	45.00			x		
Tranquillitatis	7.00	30.00	700.00	Pre-Nect.	x			
Tsiolkovsky-Stark	-15.00	128.00	700.00	Pre-Nect.	x			
Von Karman	-44.80	175.90	180.00	Pre-Nect.	x			
Von Karman M	-47.20	176.20	225.00	Pre-Nect.	x			
Werner-Airy	-24.00	12.00	500.00	Pre-Nect.	x			
Zeeman	-75.20	-133.60	190.00	Nectarian		x		

Table A3.3 Final list of potential landing sites for Science Goal 3a. Highlighted ones correspond to prioritized sites, where at least 3 of the 4 requirements could be addressed. Note that for this Table, the requirement R2 was considered achieved only when sites were sampling H1 and H2 types, which are the high priority targets.

Requirements:

R1: sample the planetary differentiation products;
R2: sample the variety of highland types;
R3: sample the 3 main geochemical terranes (FHT, PKT, SPAT);
R4: determine the origin and extent of the KREEP layer.

Name	Lat (°N)	Long (°E)	Diameter (km)	Age	Geological province	R1	R2	R3	R4
Abbe	-57.30	175.20	66.00	Nectarian	SPAT	**x**		**x**	
Airy M	-19.20	7.60	1.00		PKT		**H3**	**x**	
Alder	-48.60	-177.40	77.00	Low. Imb.	SPAT	**x**		**x**	
Al-Khwarizmi-King	1.00	112.00	590.00	Pre-Nect.	FHTa	**x**		**x**	**Low**
Alpetragius H	-18.00	-6.00	5.00		PKT		**H3**	**x**	
Alphonsus	-14.00	-3.00	119.00	Nectarian	PKT	**x**		**x**	
Amundsen-Ganswindt	-81.00	120.00	335.00	Pre-Nect.	SPAT	**x**		**x**	**low**
Anaxagoras	74.10	-8.90	50.00			**x**			
Antoniadi	-69.70	-172.00	143.00	Up. Imb.	SPAT	**x**		**x**	**high**
Apollo	-36.10	-151.80	537.00	Pre-Nect.	SPAT	**x**		**x**	**low**
Appleton	40.00	158.00	63.00	Nectarian	FHTa	**x**		**x**	
Aratus	23.60	4.50	10.00		PKT		**H3**	**x**	
Archimedes E	25.00	-7.20	3.00	Copernican	PKT		**H5**	**x**	
Archimedes L	25.00	-2.60	4.00	Copernican	PKT		**H5**	**x**	
Archimedes R	26.00	-6.60	4.00	Copernican	PKT		**H5**	**x**	
Aristarchus	23.70	-47.40	40.00	Copernican	PKT	**x**	**H5**	**x**	
Atlas	47.00	44.40	87.00	Up. Imb.		**x**			
Australe	-52.00	95.00	880.00	Pre-Nect.		**x**			**low**
Autolycus	30.70	1.50	39.00	Copernican	PKT		**H5**	**x**	
Autolycus A	30.90	2.20	4.00	Copernican	PKT		**H5**	**x**	
Balmer-Kapteyn	-15.00	70.00	500.00	Pre-Nect.		**x**			
Belyaer	23.00	143.00	51.00		FHTa	**x**		**x**	
Berkner	25.00	-105.00	95.00			**x**			
Berlage	-63.20	-162.80	92.00		SPAT	**x**		**x**	
Bernouilli	35.00	61.00	47.00	Up. Imb.		**x**			
Bettinus	-64.00	-45.00	82.00			**x**			
Bhabha	-55.10	-164.50	64.00	Nectarian	SPAT	**x**		**x**	
Birkeland	-30.20	173.90	82.00	Eratosth.	SPAT	**x**		**x**	
Birkhoff	58.70	-146.10	345.00	Pre-Nect.	FHTa	**x**		**x**	
Birkhoff Z	61.30	-145.30	30.00	Copernican	FHTa	**x**		**x**	
Birkhoff Z	61.30	-145.30	30.00	Copernican	FHTa		**H1**	**x**	
Bode G	6.40	-3.50	4.00		PKT		**H4**	**x**	
Bohnenberger F	-14.70	39.60	10.00			**x**			

Name	Lat (˚N)	Long (˚E)	Diameter (km)	Age	Geological province	R1	R2	R3	R4
Bonpland C	-10.20	-17.40	4.00		PKT		**H4**	**x**	
Borman	-38.80	-147.70	50.00	Low. Imb.	SPAT	**x**		**x**	
Bose	-53.50	-170.00	91.00	Nectarian	SPAT	**x**		**x**	
Boyle	-53.10	178.10	57.00	Nectarian	SPAT	**x**		**x**	
Bridgman	43.50	137.00	94.00			**x**			
Byrgius A	-24.10	-63.80	20.00			**x**			
Cabannes	-60.90	-169.60	80.00		SPAT	**x**		**x**	
Cabannes Q	-63.30	-174.50	49.00	Nectarian	SPAT	**x**		**x**	
Cantor	38.50	119.00	75.00	Up. Imb.		**x**			
Carpenter	70.00	-50.50	60.00	Copernican		**x**			
Cassini K	45.20	4.10	4.00		PKT		**H4**	**x**	
Compton	55.30	103.80	162.00	Low. Imb.		**x**			**high**
Condorcet T	11.80	65.80	15.00				**H2**		
Conon	21.60	2.00	21.00	Copernican	PKT		**H3**	**x**	
Copernicus	9.70	-20.10	93.00	Copernican	PKT		**H4**	**x**	
Coulomb-Sarton	52.00	-123.00	440.00	Pre-Nect.		**x**			**low**
Crisium	18.00	59.00	740.00	Nectarian		**x**			
Crommelin	-68.10	-146.90	94.00		SPAT	**x**		**x**	
Crommelin C	-66.40	-144.80	44.00	Nectarian	SPAT	**x**		**x**	
Crookes	-10.65	-165.20	49.00	Copernican	FHTa	**x**		**x**	
Crookes	-10.65	-165.20	49.00	Copernican	FHTa		**H1**	**x**	
Cyrillus	-13.50	24.00	93.00	Nectarian		**x**			
Daedalus	-5.50	180.00	100.00	Low. Imb.	FHTa	**x**		**x**	
Damoiseau C	-6.40	-63.30	15.00		PKT	**x**		**x**	
Damoiseau D	-9.10	-62.50	17.00		PKT	**x**		**x**	
Darwin C	-20.50	-71.00	16.00				**H2**		
Das	-26.84	-137.01	38.00	Copernican	FHTa	**x**		**x**	
Davisson	-37.50	-174.60	87.00		SPAT	**x**		**x**	
Dawson V	-66.60	-137.00	58.00		SPAT	**x**		**x**	
Delporte	-16.00	121.50	40.00		FHTa	**x**		**x**	
Doppel-Mayer	-28.50	-41.00	65.00	Nectarian		**x**			
Eichstadt	-22.00	-78.00	45.00			**x**			
Eijkman	-63.10	-141.50	54.00	Nectarian	SPAT	**x**		**x**	
Einstein	17.00	-72.00	48.00		PKT	**x**		**x**	
Eudoxus	44.30	16.30	67.00	Copernican	PKT		**H3**	**x**	
Fabry	42.90	100.70	184.00	Pre-Nect.		**x**			
Fechner T	-59.00	122.00	18.00			**x**			
Fecunditatis	-4.00	52.00	690.00	Pre-Nect.		**x**			
Finsen	-42.00	-177.90	72.00	Eratosth.	SPAT	**x**		**x**	
Fizeau	-58.60	-133.90	111.00	Up. Imb.	SPAT	**x**		**x**	
Flammarion A	-1.90	-2.50	4.00		PKT		**H4**	**x**	
Flamsteed-Billy	-7.00	-45.00	570.00	Pre-Nect.	PKT	**x**		**x**	**high**
Fra Mauro F	-6.70	-16.90	3.00	Copernican	PKT		**H5**	**x**	
Fra Mauro H	-4.10	-15.50	6.00	Copernican	PKT		**H5**	**x**	

Name	Lat (˚N)	Long (˚E)	Diameter (km)	Age	Geological province	R1	R2	R3	R4
Fra Mauro J	-2.60	-18.60	3.00	Copernican	PKT		**H5**	**x**	
Fra Mauro K	-2.50	-16.70	6.00	Copernican	PKT		**H5**	**x**	
Fra Mauro R	-2.20	-15.60	3.00	Copernican	PKT		**H5**	**x**	
Fra Mauro W	-1.30	-16.80	4.00	Copernican	PKT		**H5**	**x**	
Freundlich-Sharonov	18.50	175.00	600.00	Pre-Nect.	FHTa	**x**		**x**	**low**
Gambart A	1.00	-18.70	12.00	Copernican	PKT		**H5**	**x**	
Gartner D	58.50	33.90	8.00		PKT		**H3**	**x**	
Gassendi A	-15.50	-39.70	33.00	Copernican	PKT		**H3**	**x**	
Gassendi E	-18.00	-44.00	9.00		PKT	**x**		**x**	
Gassendi K	-18.70	-43.60	6.00		PKT	**x**		**x**	
Geminus	34.50	56.70	86.00	Eratosth.		**x**			
Giordano Bruno	36.00	103.00	22.00	Copernican		**x**			
Glazenap F	-1.50	139.70	11.00		FHTa	**x**		**x**	
Glazenap F	-1.50	139.70	11.00		FHTa		**H1**	**x**	
Godin	1.80	10.20	34.00	Copernican	PKT		**H3**	**x**	
Goldschmidt	73.20	-3.80	113.00	Nectarian?		**x**			
Goltsyn	-27.10	-103.60	20.00			**x**			
Green M	0.90	132.90	37.00		FHTa	**x**		**x**	
Grimaldi (inner rim)	-5.50	-68.30	172.00		PKT	**x**		**x**	
Grissom-White	-44.00	-161.00	600.00	Pre-Nect.	SPAT	**x**		**x**	
Hahn	31.50	74.00	84.00	Low. Imb.		**x**			
Harpalus	52.60	-43.40	39.00	Copernican	PKT		**H4**	**x**	
Helmholtz	-69.00	65.50	110.00			**x**			
Hertzsprung	2.60	-129.20	591.00	Nectarian	FHTa	**x**		**x**	**low**
Hess	-54.30	174.60	88.00		SPAT	**x**		**x**	
Hubble (Plutarch A)	22.50	87.00	82.00	Nectarian		**x**			
Humboldt	-27.00	80.90	189.00	Up. Imb.		**x**			
Humboldtianum	59.00	82.00	650.00	Nectarian		**x**			
Humorum	-24.00	-39.00	425.00	Nectarian		**x**			**high**
Imbrium	35.00	-17.00	1160.00	Low. Imb.	PKT	**x**		**x**	**high**
Ingenii	-43.00	165.00	560.00	Pre-Nect.	SPAT	**x**		**x**	**high**
Insularum	9.00	-18.00	600.00	Pre-Nect.	PKT	**x**		**x**	**high**
Jackson	22.00	-163.00	71.00	Copernican	FHTa	**x**		**x**	
Janssen K	-46.10	42.30	16.00			**x**	**H2**		
Joliot-Curie	26.00	93.50	143.00	Pre-Nect.		**x**			
Kant	-11.00	20.00	33.00			**x**			
Keeler	-10.00	162.00	132.00	Low. Imb.	FHTa	**x**		**x**	
Keeler-Heaviside	-10.00	162.00	500.00	Pre-Nect.	FHTa	**x**		**x**	
Kepler	8.10	-38.00	31.00	Copernican	PKT		**H5**	**x**	
Kepler A	7.20	-36.10	11.00	Copernican	PKT		**H5**	**x**	
King	6.00	120.50	77.00	Copernican	FHTa	**x**		**x**	
Kirkwood	69.00	123.00	70.00	Eratosth.		**x**			

Name	Lat (˚N)	Long (˚E)	Diameter (km)	Age	Geological province	R1	R2	R3	R4
Klute W	38.20	-143.00	13.00	Eratosthenian	FHTa	x	H1	x	
Korolev	-9.00	-157.00	57.00	Nectarian	FHTa	x		x	
Larmor Q	28.60	176.20	22.00		FHTa	x	H1	x	
Leeuwenhoek	-29.30	-178.70	125.00	Nectarian	SPAT	x		x	
Legendre H	-32.50	78.10	7.00				H2		
Leibnitz	-38.30	179.20	245.00	Pre-Nect.	SPAT	x		x	
Leibnitz S	-39.60	172.00	2.00		SPAT	x		x	
Lemaitre	-61.20	-149.60	91.00	Nectarian	SPAT	x		x	
Leuschner	1.50	-109.00	42.00		FHTa	x		x	
Liebig A	-24.30	-47.70	12.00			x			
Liebig B	-25.00	-47.10	9.00			x			
Lodygin	-18.00	-147.00	50.00		FHTa	x		x	
Lomonosov-Fleming	19.00	105.00	620.00	Pre-Nect.		x			low
Lorentz	32.60	-95.30	312.00	Pre-Nect.		x			
Lowell W	-10.00	-107.00	18.00		FHTa	x		x	
Lyman	-64.80	163.60	84.00	Up. Imb.	SPAT	x		x	
Mach	18.00	-149.00	155.00		FHTa	x		x	
Maksutov	-40.50	-168.70	83.00	Up. Imb.	SPAT	x		x	
Mandel'shtam F	5.20	166.20	17.00		FHTa	x	H1	x	
Manilius	14.50	9.00	40.00	Eratosth.	PKT	x		x	
Marco Polo F	15.70	-4.50	4.00		PKT		H4	x	
Marginis	20.00	84.00	580.00	Pre-Nect.		x			low
Maurolycus	-42.00	13.50	137.00			x			
Mendeleev	5.70	140.90	313.00	Nectarian	FHTa	x		x	
Mendell	-51.00	-110.00	160.00			x			
Mendel-Rydberg	-50.00	-94.00	630.00	Nectarian	SPAT	x		x	low
Mersenius C	-19.80	-45.90	14.00			x			
Michelson H	4.60	-116.80	35.00		FHTa	x		x	
Miller	-39.00	1.00	68.00			x			
Millikan	47.00	121.00	100.00	Nectarian		x			
Milne N	-32.50	110.80	3.00			x			
Minkowski	-56.50	-146.00	113.00		SPAT	x		x	
Minnaert	-67.80	179.60	125.00		SPAT	x		x	
Moore F	37.40	-175.00	24.00		FHTa	x		x	
Morse	22.00	-175.00	62.00	Eratosth.	FHTa	x		x	
Moscoviense	26.00	148.00	445.00	Nectarian	FHTa	x		x	low
Mosting	-0.70	-5.90	24.00	Copernican	PKT		H4	x	
Mosting C	-1.80	-8.00	4.00		PKT		H5	x	
Mutus-Vlacq	-52.00	21.00	700.00	Pre-Nect.		x			low
Nansen	81.00	95.00	116.00	Nectarian		x			
Necho	-5.00	123.10	30.00	Copernican	FHTa	x		x	
Nectaris	-16.00	34.00	860.00	Nectarian		x			
Nubium	-21.00	345.00	690.00	Pre-Nect.	PKT	x		x	high

Name	Lat (˚N)	Long (˚E)	Diameter (km)	Age	Geological province	R1	R2	R3	R4
Numerov	-70.70	-160.70	113.00	Nectarian	SPAT	x		x	high
O'Day	-31.00	157.00	71.00		SPAT	x		x	
Ohm	18.40	-113.50	64.00	Copernican	FHTa	x		x	
Oppenheimer	-35.20	-166.30	208.00	Nectarian	SPAT	x		x	
Orientale	-19.00	-95.00	930.00	Low. Imb.		x			low
Orientale (Inner Rook massif)	-21.00	-86.00	327.00			x			
Orientale (Inner Rook North)	-10.00	-96.00	327.00	Low. Imb.		x			
Paracelsus	-23.00	163.00	71.00		SPAT	x		x	
Parry M	-8.90	-14.50	26.00	Copernican	PKT		H5	x	
Petavius	-25.00	60.40	188.00			x			
Philolaus	72.50	-32.50	71.00	Copernican		x			
Piccolomini	-29.50	32.00	88.00	Up. Imb.		x			
Pingre-Hausen	-56.00	-82.00	300.00	Pre-Nect.		x			
Pitatus	-30.00	-13.50	101.00	Nectarian	PKT	x		x	
Plana	42.00	28.50	44.00		PKT	x		x	
Planck	-57.90	136.80	314.00	Pre-Nect.	SPAT	x		x	low
Plato J	49.00	-4.60	8.00		PKT		H4	x	
Plato M	53.10	-15.40	8.00		PKT		H4	x	
Plinius	15.50	23.50	43.00	Eratosth.		x			
Plutarch	24.50	79.00	68.00	Eratosth.		x			
Poincare	-56.70	163.60	319.00	Pre-Nect.	SPAT	x		x	high
Posidonius	32.00	30.00	95.00	Up. Imb.		x			
Proclus	16.00	46.60	28.00			x			
Pythagoras	64.00	-63.00	130.00	Eratosth.		x			
Robertson	22.00	-105.00	88.00	Copernican		x			
Rumford T	-28.60	-172.10	108.00		SPAT	x		x	
Rutherford	10.70	137.00	13.00	Copernican	FHTa	x	H1	x	
Rydberg	-47.00	-96.00	50.00	Eratosth.		x			
Ryder	-42.00	143.00	17.00			x			
Saha E	-0.20	107.60	28.00		FHTa	x		x	
Saunder T	-4.00	10.40	6.00		PKT		H3	x	
Schiller-Zucchius	-56.00	-45.00	335.00	Pre-Nect.		x			
Schjellerup	70.00	157.00	68.00	Up. Imb.		x			
Schorr	-19.50	90.00	48.00	Up. Imb.		x			
Schrodinger	-75.00	132.40	312.00	Low. Imb.	SPAT	x		x	low
Serenitatis	26.00	18.00	920.00	Nectarian	PKT	x		x	high
Sikorsky-Rittenhouse	-68.00	111.00	310.00	Nectarian		x			low
Sirsalis F	-13.50	-60.10	13.00		PKT		H3	x	
Sita	4.60	120.80	2.00		FHTa	x		x	
Slipher	50.00	160.00	87.00	Up. Imb.	FHTa	x		x	
Smythii	-2.00	87.00	740.00	Pre-Nect.		x			

Name	Lat (˚N)	Long (˚E)	Diameter (km)	Age	Geological province	R1	R2	R3	R4
South Ray	-9.00	15.00	0.80			**x**			
Stiborius	-35.00	32.00	45.00			**x**			
Stoney	-55.30	-156.10	45.00		SPAT	**x**		**x**	
T. Mayer H	11.70	-25.50	3.00		PKT		**H5**	**x**	
Thebit A	-21.50	-4.90	20.00	Copernican	PKT		**H3**	**x**	
Theophilus	-11.40	26.40	110.00	Eratosth.		**x**			
Tranquillitatis	7.00	30.00	700.00	Pre-Nect.		**x**			
Triesnecker	4.20	3.60	26.00	Copernican	PKT		**H4**	**x**	
Tsiolkovsky	-20.00	129.00	185.00	Up. Imb.	FHTa	**x**		**x**	
Tsiolkovsky-Stark	-15.00	128.00	700.00	Pre-Nect.	FHTa	**x**		**x**	**low**
Turner M	-4.20	-11.80	4.00	Copernican	PKT		**H5**		
Tycho	-43.00	-11.00	85.00			**x**			
Vavilov	-1.50	-139.00	99.00	Copernican	FHTa	**x**	**H1**	**x**	
Ventris M	-6.00	157.90	18.00		FHTa	**x**		**x**	
Virtanen	15.50	176.70	44.00	Copernican	FHTa	**x**		**x**	
Vitello	-30.40	-37.50	42.00	Low. Imb.		**x**			
Vlacq	-53.50	39.00	98.00			**x**			
Von Karman	-44.80	175.90	180.00	Pre-Nect.	SPAT	**x**		**x**	
Von Karman M	-47.20	176.20	225.00	Pre-Nect.	SPAT	**x**		**x**	
Wallace C	17.60	-6.40	5.00		PKT		**H4**	**x**	
Werner-Airy	-24.00	12.00	500.00	Pre-Nect.		**x**			
Wiener	41.00	146.00	131.00	Nectarian	FHTa	**x**		**x**	
Wiener F	41.20	150.00	47.00	Copernican	FHTa	**x**	**H2**	**x**	
Zeeman	-75.20	-133.60	190.00	Nectarian	SPAT	**x**		**x**	

Table A3.4 Detection of gabbro (G), norite (N), troctolite (T), gabbronorite (GN), anorthositic troctolite (AT), anorthositic gabbro (AG), and anorthositic gabbronorite (AGN) in central peaks (Tompkins and Pieters, 1999). They might correspond to Mg-suite, lower crust or mantle rocks.

Name	Latitude (˚N)	Longitude (˚E)	Diameter (km)	Age	Setting	Peak lithologies
Bhabha	-55.73	-165.29	78	?	basin	GN, G
Birkeland	-30.42	173.84	85	E	basin	AN, GN
Bose	-54.17	-169.65	94	?	basin	AGN
Bullialdus	-20.70	-22.20	61	UI	basin	N
Eratosthenes	14.50	-11.30	58	E	basin	AGN
Finsen	-42.56	-177.99	87	E	basin	AGN, GN, N
Jackson	22.40	-163.10	71	C	highlands	AGN
Keeler	-9.97	161.52	132	LI	highlands	AT
King	5.00	120.50	77	C	highlands	AGN
Langmuir	-36.20	-128.73	85	?	highlands	AGN
Langrenus	-8.90	61.10	132	E	basin	T
Lansberg	-0.30	-26.60	40	UI	basin	AGN
Lowell	-12.90	-103.10	66	C	basin	AG
Lyman	-65.09	161.88	90	UI	highlands	N
Maunder	-14.60	-93.80	55	E	basin	AG
Ohm	18.40	-113.50	64	C	highlands	AG
Orlov	-26.13	-175.37	61	?	highlands	AGN
Scaliger	-27.10	108.90	78	UI	highlands	AG
Stevinus	-32.50	54.20	75	C	highlands	AG, AGN
Theophilus	-11.40	26.40	100	E	basin	AT
Tsiolkovsky	-21.20	128.90	185	UI	highlands	AT
Tycho	-43.40	-11.10	85	C	highlands	AG, AGN, G
Vavilov	-0.80	-137.90	99	C	highlands	AGN
White	-45.17	-159.07	45	?	highlands	AG, GN
Zucchius	-61.40	-50.30	64	C	basin	AG, G

Table A3.5 Pyroclastic deposits, from the USGS Lunar Pyroclastic Volcanism Project (Lisa R. Gaddis *et al.*, 2008, and references therein) and additional sources (Giguere *et al.* 2003, 2007; Sunshine *et al.* 2010).

Name	Latitude (˚N)	Longitude (˚E)	Area (km^2)
Aestatis	-15.00	-68.40	370
Alphonsus (C)	-13.70	-3.40	11
Alphonsus (E)	-12.50	-2.00	8
Alphonsus (E)	-12.50	-1.70	8
Alphonsus (E)	-12.60	-1.70	10
Alphonsus (E)	-12.80	-1.60	25
Alphonsus (E)	-13.00	-1.60	48
Alphonsus (E)	-13.50	-1.60	55
Alphonsus (S)	-14.40	-2.00	43
Alphonsus (W)	-13.60	-4.10	39
Alphonsus (W)	-13.50	-4.20	41
Alphonsus (W)	-13.70	-4.30	79
Apollo Basin (E)	-30.00	-153.10	69
Apollo Basin (W)	-30.00	-153.50	2
Archimedes	28.00	-4.00	8
Aristarchus	26.70	-50.50	37400
Atlas (N)	47.30	44.80	100
Atlas (S)	45.70	44.60	250
Autumni	-9.50	-82.20	330
Cavalerius	5.10	-66.90	880
Compton (SC)	54.00	105.00	24
Compton (SE)	54.00	106.00	45
Compton (SW)	54.00	104.00	5
Cruger (N)	-16.70	-66.70	120
Cruger (S)	-17.90	-66.70	760
Cruger (W1)	-16.70	-66.70	50
Cruger (W2)	-16.70	-66.70	50
Daguerre	-11.20	34.00	297
E. Mare Frigoris (E)	50.10	34.40	575
E. Mare Frigoris (W)	49.60	27.40	1000
Franklin	38.40	47.90	1000
Gambart	-1.00	-15.20	100
Gassendi N-E	-14.82	-37.71	250
Gaudibert	-11.10	37.70	40
Gaudibert B	-12.40	38.70	576
Gauss	36.00	77.00	350
Grimaldi	-5.20	-68.30	2100
Grimaldi F	-7.90	-66.20	90
Haldane	-1.60	83.70	85
Hedin (N)	2.20	-77.00	113
Hedin (NW)	2.20	-77.00	130
Hedin (W)	2.20	-77.00	150
Hevelius	2.20	-67.50	76
J. Herschel (C)	62.00	-36.90	120

Name	Latitude (˚N)	Longitude (˚E)	Area (km^2)
J. Herschel (N)	61.40	-38.00	260
J. Herschel (S)	61.00	-37.00	60
Kiess	-6.50	84.10	1450
Lagrange C	-29.90	-65.00	1900
Lavoisier	38.50	-81.90	5
Lavoisier	38.30	-79.70	5
Lavoisier	37.60	-80.70	8
Lavoisier	38.20	-79.80	9
Lavoisier	37.80	-80.30	11
Lavoisier	37.50	-80.80	11
Lavoisier	38.00	-80.10	18
Lavoisier F	36.40	-76.40	3
Lavoisier H	38.20	-78.10	36
Lomonosov-Fleming	29.40	103.64	6875
Lomonosov-Fleming	20.71	98.97	2500
Lomonosov-Fleming	23.56	99.65	625
Lomonosov-Fleming	26.89	104.07	1250
Mare Humorum	-30.00	-40.00	3000
Mare Smythii (NNW)	2.00	83.00	590
Mare Smythii (SW)	-6.00	86.00	460
Mare Smythii (W)	1.00	85.00	245
Mare Smythii (WSW)	-4.50	81.50	355
Mare Vaporum	10.00	7.00	10000
McAdie	3.60	91.70	43
Mersenius (NW)	-21.50	-49.20	53
Mersenius (SW)	-21.50	-49.20	91
Mersenius (W)	-21.50	-49.20	76
Mersenius (WNW)	-21.50	-49.20	91
Messala	39.00	60.00	700
Montes Carpatus	15.00	-25.00	2500
Montes Harbinger	20.00	-42.00	5400
Moscoviense	25.70	154.30	1500
Moscoviense	23.60	147.70	3700
NE Lavoisier (N)	41.40	-80.00	36
NE Lavoisier (NW)	41.30	-80.60	68
NE Lavoisier (W)	40.90	-80.60	14
Oppenheimer	-35.80	-163.30	13
Oppenheimer	-37.50	-164.60	25
Oppenheimer	-34.00	-165.50	38
Oppenheimer	-37.10	-163.50	140
Oppenheimer	-37.00	-168.50	245
Oppenheimer	-34.80	-168.30	1300
Oppenheimer	-38.00	-166.80	1500
Orientale	-30.20	-97.40	3600
Pacificus	-28.50	-99.00	1600
Riccioli (N)	-2.50	-83.00	1400

Name	Latitude (˚N)	Longitude (˚E)	Area (km^2)
Riccioli (NW)	-2.50	-83.00	150
Riccioli (SE)	-2.90	-83.00	20
Riccioli (SW)	-2.50	-83.00	50
Riccioli (W)	-2.50	-83.00	40
Riccioli (W-SW)	-2.50	-83.00	40
Rima Bode	13.00	-3.00	10000
Rima Fresnel	28.50	4.00	2120
Schluter A	-9.20	-82.20	40
Schrodinger	-75.00	140.00	680
SE of Nectaris	-22.60	40.40	891
Sinus Aestuum	5.00	-7.00	30000
Sinus Aestuum	5.44	-15.06	10000
Sulpicius Gallus	20.00	10.00	6000
Taruntius	5.10	46.00	3
Taruntius	5.30	46.80	4
Tasso S	-2.00	92.00	250
Taurus-Littrow	20.10	30.10	4000

Table A3.6 Studied cryptomare locations. Highlighted in grey are regions that have been studied and mapped precisely in the literature.

Cryptomare deposit	Latitude (˚N)	Longitude (˚E)	Source
Australe (interior)	-41.9	96.1	Antonenko *et al.*, 1999
Balmer-Kapteyn	-18.3	70.0	Bell and Hawke, 1984; Antonenko *et al.*, 1999; Hawke *et al.*, 2003, 2005a, 2005b
Copernicus	9.70	-20.10	Bell and Hawke, 1984
Gassendi	-16.5	-43.0	Antonenko *et al.*, 1999; Hawke *et al.*, 2005a; Giguere *et al.*, 2007
Hercules	46.8	39.2	Antonenko *et al.*, 1999
Humboldtianum	55.7	73.6	Antonenko *et al.*, 1999
Humboldtianum	54.5	83.8	Antonenko *et al.*, 1999
Korolev	-4.5	-157.3	Antonenko *et al.*, 1999
Langemak	-11.3	119.4	Antonenko *et al.*, 1999
Lomonosov-Fleming	20.3	107.4	Antonenko *et al.*, 1999; Giguere *et al.*, 2003; Hawke *et al.*, 2003, 2005a
Marginis (East margin)	12.4	93.9	Antonenko *et al.*, 1999; Giguere *et al.*, 2003
Maurolycus	-37.1	16.6	Antonenko *et al.*, 1999
Mendeleev	1.3	141.8	Antonenko *et al.*, 1999
Mendel-Rydberg	-48.8	-95.5	Antonenko *et al.*, 1999; Hawke *et al.*, 2003, 2005a
Milne	-29.40	116.5	Antonenko *et al.*, 1999
Moscoviense	21.4	148.3	Hawke *et al.*, 2005a
Orientale (East)/ Procellarum (South-West margin)	-11.9	-61.7	Antonenko *et al.*, 1999; Campbell and Hawke, 2005
Schiller-Schickard	-46.1	-51.4	Bell and Hawke, 1984; Blewett *et al.*, 1995; Antonenko *et al.*, 1999; Hawke *et al.*, 2003, 2005a
Smythii	-4.5	93.4	Antonenko *et al.*, 1999; Hawke *et al.*, 2005a
South Pole-Aitken	-49.8	-160.6	Antonenko *et al.*, 1999; Pieters *et al.*, 2001a, 2001b
South Pole-Aitken	-67.2	150.7	Antonenko *et al.*, 1999; Pieters *et al.*, 2001a, 2001b
Taruntius	5.4	46.3	Antonenko *et al.*, 1999
Tsiolkovskiy	-22.5	126.3	Antonenko *et al.*, 1999

Table A3.7 List of all the craters and basins that are thought to contain lower crust material in their melt or central peak/uplifted rings, based on calculations only. Pm = Proximity for melt (used to infer the depth from where the central peak material comes from), Pe = proximity for excavation, M = melt depth (include the crust thickness). IDs refer to their number on Fig. 3.54. Only those highlighted in gray have some central peaks (P) or uplifted rings (R) and are therefore considered as final landing sites.

ID	Name	Lat	Long	Diameter (km)	Pm	Pe	M	Age	Peak? Rings ?
0	Chaffee F	-38.8	-152.5	35.0	-5.1	-3.1	5.1	Nectarian	
1	Warner	-4.0	87.3	35.0	-5.5	-3.5	5.1		
2	Haldane	-1.7	84.1	37.0	-5.7	-3.5	5.4		
3	Runge	-2.5	86.7	38.0	-5.6	-3.3	5.5		
4	Crommelin C	-66.4	-144.8	44.0	-5.3	-2.5	6.5	Nectarian	P
5	Numerov Z	-68.1	-160.0	44.0	-5.5	-2.7	6.5		
6	Stoney	-55.3	-156.1	45.0	-6.1	-3.3	6.7		P
7	Cabannes M	-64.2	-170.2	48.0	-6.6	-3.5	7.1		
8	Cabannes Q	-63.3	-174.5	49.0	-6.5	-3.3	7.3	Nectarian	P
9	Chaffee	-38.8	-153.9	49.0	-5.4	-2.2	7.3	Nectarian	
10	Borman	-38.8	-147.7	50.0	-6.1	-2.8	7.5	Low. Imb.	P
11	Karrer	-52.1	-141.8	51.0	-7.5	-4.1	7.6	Nectarian	
12	Boyle Z	-51.3	177.7	52.0	-6.6	-3.1	7.8	Nectarian	
13	Eijkman	-63.1	-141.5	54.0	-7.2	-3.5	8.1	Nectarian	P
14	Baldet	-53.3	-151.1	55.0	-8.2	-4.5	8.3		
15	Boyle	-53.1	178.1	57.0	-8.3	-4.4	8.6	Nectarian	P
16	Bel'kovich A	58.7	86.0	58.0	-5.6	-1.5	8.8	Nectarian	
17	Dawson V	-66.6	-137.0	58.0	-6.4	-2.4	8.8		P
18	Lyman T	-64.1	157.7	59.0	-5.2	-1.0	8.9		
19	Fizeau S	-58.7	-139.9	62.0	-7.8	-3.4	9.4		
20	Bellinsgauzen	-60.6	-164.6	63.0	-7.2	-2.7	9.6		
21	Bhabha	-55.1	-164.5	64.0	-7.0	-2.4	9.7	Nectarian	P
22	Cori	-50.6	-151.9	65.0	-9.0	-4.3	9.9	Nectarian	
23	Nishina	-44.6	-170.4	65.0	-5.2	-0.5	9.9		
24	Abbe	-57.3	175.2	66.0	-10.0	-5.3	10.1	Nectarian	
25	Alekhin	-68.2	-131.3	70.0	-6.6	-1.5	10.7		
26	Cajori	-47.4	168.8	70.0	-7.7	-2.5	10.7		
27	Finsen	-42.0	-177.9	72.0	-7.6	-2.3	11.1	Eratosth.	P
28	Hess Z	-52.0	174.0	73.0	-9.9	-4.5	11.2		
29	Oresme	-42.4	169.2	76.0	-5.1	0.7	11.7		
30	Alder	-48.6	-177.4	77.0	-8.4	-2.5	11.9	Low. Imb.	P

ID	Name	Lat	Long	Diameter (km)	Pm	Pe	M	Age	Peak? Rings ?
31	Cabannes	-60.9	-169.6	80.0	-10.6	-4.5	12.4		P
32	Birkeland	-30.2	173.9	82.0	-5.2	1.2	12.7	Eratosth.	P
33	Maksutov	-40.5	-168.7	83.0	-9.8	-3.3	12.9	Up. Imb.	P
34	Lyman	-64.8	163.6	84.0	-8.9	-2.3	13.1	Up. Imb.	P
35	Davisson	-37.5	-174.6	87.0	-10.1	-3.2	13.6		P
36	Chretien	-43.9	163.6	88.0	-5.4	1.6	13.7		
37	Hess	-54.3	174.6	88.0	-13.3	-6.2	13.7		
38	Hopmann	-50.8	160.3	88.0	-8.7	-1.7	13.7		
39	Bose	-53.5	-170.0	91.0	-11.6	-4.3	14.2	Nectarian	P
40	Lemaitre	-61.2	-149.6	91.0	-13.1	-5.8	14.2	Nectarian	P
41	Berlage	-63.2	-162.8	92.0	-12.6	-5.2	14.4		
42	Crommelin	-68.1	-146.9	94.0	-12.5	-4.9	14.7		P
43	Rumford T	-28.6	-172.1	108.0	-6.3	2.8	17.1		P
44	Fizeau	-58.6	-133.9	111.0	-12.7	-3.3	17.6	Up. Imb.	P
45	Numerov	-70.7	-160.7	113.0	-14.1	-4.5	18.0	Nectarian	P
46	Minkowski	-56.5	-146.0	113.0	-16.9	-7.2	18.0		P
47	Leeuwenhoek E	-28.2	-176.7	117.0	-7.9	2.2	18.7		
48	Thomson	-32.7	166.2	117.0	-5.8	4.3	18.7		
49	Thomson M	-35.7	166.0	119.0	-6.9	3.5	19.0		
50	Leeuwenhoek	-29.3	-178.7	125.0	-11.4	-0.4	20.1	Nectarian	P
51	Minnaert	-67.8	179.6	125.0	-17.5	-6.5	20.1		
52	Repsold C	48.9	-73.6	133.0	-5.1	6.8	21.4	Pre-Nect.	
53	Neper	8.5	84.6	137.0	-8.8	3.5	22.1	Nectarian	
54	Babbage	59.7	-57.1	143.0	-5.5	7.6	23.2	Pre-Nect.	
55	Antoniadi	-69.7	-172.0	143.0	-19.7	-6.7	23.2	Up. Imb.	P
56	W. Bond	65.4	4.5	156.0	-7.0	7.5	25.5	Pre-Nect.	
57	Compton	55.3	103.8	162.0	-8.4	6.8	26.5	Low. Imb.	P
58	Riemann	38.9	86.8	163.0	-5.6	9.7	26.7		
59	Struve	22.4	-77.1	164.0	-8.1	7.4	26.9	Pre-Nect.	
60	J. Herschel	62.0	-42.0	165.0	-10.1	5.6	27.1	Pre-Nect.	
61	Hecataeus	-21.8	79.4	167.0	-5.2	10.7	27.4	Nectarian	
62	Gauss	35.7	79.0	177.0	-8.7	8.4	29.2	Nectarian	
63	Von Karman	-44.8	175.9	180.0	-25.8	-8.4	29.7	Pre-Nect.	
64	Fabry	42.9	100.7	184.0	-8.4	9.4	30.4	Pre-Nect.	P
65	Vertregt	-19.8	171.1	187.0	-6.5	11.8	31.0	Pre-	

ID	Name	Lat	Long	Diameter (km)	Pm	Pe	M	Age	Peak? Rings ?
								Nect.	
66	Petavius	-25.1	60.4	188.0	-6.3	12.1	31.2	Low. Imb.	P
67	Humboldt	-27.0	80.9	189.0	-11.0	7.5	31.3	Up. Imb.	P
68	Zeeman	-75.2	-133.6	190.0	-19.8	-1.2	31.5	Nectarian	P
69	Maginus	-50.5	-6.3	194.0	-8.7	10.4	32.2	Pre-Nect.	
70	Einstein	16.3	-88.7	198.0	-6.1	13.5	33.0	Pre-Nect.	
71	Janssen	-45.4	40.3	199.0	-9.2	10.5	33.1	Pre-Nect.	
72	Schickard	-44.3	-55.3	206.0	-7.1	13.4	34.4	Pre-Nect.	
73	Oppenheimer	-35.2	-166.3	208.0	-28.1	-7.3	34.8	Nectarian	
74	Schwarzschild	70.1	121.2	212.0	-12.6	8.8	35.5	Nectarian	
75	Bel'kovich	61.1	90.2	214.0	-14.6	7.0	35.8	Nectarian	
76	Von Karman M	-47.2	176.2	225.0	-33.3	-10.4	37.8	Pre-Nect.	
77	Van de Graaff	-27.4	172.2	233.0	-20.4	3.5	39.3	Nectarian	
78	Harkhebi	39.6	98.3	237.0	-17.3	7.1	40.0	Pre-Nect.	
79	Leibnitz	-38.3	179.2	245.0	-35.4	-10.0	41.5	Pre-Nect.	
80	Clavius	-58.8	-14.1	245.0	-17.8	7.7	41.5	Nectarian	
81	d'Alembert	50.8	163.9	248.0	-5.2	20.6	42.0	Nectarian	
82	Deslandres	-33.1	-4.8	256.0	-21.9	5.0	43.5	Pre-Nect.	
83	Gagarin	-20.2	149.2	265.0	-15.1	13.0	45.1	Pre-Nect.	
84	Milne	-31.4	112.2	272.0	-19.3	9.7	46.4	Pre-Nect.	
85	Bailly	-66.5	-69.1	287.0	-20.0	10.9	49.2	Nectarian	
86	Pingre-Hausen	-56.0	-82.0	300.0	-18.9	13.7	51.6	Pre-Nect.	R
87	Sikorsky-Rittenhouse	-68.0	111.0	310.0	-32.4	1.5	53.5	Nectarian	R
88	Lorentz	32.6	-95.3	312.0	-26.6	7.6	53.8	Pre-Nect.	R
89	Schrodinger	-75.0	132.4	312.0	-35.5	-1.3	53.8	Low. Imb.	R
90	Mendeleev	5.7	140.9	313.0	-15.3	19.1	54.0	Nectarian	R
91	Planck	-57.9	136.8	314.0	-38.2	-3.7	54.2	Pre-	R

ID	Name	Lat	Long	Diameter (km)	Pm	Pe	M	Age	Peak? Rings ?
								Nect.	
92	Poincare	-56.7	163.6	319.0	-42.8	-7.6	55.2	Pre-Nect.	R
93	Amundsen-Ganswindt	-81.0	120.0	335.0	-35.6	1.7	58.1	Pre-Nect.	R
94	Schiller-Zucchius	-56.0	-45.0	335.0	-29.5	7.8	58.1	Pre-Nect.	R
95	Birkhoff	58.7	-146.1	345.0	-26.3	12.4	60.0	Pre-Nect.	R
96	Humorum	-24.0	-39.0	425.0	-54.1	-4.4	75.2	Nectarian	R
97	Korolev	-4.0	-157.4	437.0	-32.3	19.0	77.5	Nectarian	R
98	Coulomb-Sarton	52.0	-123.0	440.0	-42.4	9.4	78.1	Pre-Nect.	R
99	Moscoviense	26.0	148.0	445.0	-42.4	10.0	79.0	Nectarian	R
100	Balmer-Kapteyn	-15.0	70.0	500.0	-68.9	-8.6	89.6	Pre-Nect.	R
101	Keeler-Heaviside	-10.0	162.0	500.0	-57.7	2.7	89.6	Pre-Nect.	R
102	Werner-Airy	-24.0	12.0	500.0	-69.6	-9.3	89.6	Pre-Nect.	
103	Apollo	-36.1	-151.8	537.0	-66.6	-1.0	96.8	Pre-Nect.	R
104	Ingenii	-43.0	165.0	560.0	-82.3	-13.2	101.3	Pre-Nect.	R
105	Flamsteed-Billy	-7.0	-45.0	570.0	-80.6	-10.1	103.2	Pre-Nect.	
106	Marginis	20.0	84.0	580.0	-82.7	-10.8	105.2	Pre-Nect.	
107	Al-Khwarizmi-King	1.0	112.0	590.0	-80.1	-6.7	107.1	Pre-Nect.	
108	Hertzsprung	2.6	-129.2	591.0	-58.5	15.1	107.3	Nectarian	R
109	Freundlich-Sharonov	18.5	175.0	600.0	-63.4	11.5	109.1	Pre-Nect.	R
110	Grissom-White	-44.0	-161.0	600.0	-81.8	-6.9	109.1	Pre-Nect.	
111	Insularum	9.0	-18.0	600.0	-93.1	-18.2	109.1	Pre-Nect.	
112	Lomonosov-Fleming	19.0	105.0	620.0	-83.8	-5.9	113.0	Pre-Nect.	
113	Mendel-Rydberg	-50.0	-94.0	630.0	-89.9	-10.5	115.0	Nectarian	R
114	Humboldtianum	59.0	82.0	650.0	-95.7	-13.3	119.0	Nectarian	R
115	Fecunditatis	-4.0	52.0	690.0	-105.0	-16.6	126.9	Pre-Nect.	
116	Nubium	-21.0	-15.0	690.0	-103.6	-15.2	126.9	Pre-Nect.	

ID	Name	Lat	Long	Diameter (km)	Pm	Pe	M	Age	Peak? Rings ?
117	Mutus-Vlacq	-52.0	21.0	700.0	-105.5	-15.6	128.9	Pre-Nect.	
118	Tranquillitatis	7.0	30.0	700.0	-106.9	-17.0	128.9	Pre-Nect.	
119	Tsiolkovsky-Stark	-15.0	128.0	700.0	-102.6	-12.7	128.9	Pre-Nect.	
120	Smythii	-2.0	87.0	740.0	-113.7	-17.7	136.8	Pre-Nect.	R
121	Crisium	18.0	59.0	740.0	-120.1	-24.1	136.8	Nectarian	R
122	Nectaris	-16.0	34.0	860.0	-141.6	-27.0	161.0	Nectarian	R
123	Australe	-52.0	95.0	880.0	-141.7	-24.0	165.0	Pre-Nect.	R
124	Serenitatis	26.0	18.0	920.0	-154.1	-30.1	173.1	Nectarian	R
125	Orientale	-19.0	-95.0	930.0	-146.7	-21.1	175.1	Low. Imb.	R
126	Imbrium	35.0	-17.0	1160.0	-200.5	-37.9	222.4	Low. Imb.	R

Table A3.8 List of all the craters and basins that are thought to have mantle in their melt or central peak/uplifted rings, based on calculations only. Pm = Proximity for melt (used to infer the depth from where the central peak material comes from), Pe = proximity for excavation, M = melt depth (include the crust thickness). Blue values indicate negative proximity for mantle excavation, corresponding to the two basins that are excavating mantle. IDs refer to their number on Fig. 3.58. Only those highlighted in gray have some uplifted rings (R) and are therefore considered as final landing sites.

ID	Name	Latitude	Longitude	Diameter (km)	Pm	Pe	M	Age	Uplifted rings?
0	Von Karman	-44.8	175.9	180.0	-7.0	10.4	29.7	Pre-Nect.	
4	Sikorsky-Rittenhouse	-68.0	111.0	310.0	-7.3	26.6	53.5	Nectarian	R
1	Oppenheimer	-35.2	-166.3	208.0	-8.2	12.7	34.8	Nectarian	
8	Amundsen-Ganswindt	-81.0	120.0	335.0	-9.6	27.7	58.1	Pre-Nect.	R
5	Schrodinger	-75.0	132.4	312.0	-11.5	22.7	53.8	Low. Imb.	R
11	Moscoviense	26.0	148.0	445.0	-12.8	39.7	79.0	Nectarian	R
10	Coulomb-Sarton	52.0	-123.0	440.0	-13.4	38.4	78.1	Pre-Nect.	R
2	Von Karman M	-47.2	176.2	225.0	-13.7	9.2	37.8	Pre-Nect.	
6	Planck	-57.9	136.8	314.0	-14.7	19.8	54.2	Pre-Nect.	R
3	Leibnitz	-38.3	179.2	245.0	-15.3	10.2	41.5	Pre-Nect.	
7	Poincare	-56.7	163.6	319.0	-20.0	15.2	55.2	Pre-Nect.	R
20	Hertzsprung	2.6	-129.2	591.0	-25.1	48.5	107.3	Nectarian	R
9	Humorum	-24.0	-39.0	425.0	-29.0	20.6	75.2	Nectarian	R
13	Keeler-Heaviside	-10.0	162.0	500.0	-30.0	30.3	89.6	Pre-Nect.	R
21	Freundlich-Sharonov	18.5	175.0	600.0	-30.6	44.3	109.1	Pre-Nect.	R
15	Apollo	-36.1	-151.8	537.0	-39.1	26.6	96.8	Pre-Nect.	R
12	Balmer-Kapteyn	-15.0	70.0	500.0	-44.0	16.3	89.6	Pre-Nect.	R
14	Werner-Airy	-24.0	12.0	500.0	-45.2	15.2	89.6	Pre-Nect.	
19	Al-Khwarizmi-King	1.0	112.0	590.0	-53.8	19.6	107.1	Pre-Nect.	
22	Grissom-White	-44.0	-161.0	600.0	-54.6	20.3	109.1	Pre-Nect.	
17	Flamsteed-Billy	-7.0	-45.0	570.0	-54.8	15.7	103.2	Pre-Nect.	
24	Lomonosov-Fleming	19.0	105.0	620.0	-56.3	21.6	113.0	Pre-Nect.	
18	Marginis	20.0	84.0	580.0	-57.4	14.6	105.2	Pre-Nect.	
16	Ingenii	-43.0	165.0	560.0	-58.0	11.0	101.3	Pre-Nect.	R
25	Mendel-Rydberg	-50.0	-94.0	630.0	-64.2	15.2	115.0	Nectarian	R
23	Insularum	9.0	-18.0	600.0	-69.0	5.9	109.1	Pre-Nect.	
26	Humboldtianum	59.0	82.0	650.0	-70.0	12.3	119.0	Nectarian	R
31	Tsiolkovsky-Stark	-15.0	128.0	700.0	-76.1	13.8	128.9	Pre-Nect.	
28	Nubium	-21.0	-15.0	690.0	-77.8	10.6	126.9	Pre-Nect.	
27	Fecunditatis	-4.0	52.0	690.0	-79.7	8.7	126.9	Pre-Nect.	
29	Mutus-Vlacq	-52.0	21.0	700.0	-80.1	9.9	128.9	Pre-Nect.	

ID	Name	Latitude	Longitude	Diameter (km)	Pm	Pe	M	Age	Uplifted rings?
30	Tranquillitatis	7.0	30.0	700.0	-81.5	8.4	128.9	Pre-Nect.	
32	Smythii	-2.0	87.0	740.0	-88.6	7.4	136.8	Pre-Nect.	R
33	Crisium	18.0	59.0	740.0	-97.0	-1.0	136.8	Nectarian	R
35	Australe	-52.0	95.0	880.0	-116.1	1.6	165.0	Pre-Nect.	R
34	Nectaris	-16.0	34.0	860.0	-117.6	-3.0	161.0	Nectarian	R
37	Orientale	-19.0	-95.0	930.0	-119.7	5.9	175.1	Low. Imb.	R
36	Serenitatis	26.0	18.0	920.0	-129.6	-5.6	173.1	Nectarian	R
38	Imbrium	35.0	-17.0	1160.0	-175.2	-12.6	222.4	Low. Imb.	R

Table A3.9 List of all the craters and basins that are thought to contain lower crust and/or mantle material in their ejecta or central peak/uplifted rings, based on calculations only. LCE = excavate lower crust material in its ejecta, ME= excavate mantle material in its ejecta, LCM = should contain lower crust material in its preserved central peak or uplifted rings, MM = should contain mantle material in its preserved uplifted rings. Craters and basins highlighted in gray should contain both lower crust and mantle material and are considered as best final landing sites to assess Science Goal 3c in general.

Name	Lat	Long	Diameter (km)	Age	LCE	LCM	ME	MM
Abbe	-57.3	175.2	66.0	Nectarian	x	**x**		
Alder	-48.6	-177.4	77.0	Low. Imb.		**x**		
Al-Khwarizmi-King	1.0	112.0	590.0	Pre-Nect.	x			
Amundsen-Ganswindt	-81.0	120.0	335.0	Pre-Nect.		**x**		**x**
Antoniadi	-69.7	-172.0	143.0	Up. Imb.	**x**	**x**		
Apollo	-36.1	-151.8	537.0	Pre-Nect.		**x**		**x**
Australe	-52.0	95.0	880.0	Pre-Nect.	x	**x**		**x**
Balmer-Kapteyn	-15.0	70.0	500.0	Pre-Nect.	x	**x**		**x**
Berlage	-63.2	-162.8	92.0		x			
Bhabha	-55.1	-164.5	64.0	Nectarian		**x**		
Birkeland	-30.2	173.9	82.0	Eratosth.		**x**		
Birkhoff	58.7	-146.1	345.0	Pre-Nect.		**x**		
Borman	-38.8	-147.7	50.0	Low. Imb.		**x**		
Bose	-53.5	-170.0	91.0	Nectarian		**x**		
Boyle	-53.1	178.1	57.0	Nectarian		**x**		
Cabannes	-60.9	-169.6	80.0			**x**		
Cabannes Q	-63.3	-174.5	49.0	Nectarian		**x**		
Compton	55.3	103.8	162.0	Low. Imb.		**x**		
Coulomb-Sarton	52.0	-123.0	440.0	Pre-Nect.		**x**		**x**
Crisium	18.0	59.0	740.0	Nectarian	x	**x**		**x**
Crommelin	-68.1	-146.9	94.0			**x**		
Crommelin C	-66.4	-144.8	44.0	Nectarian		**x**		
Davisson	-37.5	-174.6	87.0			**x**		
Dawson V	-66.6	-137.0	58.0			**x**		
Eijkman	-63.1	-141.5	54.0	Nectarian		**x**		
Fabry	42.9	100.7	184.0	Pre-Nect.		**x**		
Fecunditatis	-4.0	52.0	690.0	Pre-Nect.	x			
Finsen	-42.0	-177.9	72.0	Eratosth.		**x**		
Fizeau	-58.6	-133.9	111.0	Up. Imb.		**x**		
Flamsteed-Billy	-7.0	-45.0	570.0	Pre-Nect.	x			
Freundlich-Sharonov	18.5	175.0	600.0	Pre-Nect.		**x**		**x**
Grissom-White	-44.0	-161.0	600.0	Pre-Nect.	x			
Hertzsprung	2.6	-129.2	591.0	Nectarian		**x**		**x**
Hess	-54.3	174.6	88.0		x			
Humboldt	-27.0	80.9	189.0	Up. Imb.		**x**		
Humboldtianum	59.0	82.0	650.0	Nectarian	x	**x**		**x**
Humorum	-24.0	-39.0	425.0	Nectarian		**x**		**x**

Name	Lat	Long	Diameter (km)	Age	LCE	LCM	ME	MM
Imbrium	35.0	-17.0	1160.0	Low. Imb.	**x**	**x**	**x**	**x**
Ingenii	-43.0	165.0	560.0	Pre-Nect.	x	**x**		**x**
Insularum	9.0	-18.0	600.0	Pre-Nect.	x			
Keeler-Heaviside	-10.0	162.0	500.0	Pre-Nect.		**x**		**x**
Korolev	-4.0	-157.4	437.0	Nectarian		**x**		
Leeuwenhoek	-29.3	-178.7	125.0	Nectarian		**x**		
Leibnitz	-38.3	179.2	245.0	Pre-Nect.	x			
Lemaitre	-61.2	-149.6	91.0	Nectarian	x	**x**		
Lomonosov-Fleming	19.0	105.0	620.0	Pre-Nect.	x			
Lorentz	32.6	-95.3	312.0	Pre-Nect.		**x**		
Lyman	-64.8	163.6	84.0	Up. Imb.		**x**		
Maksutov	-40.5	-168.7	83.0	Up. Imb.		**x**		
Marginis	20.0	84.0	580.0	Pre-Nect.	x			
Mendeleev	5.7	140.9	313.0	Nectarian		**x**		
Mendel-Rydberg	-50.0	-94.0	630.0	Nectarian	x	**x**		**x**
Minkowski	-56.5	-146.0	113.0		x	**x**		
Minnaert	-67.8	179.6	125.0		x			
Moscoviense	26.0	148.0	445.0	Nectarian		**x**		**x**
Mutus-Vlacq	-52.0	21.0	700.0	Pre-Nect.	x			
Nectaris	-16.0	34.0	860.0	Nectarian	x	**x**		**x**
Nubium	-21.0	-15.0	690.0	Pre-Nect.	x			
Numerov	-70.7	-160.7	113.0	Nectarian		**x**		
Oppenheimer	-35.2	-166.3	208.0	Nectarian	x			
Orientale	-19.0	-95.0	930.0	Low. Imb.	**x**	**x**		**x**
Petavius	-25.1	60.4	188.0	Low. Imb.		**x**		
Pingre-Hausen	-56.0	-82.0	300.0	Pre-Nect.		**x**		
Planck	-57.9	136.8	314.0	Pre-Nect.		**x**		**x**
Poincare	-56.7	163.6	319.0	Pre-Nect.	x	**x**		**x**
Rumford T	-28.6	-172.1	108.0			**x**		
Schiller-Zucchius	-56.0	-45.0	335.0	Pre-Nect.		**x**		
Schrodinger	-75.0	132.4	312.0	Low. Imb.		**x**		**x**
Serenitatis	26.0	18.0	920.0	Nectarian	x	**x**	**x**	**x**
Sikorsky-Rittenhouse	-68.0	111.0	310.0	Nectarian		**x**		**x**
Smythii	-2.0	87.0	740.0	Pre-Nect.	x	**x**		**x**
Stoney	-55.3	-156.1	45.0			**x**		
Tranquillitatis	7.0	30.0	700.0	Pre-Nect.	x			
Tsiolkovsky-Stark	-15.0	128.0	700.0	Pre-Nect.	x			
Von Karman	-44.8	175.9	180.0	Pre-Nect.	x			
Von Karman M	-47.2	176.2	225.0	Pre-Nect.	x			
Werner-Airy	-24.0	12.0	500.0	Pre-Nect.	x			
Zeeman	-75.2	-133.6	190.0	Nectarian		**x**		

Table A3.10 List of all the suggested landing sites to address Science Goal 3d and their associated feature: intrusive feature (IF), massif (M), plateau (P), red spot (RS), gravity anomaly type (GA), crustal thickness extreme (TE). Also mentioned is the presence of a central peak (CP) if the feature is a crater, and whether it is of Copernican age (CC). Sinuous rilles are not mentioned for they are not punctual features.

Feature name	Lat	Long	IF	M	P	RS	GA	TE	CP	CC
Anaxagoras	73.40	-10.10								x
Apollo	-36.00	-151.00					II			
Archytas	55.71	0.71	intrusive dome							
Archytas	55.71	1.05	intrusive dome							
Aristarchus	23.70	-47.40	pluton		x				x	x
Aristillus	33.90	1.20							x	x
Aristillus 1	33.28	5.67	intrusive dome							
Autolycus	30.70	1.50								x
Balboa A	17.40	-81.90							x	
Bel'kovich K	63.80	93.60							x	x
Birkeland	-30.20	173.90							x	
Birkhoff Z	61.30	-145.30								x
Bok	-20.20	-171.60							x	
Bulliadus	-20.70	-22.20	pluton						x	
Burg	45.00	28.20								x
Carpenter	69.40	-50.90							x	x
Central Mare Tranquillitatis plains	7.06	34.66	intrusive dome							
Conon	21.60	2.00								x
Copernicus	9.70	-20.10	pluton						x	x
Coulomb-Sarton	52.00	-123.00					II			
Crisium	17.00	59.10					P M			
Crookes	-10.30	-164.50								x
Darney Chi	-12.00	-24.00				x				
Darney Tau	-12.00	-24.00				x				
Das	-26.60	-136.80								x
Dirichlet-Jackson	14.00	-158.00					I	x		
Eratosthenes	14.50	-11.30							x	
Eudoxus	44.30	16.30								x
Fabricius	-42.90	42.00							x	

Feature name	Lat	Long	IF	M	P	RS	GA	TE	CP	CC
Faraday C	-43.30	8.10								x
Finsen	-42.00	-177.90							x	
Freundlich-Sharanov	18.00	175.00					II			
Gambart	-0.75	-14.84	intrusive dome							
Gassendi A	-15.50	-39.70								x
Giordano Bruno	35.90	102.80								x
Glushko (Earlier Olbers A)	8.00	-78.00								x
Godin	1.80	10.20								x
Grimaldi 1	-4.45	-68.62	intrusive dome							
Guthnick	-47.70	-93.90								x
Harpalus	52.60	-43.40								x
Hausen	-65.00	-88.10							x	
Hayn	64.70	85.20							x	x
Helmet	-17.00	-30.00				x				
Helmholtz D	-66.30	54.30							x	
Hertzsprung	1.50	-128.50					II			
Humboldtianum	61.00	84.00					II			
Humorum	-24.40	-38.60					PM			
Imbrium	32.80	-15.60					PM			
Ingenii	-34.00	163.00					I			
Jackson	22.40	-163.10	pluton						x	x
Kant plateau	-7.90	17.16			x					
Kepler	8.10	-38.00								x
King	5.00	120.50	pluton						x	x
Korolev	-4.50	-157.00					I			
Langmuir	-36.20	-128.73	pluton							
Langrenus	-8.90	61.10							x	
Lassell	-15.00	-8.00				x				
Leuschner	1.80	-108.80							x	
Lorentz	34.00	-97.00					I			
Malapert Massif	-85.99	-2.93		x						
Marius Hills plateau	13.29	-53.22			x					
Mendeleev	6.00	141.00					I			

Feature name	Lat	Long	IF	M	P	RS	GA	TE	CP	CC
Mendel-Rydberg	-50.00	-94.00					II			
Milichius	11.68	-31.53	intrusive dome							
Milne N	-35.50	110.80								x
Mons Agnes	18.60	5.30		x						
Mons Ampère	19.00	-4.00		x						
Mons André	5.20	120.60		x						
Mons Ardeshir	5.00	121.00		x						
Mons Argaeus	19.00	29.00		x						
Mons Bradley	22.00	1.00		x						
Mons Delisle	29.50	-35.80		x						
Mons Dieter	5.00	120.20		x						
Mons Dilip	5.60	120.80		x						
Mons Esam	14.60	35.70		x						
Mons Ganau	4.80	120.60		x						
Mons Gruithuisen Delta	36.00	-39.00		x		x				
Mons Gruithuisen Gamma	37.00	-41.00		x		x				
Mons Hadley	27.00	5.00		x						
Mons Hadley Delta	26.00	4.00		x						
Mons Hansteen Alpha	-12.00	-50.00		x		x				
Mons Herodotus	27.00	-53.00		x						
Mons Huygens	20.00	-3.00		x						
Mons La Hire	28.00	-25.00		x		x				
Mons Maraldi	20.00	35.00		x						
Mons Moro	-12.00	-20.00		x						
Mons Penck	-10.00	22.00		x						
Mons Pico	46.00	-9.00		x						
Mons Piton	41.00	-1.00		x						
Mons Rümker	41.00	-58.00		x						
Mons Usov	12.00	63.00		x						
Mons Vinogradov	22.00	-32.00		x						
Mons Vitruvius	19.00	31.00		x						
Mons Wolff	17.00	-7.00		x						
Mont Blanc	45.00	1.00		x						
Montes Agricola	29.00	-54.00		x						
Montes Alpes	46.00	-1.00		x						
Montes Apenninus	18.90	-3.60		x						
Montes Archimedes	26.00	-5.00		x						
Montes Carpatus	15.00	-25.00		x						

Feature name	Lat	Long	IF	M	P	RS	GA	TE	CP	CC
Montes Caucasus	39.00	9.00		x						
Montes Cordillera	-20.00	-80.00		x						
Montes Haemus	17.00	13.00		x						
Montes Harbinger	27.00	-41.00		x						
Montes Jura	47.00	-37.00		x						
Montes Pyrenaeus	-14.00	41.00		x						
Montes Recti	48.00	-20.00		x						
Montes Riphaeus	-7.00	-28.00		x		x				
Montes Rook	-20.00	-83.00		x						
Montes Secchi	3.00	43.00		x						
Montes Spitzbergen	35.00	-5.00		x						
Montes Taurus	25.00	36.00		x						
Montes Teneriffe	48.00	-13.00		x						
Moretus	-70.60	-5.80							x	
Moscoviense	26.00	148.00					II	x		
Mosting	-0.70	-5.90								x
Necho	-5.00	123.10								x
Nectaris	-15.20	35.50					PM			
O'Day	-30.60	157.50							x	x
Ohm	18.40	-113.50	pluton							x
Olcott	20.60	117.80							x	
Orientale	-20.00	-95.00					II			
Orlov	-26.13	-175.37	pluton							
Palitzsch B	-26.40	68.40								x
Palmieri	-26.63	-47.88	intrusive dome							
Pasteur D	-8.80	108.80								x
Perrine E	42.80	-124.90								x
Petavius B	-19.90	57.10								x
Philolaus	72.10	-32.40							x	x
Planck	-57.50	135.50					I			
Plutarch	24.10	79.00							x	
Proclus	16.10	46.80								x
Promontorium Laplace	47.08	-29.16	intrusive dome							
Pythagoras	63.50	-63.00							x	
Ricco	75.60	176.30							x	
Rima Cauchy	11.06	36.75	intrusive dome							

650

Feature name	Lat	Long	IF	M	P	RS	GA	TE	CP	CC
Robertson	21.80	-105.20							x	x
Rowland J	53.10	-155.50							x	
Rupes Cauchy	10.00	35.19	intrusive dome							
Rutherfurd	-60.90	-12.10							x	x
Rydberg	-46.50	-96.30							x	
Schomberger A	-78.80	24.40								x
Schrodinger	-75.00	134.00					I			
Scoresby	77.70	14.10							x	
Serenitatis	28.00	17.50					PM			
Sharonov	12.40	173.30								x
Smythii	1.30	87.50					PM			
Stevinus	-32.50	54.20	pluton						x	x
Taruntius	5.60	46.50	laccolith						x	x
Thales	61.80	50.30								x
Theophilus	-11.40	26.40							x	
Triesnecker	4.20	3.60								x
Tycho	-43.40	-11.10	pluton						x	x
Valentine dome	30.70	10.20	intrusive dome							
Valentine dome	31.89	10.26	intrusive dome							
Vavilov	-0.80	-137.90							x	x
Virtanen	15.50	176.70								x
Zucchius	-61.40	-50.30							x	x

Table A3.11 List of all craters shown in Fig. 3.80. The lunar region in which each crater belongs is also indicated (nearside mare, highlands, SPA). The shadowed lines represent the craters in Fig. 3.80 which are not labeled. The central peaks of those craters could potentially show the limiting extent of the megaregolith, but they are less likely to, as they lie within the +5 km limit.

Name	Lat (°)	Long (°)	Diam. (km)	Age	Stratigraphic Uplift (km)	Mare	Highlands	SPA
Aristillus	33.9	1.2	55.0	Copernican	7.34	**X**		
Taruntius	5.6	46.5	56.0	Copernican	7.54	**X**		
Eratosthenes	14.5	-11.3	58.0	Eratosthenian	7.93	**X**		
Bullialdus	-20.7	-22.2	60.0	Eratosthenian	8.33	**X**		
Copernicus	9.7	-20.1	93.0	Copernican	15.73	**X**		
Langrenus	-8.9	61.1	127.0	Eratosthenian	24.71	**X**		
Theophilus	-11.4	26.4	110.0	Eratosthenian	20.07	**X**	**X**	
Vavilov	-0.8	-137.9	98.0	Copernican	16.97		**X**	
Tycho	-43.4	-11.1	102.0	Copernican	17.98		**X**	
Plaskett	82.1	174.3	109.0	Upper Imbrian	19.80		**X**	
Moretus	-70.6	-5.8	111.0	Eratosthenian	20.33		**X**	
Kovalevskaya	30.8	-129.6	115.0	Upper Imbrian	21.40		**X**	
Pythagoras	63.5	-63.0	142.0	Eratosthenian	29.06		**X**	
Tsiolkovskiy	-21.2	128.9	185.0	Upper Imbrian	42.64		**X**	
Humboldt	-27.0	80.9	189.0	Upper Imbrian	43.98		**X**	
Hausen	-65.0	-88.1	167.0	Eratosthenian	36.76		**X**	**X**
Bok	-20.2	-171.6	45.0	Eratosthenian	5.49			**X**
Oresme V	-40.5	165.6	51.0	Upper Imbrian	6.58			**X**
de Vries	-19.9	-176.7	59.0	Upper Imbrian	8.13			**X**
O'Day	-30.6	157.5	71.0	Copernican	10.64			**X**
Finsen	-42.0	-177.9	72.0	Eratosthenian	10.85			**X**
Birkeland	-30.2	173.9	82.0	Eratosthenian	13.11			**X**
Maksutov	-40.5	-168.7	83.0	Upper Imbrian	13.34			**X**
Lyman	-64.8	163.6	84.0	Upper Imbrian	13.57			**X**
Fizeau	-58.6	-133.9	111.0	Upper Imbrian	20.33			**X**
Antoniadi	-69.7	-172.0	143.0	Upper Imbrian	29.35			**X**

Name	Lat (°)	Long (°)	Diam. (km)	Age	Stratigraphic Uplift (km)	Mare	Highlands	SPA
Stormer	57.3	146.3	69.0	Upper Imbrian	10.20		X	
Philolaus	72.1	-32.4	70.0	Copernican	10.42		X	
Jackson	22.4	-163.1	71.0	Copernican	10.64		X	
Jenner	-42.1	95.9	71.0	Upper Imbrian	10.64		X	
Stevinus	-32.5	54.2	74.0	Copernican	11.29		X	
King	5.0	120.5	76.0	Copernican	11.74		X	
la Perouse	-10.7	76.3	77.0	Upper Imbrian	11.96		X	
Fabricius	-42.9	42.0	78.0	Eratosthenian	12.19		X	
von Neumann	40.4	153.2	78.0	Upper Imbrian	12.19		X	
Olcott	20.6	117.8	81.0	Eratosthenian	12.87		X	
Schomberger	-76.7	24.9	85.0	Upper Imbrian	13.81		X	
Hayn	64.7	85.2	87.0	Copernican	14.28		X	
Piccolomini	-29.7	32.2	87.0	Upper Imbrian	14.28		X	
Robertson	21.8	-105.2	88.0	Copernican	14.52		X	
Schluter	-5.9	-83.3	89.0	Upper Imbrian	14.76		X	

Table A3.12 List of all craters showed in Fig. 3.82. The lunar region in which each crater belongs is also indicated (nearside mare, highlands, SPA)

Name	Lat (˚)	Long (˚)	Diam. (km)	Age	Stratigraphic Uplift (km)	Mare	Highlands	SPA
Taruntius	5.6	46.5	56	Copernican	2.57	**X**		
Kepler	8.1	-38	31	Copernican	3.09	**X**		
Conon	21.6	2	21	Copernican	3.44	**X**		
Petavius B	-19.9	57.1	33	Copernican	3.55	**X**		
Burg	45	28.2	39	Copernican	3.59	**X**		
Harpalus	52.6	-43.4	39	Copernican	3.67	**X**		
Aristarchus	23.7	-47.4	40	Copernican	3.76	**X**		
Aristillus	33.9	1.2	55	Copernican	3.93	**X**		
Gassendi A	-15.5	-39.7	33	Copernican	3.94	**X**		
Autolycus	30.7	1.5	39	Copernican	4.02	**X**		
Copernicus	9.7	-20.1	93	Copernican	4.24	**X**		
Virtanen	15.5	176.7	44	Copernican	5.00		**X**	
Crookes	-10.3	-164.5	49	Copernican	5.01		**X**	
Robertson	21.8	-105.2	88	Copernican	5.04		**X**	
Philolaus	72.1	-32.4	70	Copernican	5.04		**X**	
Eudoxus	44.3	16.3	67	Copernican	5.12		**X**	
Rutherfurd	-60.9	-12.1	48	Copernican	5.15		**X**	
Carpenter	69.4	-50.9	59	Copernican	5.17		**X**	
Stevinus	-32.5	54.2	74	Copernican	5.19		**X**	
Tycho	-43.4	-11.1	102	Copernican	5.37		**X**	
Bel'kovich K	63.8	93.6	47	Copernican	5.41		**X**	
Zucchius	-61.4	-50.3	64	Copernican	5.45		**X**	
Ohm	18.4	-113.5	64	Copernican	5.50		**X**	
Sharonov	12.4	173.3	74	Copernican	5.70		**X**	
Jackson	22.4	-163.1	71	Copernican	5.80		**X**	
King	5	120.5	76	Copernican	5.81		**X**	
Hayn	64.7	85.2	87	Copernican	6.18		**X**	
O'Day	-30.6	157.5	71	Copernican	6.67			**X**

Table A3.13 List of all suggested landing sites that fulfill at least two of the Science Concept 3 Science Goals. The fourth column indicates how many of the Science Goals they address, followed by a description of how they each address it. Sites were selected as possible locations to address Science Goal 3a if they are within one of the 5 highland types (H1 to H5), or within the primordial highland material, or have PAN detections, or contain lower crust or mantle material (*cf.* Comments 3C for the detail of what can exactly be sampled and where), or are good sites to assess the extent of the urKREEP layer. Specific sites were selected to address Science Goal 3b if they contain pyroclastic deposits or cryptomare, but Science Goal 3b could actually be assessed almost everywhere on the Moon. Sites were selected for Science Goal 3c if they have central peaks or peak rings and contain lower crust (lcm) or mantle (mm) in their central peaks/rings, or lower crust (lce) or mantle (me) in their ejecta. If the proximity value is between 0 and -5 km, there is an uncertainty on the possible excavation of lower/crust or mantle, and the comment will precise 'mm in EB', where 'EB' means error bar. Sites were selected for Science Goal 3d if they correspond to any gravity anomalies, massif, plateau, identified plutonic feature, red spot or young features. Sites were selected for Science Goal 3e if they are young and deep enough to show the transition from megaregolith to upper crust in their central peaks or walls.

Feature Name	Lat	Long	#	Comments 3A	Comments 3B	Comment 3C	Comment 3D	Comments 3E
Orientale	-19.0	-95.0	**5**	lower crust or/and mantle, low KREEP, PAN (Inner Rook massif & Inner Rook North)	Pyroclastics, cryptomare	peak rings, lce, lcm, mm	Type II gravity anomaly	Walls or peak rings should show contacts between megaregolith and underlying fractured crust
Schrödinger	-75.0	132.4	**5**	lower crust or/and mantle, low KREEP, PAN detection	Pyroclastics	peak rings, lcm, mm	Type I gravity anomaly	Walls or peak rings should show contacts between megaregolith and underlying fractured crust
Apollo	-36.1	-151.8	**4**	lower crust or/and mantle, low KREEP	Pyroclastics	peak rings, lcm, mm	Type II gravity anomaly	
Aristarchus	23.7	-47.4	**4**	h5, KREEP, PAN detection	Pyroclastics		Pluton, young crater walls and central peak	Young craters deeper than the estimated megaregolith thickness. Walls might show contact.
Australe	-52.0	95.0	**4**	lower crust or/and mantle, low KREEP	Cryptomare	peak rings, lce, lcm, mm	Type NM gravity anomaly	
Birkeland	-30.2	173.9	**4**	lower crust or/and mantle		central peak, lcm	Young central peak	Central peak should show the contact between the megaregolith and the underlying fractured crust
Copernicus	9.7	-20.1	**4**	high KREEP, h4	Cryptomare		Pluton, young crater	Central peak should show

Feature Name	Lat	Long	#	Comments 3A	Comments 3B	Comment 3C	Comment 3D	Comments 3E
							walls and central peak	the contact between the megaregolith and the underlying fractured crust. Young craters deeper than the estimated megaregolith thickness. Walls might show contact.
Finsen	-42.0	-177.9	**4**	lower crust or/and mantle		central peak, lcm	Young crater central peak	Central peak should show the contact between the megaregolith and the underlying fractured crust
Humboldtianum	56.8	81.5	**4**	lower crust or/and mantle, med KREEP	Cryptomare	peak rings, lce, lcm, mm	Type II gravity anomaly	
Humorum	-24.0	-39.0	**4**	lower crust or/and mantle, high KREEP	Pyroclastics(Lat:-30, Lon:-40)	peak rings, lce, lcm, mm	Type PM gravity anomaly	
Korolev	-4.0	-157.4	**4**	lower crust or/and mantle, PAN detection	Cryptomare	peak rings, lcm, (mm in EB),	Type I gravity anomaly	
Mendeleev	5.7	140.9	**4**	lower crust or/and mantle	Cryptomare	peak rings, lcm	Type I gravity anomaly	
Mendel-Rydberg	-50.0	-94.0	**4**	lower crust or/and mantle, low KREEP	Cryptomare, pyroclastics	peak rings, lce, lcm, mm	Type II gravity anomaly	
Moscoviense	26.0	148.0	**4**	lower crust or/and mantle, low KREEP	Cryptomare, pyroclastics	peak rings, lcm, mm	Type II gravity anomaly	
Nectaris	-16.0	34.0	**4**	lower crust or/and mantle, med KREEP,	Pyroclastics	peak rings, lce, lcm, (me in error bar), mm	Type PM gravity anomaly	
Smythii	-2.0	87.0	**4**	lower crust or/and mantle, med KREEP	Cryptomare, pyroclastics (lat:2, lon:83)	peak rings, lce, lcm, mm	Type PM gravity anomaly	
Antoniadi	-69.7	-172.0	**3**	lower crust or/and mantle, high KREEP		central peak, lce, lcm, (mm within EB		Central peak should show the contact between the megaregolith and the underlying

Feature Name	Lat	Long	#	Comments 3A	Comments 3B	Comment 3C	Comment 3D	Comments 3E
								fractured crust
Autolycus	30.7	1.5	**3**	h5			Young crater walls	Young craters deeper than the estimated megaregolith thickness. Walls might show contact.
Balmer Kapteyn	-15.5	69.0	**3**	lower crust or/and mantle, med KREEP	Cryptomare	peak rings, lce, lcm, mm		
Carpenter	70.0	309.5	**3**	PAN detection			Young central peak and crater walls	Young craters deeper than the estimated megaregolith thickness. Walls might show contact.
Compton	55.3	103.8	**3**	lower crust or/and mantle, high KREEP	Pyroclastics	central peak, lcm		
Conon	21.6	2.0	**3**	KREEP, h3.			Massif: Mons Bradley, young crater walls	Young craters deeper than the estimated megaregolith thickness. Walls might show contact.
Coulomb-Sarton	52.0	-123.0	**3**	lower crust or/and mantle, low KREEP		peak rings, lcm, mm	Type II gravity anomaly	
Crisium	18.0	59.0	**3**	lower crust or/and mantle, med KREEP		peak rings, lce, lcm, (me in EB), mm	Type PM gravity anomaly	
Crookes	-10.6	-165.2	**3**	primordial feldspathic crust sample, h1			Young crater walls	Young craters deeper than the estimated megaregolith thickness. Walls might show contact.
Eudoxus	44.3	16.3	**3**	h3			Young crater walls	Young craters deeper than the estimated megaregolith thickness. Walls might show contact.
Fizeau	-58.6	-	**3**	lower crust		central		Central peak

Feature Name	Lat	Long	#	Comments 3A	Comments 3B	Comment 3C	Comment 3D	Comments 3E
		133.9		or/and mantle		peak, lcm		should show the contact between the megaregolith and the underlying fractured crust
Freundlich-Sharonov	18.5	175.0	**3**	lower crust or/and mantle, low KREEP		peak rings, lcm, mm	Type II gravity anomaly	
Gassendi A	-15.5	-39.7	**3**	h3			Young crater walls	Young craters deeper than the estimated megaregolith thickness. Walls might show contact.
Grimaldi	-5.2	-68.3	**3**	PAN detection	Pyroclastics (36x24km)		intrusive dome	
Harpalus	52.6	-43.4	**3**	h4			Young crater walls	Young craters deeper than the estimated megaregolith thickness. Walls might show contact.
Hertzsprung	2.6	-129.2	**3**	lower crust or/and mantle, low KREEP		peak rings, lcm, mm	Type II gravity anomaly	
Humboldt	-27.0	80.9	**3**	lower crust or/and mantle		central peak, lcm		Central peak should show the contact between the megaregolith and the underlying fractured crust
Imbrium	35.0	-17.0	**3**	lower crust or/and mantle, high KREEP		peak rings, lce, lcm, me, mm	Type PM gravity anomaly	
Ingenii	-43.0	165.0	**3**	lower crust or/and mantle, high KREEP		peak rings, lce, lcm, mm	Type I gravity anomaly	
Jackson	22.0	197.0	**3**	PAN detection, primordial feldspathic crust sample			Pluton, young crater central peak and walls	Young craters deeper than the estimated megaregolith thickness. Walls might show contact.
Keeler-Heaviside	-10.0	162.0	**3**	lower crust or/and mantle,		peak rings, lcm, mm	Type NM gravity anomaly	

Feature Name	Lat	Long	#	Comments 3A	Comments 3B	Comment 3C	Comment 3D	Comments 3E
				med KREEP				
Kepler	8.1	-38.0	**3**	h5			Young crater walls	Young craters deeper than the estimated megaregolith thickness. Walls might show contact.
King	6.0	120.5	**3**	PAN detection			Pluton, young crater central peak and walls	Young craters deeper than the estimated megaregolith thickness. Walls might show contact.
Lomonosov-Fleming	19.0	105.0	**3**	lower crust or/and mantle, low KREEP	Cryptomare, pyroclastics	lce		
Lorentz	32.6	-95.3	**3**	lower crust or/and mantle		peak rings, lcm, (mm in EB)	Type I gravity anomaly	
Lyman	-64.8	163.6	**3**	lower crust or/and mantle		central peak, lcm		Central peak should show the contact between the megaregolith and the underlying fractured crust
Maksutov	-40.5	-168.7	**3**	lower crust or/and mantle		central peak, lcm		Central peak should show the contact between the megaregolith and the underlying fractured crust
Marginis	20.0	84.0	**3**	lower crust or/and mantle, low KREEP	Cryptomare (east margin)	lce		
O'Day	-31.0	157.0	**3**	PAN detection			Young crater central peak and walls	Central peak should show the contact between the megaregolith and the underlying fractured crust. Young craters deeper than the estimated megaregolith thickness. Walls might show contact.
Ohm	18.4	-	**3**	primordial			Pluton,	Young

Feature Name	Lat	Long	#	Comments 3A	Comments 3B	Comment 3C	Comment 3D	Comments 3E
		113.5		feldspathic crust sample			young crater walls	craters deeper than the estimated megaregolith thickness. Walls might show contact.
Oppenheimer	-35.2	-166.3	**3**	lower crust or/and mantle, med KREEP	Pyroclastics	lce		
Philolaus	72.1	-32.4	**3**	PAN detection			Young crater central peak and walls	Young craters deeper than the estimated megaregolith thickness. Walls might show contact.
Planck	-57.9	136.8	**3**	lower crust or/and mantle, low KREEP		peak rings, lce, lcm, mm	Type I gravity anomaly	
Poincare	-56.7	163.6	**3**	lower crust or/and mantle, high KREEP		peak rings, lce, lcm, mm	Type NM gravity anomaly	
Pythagoras	63.5	-63.0	**3**	KREEP, PAN detection		(central peak, lcm in error bar)	Young crater central peak	Central peak should show the contact between the megaregolith and the underlying fractured crust
Robertson	21.8	-105.2	**3**	PAN detection			Young crater central peak and walls	Young craters deeper than the estimated megaregolith thickness. Walls might show contact.
Serenitatis	26.0	18.0	**3**	lower crust or/and mantle, high KREEP		peak rings, lce, lcm, me, mm	Type PM gravity anomaly	
Taruntius	5.1	46.0	**3**		Pyroclastics, cryptomare		Laccolith, young crater central peak and walls	Central peak should show the contact between the megaregolith and the underlying fractured crust. Young craters deeper than the estimated megaregolith

Feature Name	Lat	Long	#	Comments 3A	Comments 3B	Comment 3C	Comment 3D	Comments 3E
								thickness. Walls might show contact.
Theophilus	-11.4	26.4	**3**	PAN detection		(central peak with lcm in the EB)	Young crater central peak, possible pluton	Central peak should show the contact between the megaregolith and the underlying fractured crust
Tsiolkovsky	-20.0	129.0	**3**	PAN detection	Cryptomare			Central peak should show the contact between the megaregolith and the underlying fractured crust
Tycho	-43.0	349.0	**3**	PAN detection			Pluton, young crater central peak and walls	Central peak should show the contact between the megaregolith and the underlying fractured crust. Young craters deeper than the estimated megaregolith thickness. Walls might show contact.
Vavilov	-0.8	-137.9	**3**	primordial feldspathic crust sample, h1, PAN detection			Young crater central peak and walls	Central peak should show the contact between the megaregolith and the underlying fractured crust
Virtanen	15.5	176.7	**3**	primordial feldspathic crust sample, PAN detection			Young crater central peak and walls	Young craters deeper than the estimated megaregolith thickness. Walls might show contact.
Abbe	-57.3	175.2	**2**	lower crust or/and mantle		lce		
Alder	-48.6	-177.4	**2**	lower crust or/and mantle		central peak, lcm		
Al-Khwarizmi-King	1.0	112.0	**2**	lower crust or/and mantle, low KREEP		lce		

Feature Name	Lat	Long	#	Comments 3A	Comments 3B	Comment 3C	Comment 3D	Comments 3E
Alphonsus	-14.0	357.0	**2**	PAN detection	Pyroclastics			
Amundsen Ganswindt	-81.0	120.0	**2**	lower crust or/and mantle, low KREEP		central ring, lcm, mm		
Anaxagoras	74.1	351.1	**2**	PAN detection			Young crater walls	
Archimedes R	26.0	-5.0	**2**	h5			Massif: Montes Archimedes	
Aristillus	33.9	1.2	**2**				Young crater central peak and walls	Central peak should show the contact between the megaregolith and the underlying fractured crust Young craters deeper than the estimated megaregolith thickness. Walls might show
Atlas	47.0	44.4	**2**	PAN detection	Pyroclastics			
Bel'kovich K	63.8	93.6	**2**				Young crater central peak and walls	Young craters deeper than the estimated megaregolith thickness. Walls might show contact.
Berlage	-63.2	-162.8	**2**	lower crust or/and mantle		lce		
Bhabha	-55.1	-164.5	**2**	lower crust or/and mantle		central peak, lcm		
Birkhoff	58.7	-146.1	**2**	lower crust or/and mantle		peak rings, lcm		
Birkhoff Z	61.3	-145.3	**2**	primordial feldspathic crust sample, h1			Young crater walls	
Bok	-20.2	-171.6	**2**				Young crater central peak	Central peak should show the contact between the megaregolith and the underlying fractured crust
Borman	-38.8	-147.7	**2**	lower crust or/and mantle		central peak, lcm		
Bose	-53.5	-170.0	**2**	lower crust or/and mantle		central peak, lcm		
Boyle	-53.1	178.1	**2**	lower crust		central		

Feature Name	Lat	Long	#	Comments 3A	Comments 3B	Comment 3C	Comment 3D	Comments 3E
				or/and mantle		peak, lcm		
Bullialdus	-20.7	-22.2	**2**				Pluton, young central peak	Central peak should show the contact between the megaregolith and the underlying fractured crust
Burg	45.0	28.2	**2**				Young crater walls	Young craters deeper than the estimated megaregolith thickness. Walls might show contact.
Cabannes	-60.9	-169.6	**2**	lower crust or/and mantle		central peak, lcm		
Cabannes Q	-63.3	-174.5	**2**	lower crust or/and mantle		central peak, lcm		
Crommelin	-68.1	-146.9	**2**	lower crust or/and mantle		central peak, lcm		
Crommelin C	-66.4	-144.8	**2**	lower crust or/and mantle		central peak, lcm		
Das	-26.8	-137.0	**2**	primordial feldspathic crust sample			Young crater walls	
Davisson	-37.5	-174.6	**2**	lower crust or/and mantle		central peak, lcm		
Dawson V	-66.6	-137.0	**2**	lower crust or/and mantle		central peak, lce, lcm		
Eijkman	-63.1	-141.5	**2**	lower crust or/and mantle		central peak, lcm		
Eratosthenes	14.5	-11.3	**2**				Young crater central peak	Central peak should show the contact between the megaregolith and the underlying fractured crust
Fabry	42.9	100.7	**2**	lower crust or/and mantle		central peak, lcm		
Fecunditatis	-4.0	52.0	**2**	lower crust or/and mantle, med KREEP		lce		
Flamsteed-Billy	-7.0	-45.0	**2**	lower crust or/and mantle, high KREEP		lce		

Feature Name	Lat	Long	#	Comments 3A	Comments 3B	Comment 3C	Comment 3D	Comments 3E
Gambart	-1.0	-15.2	**2**		Pyroclastics		Intrusive dome	
Giordano Bruno	36.0	103.0	**2**	PAN detection			Young crater walls	
Godin	1.8	10.2	**2**	h3			Young crater walls	
Grissom-White	-44.0	-161.0	**2**	lower crust or/and mantle, med KREEP		lce		
Hausen	-65.0	-88.1	**2**				Young crater central peak	Central peak should show the contact between the megaregolith and the underlying fractured crust
Hayn	64.7	85.2	**2**				Young crater central peak and walls	Young craters deeper than the estimated megaregolith thickness. Walls might show contact.
Hess	-54.3	174.6	**2**	lower crust or/and mantle		lce		
Insularum	9.0	-18.0	**2**	lower crust or/and mantle, high KREEP		lce		
Langrenus	-8.9	61.1	**2**				Young crater central peak	Central peak should show the contact between the megaregolith and the underlying fractured crust
Leeuwenhoek	-29.3	-178.7	**2**	lower crust or/and mantle		central peak, lcm		
Leibnitz	-38.3	179.2	**2**	lower crust or/and mantle, med KREEP		lce		
Lemaitre	-61.2	-149.6	**2**	lower crust or/and mantle		central peak, lce, lcm		
Leuschner	1.5	251.0	**2**	PAN detection			Young crater central peak	
Maurolycus	-42.0	13.5	**2**	PAN detection	Cryptomare			
Milne N	-32.5	110.8	**2**	PAN detection			Young crater walls	
Minkowski	-56.5	-146.0	**2**	lower crust or/and mantle		central peak, lce, lcm		

Feature Name	Lat	Long	#	Comments 3A	Comments 3B	Comment 3C	Comment 3D	Comments 3E
Minnaert	-67.8	179.6	**2**	lower crust or/and mantle		lce		
Moretus	-70.6	-5.8	**2**				Young crater central peak	Central peak should show the contact between the megaregolith and the underlying fractured crust
Mosting	-0.7	-5.9	**2**	h4			Young crater walls	
Mutus-Vlacq	-52.0	21.0	**2**	lower crust or/and mantle, low KREEP		lce		
Necho	-5.0	123.1	**2**	primordial feldspathic crust sample			Young crater walls	
Nubium	-21.0	-15.0	**2**	lower crust or/and mantle, high KREEP		lce		
Numerov	-70.7	-160.7	**2**	lower crust or/and mantle, high KREEP		central peak, lcm		
Petavius	-25.1	60.4	**2**	lower crust or/and mantle, PAN detection		central peak, lcm		
Petavius B	-19.9	57.1	**2**				Young crater walls	Young craters deeper than the estimated megaregolith thickness. Walls might show contact.
Plutarch	24.5	79.0	**2**	PAN detection			Young crater central peak	
Proclus	16.0	46.6	**2**	PAN detection			Young crater walls	
Rumford T	-28.6	-172.1	**2**	lower crust or/and mantle		central peak, lcm		
Rutherfurd	-60.9	-12.1	**2**				Young crater central peak and walls	Young craters deeper than the estimated megaregolith thickness. Walls might show contact.
Rydberg	-47.0	264.0	**2**	PAN detection			Young crater central peak	
Schiller-Zucchius	-56.0	-45.0	**2**	lower crust		peak rings,		

Feature Name	Lat	Long	#	Comments 3A	Comments 3B	Comment 3C	Comment 3D	Comments 3E
				or/and mantle		lcm, (mm in EB)		
Sharonov	12.4	173.3	**2**				Young crater walls	Young craters deeper than the estimated megaregolith thickness. Walls might show contact.
Sikorsky-Rittenhouse	-68.0	111.0	**2**	lower crust or/and mantle, low KREEP		peak rings, lcm, mm		
Stevinus	-32.5	54.2	**2**				Pluton, young crater central peak and walls	Young craters deeper than the estimated megaregolith thickness. Walls might show contact.
Stoney	-55.3	-156.1	**2**	lower crust or/and mantle		central peak, lcm		
Tranquillitatis	7.0	30.0	**2**	lower crust or/and mantle, med KREEP		lce		
Triesnecker	4.2	3.6	**2**	h4			Young crater walls	
Tsiolkovsky-Stark	-15.0	128.0	**2**	lower crust or/and mantle, low KREEP		lce		
Von Karman	-44.8	175.9	**2**	lower crust or/and mantle, med KREEP		lce		
Von Karman M	-47.2	176.2	**2**	lower crust or/and mantle, med KREEP		lce		
Wallace C	17.6	-6.4	**2**	h4			Massif: Mons Wolff	
Werner-Airy	-24.0	12.0	**2**	lower crust or/and mantle, med KREEP		lce		
Zeeman	-75.2	-133.6	**2**	lower crust or/and mantle		central peak, lcm		
Zucchius	-61.4	-50.3	**2**				Young crater central peak and walls	Young craters deeper than the estimated megaregolith thickness. Walls might show contact.

SCIENCE CONCEPT 4

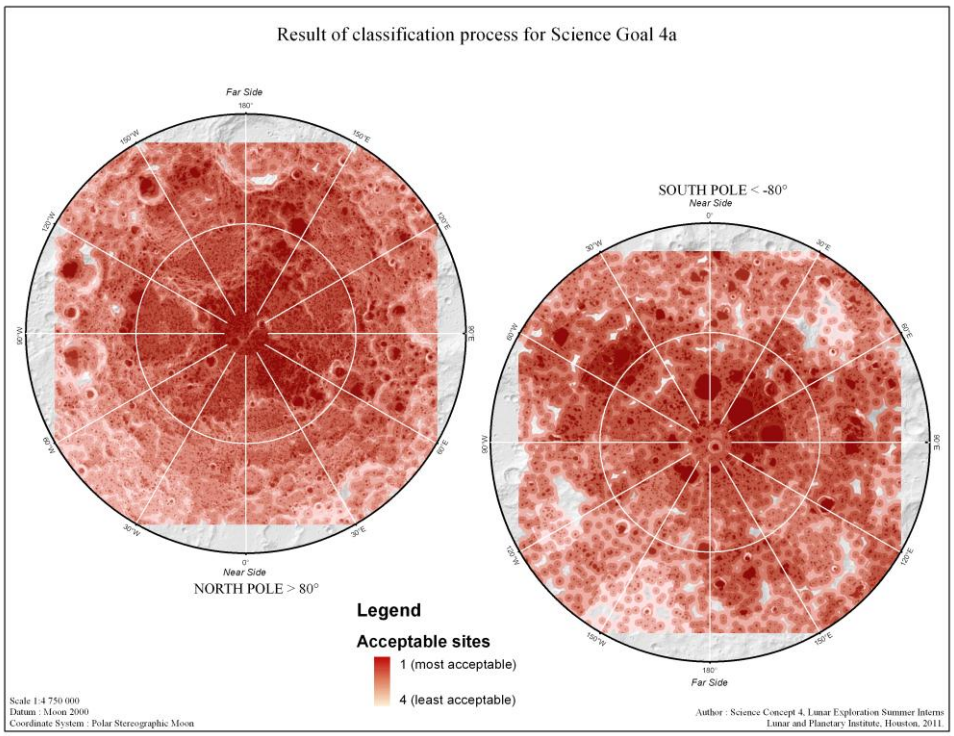


Figure A4.1 Result of classification process for Science Goal 4a.

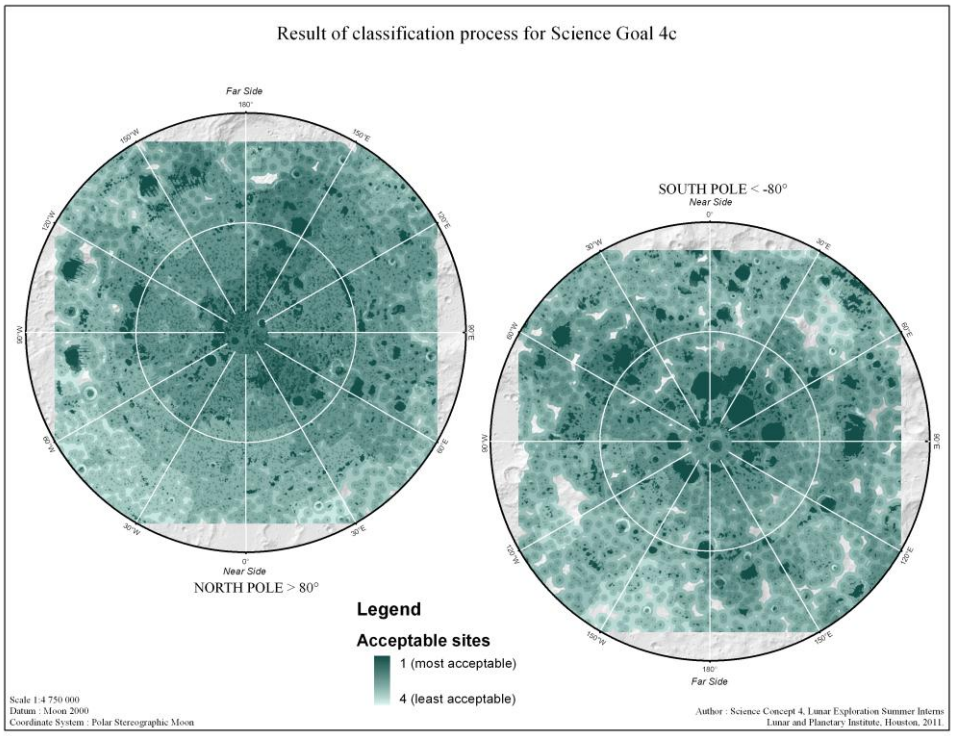


Figure A4.2 Result of classification process for Science Goal 4c.

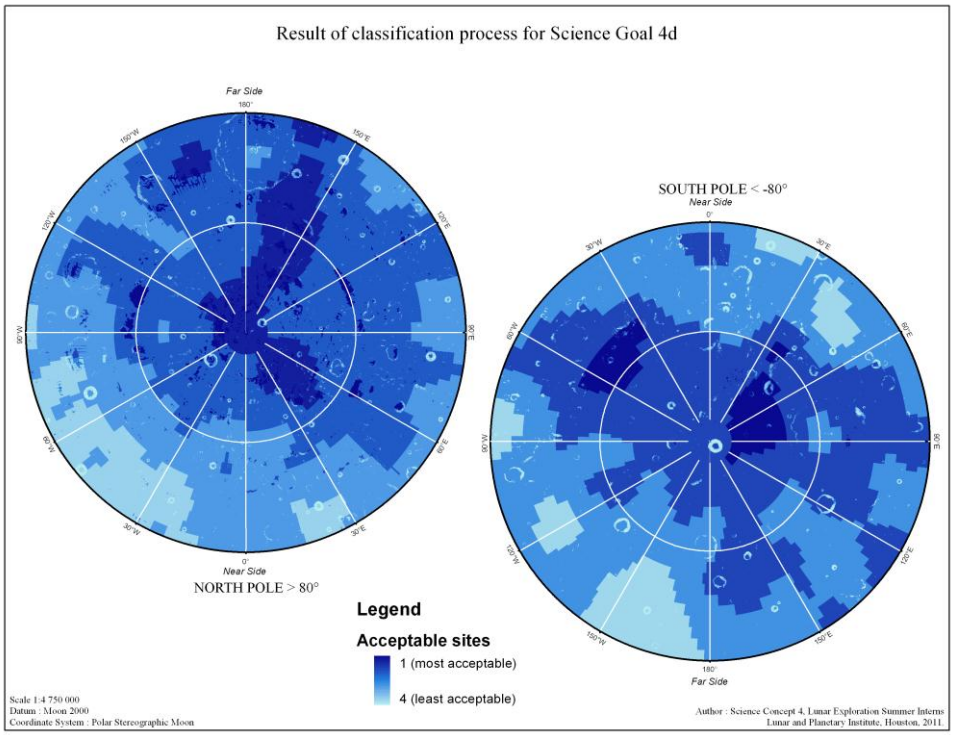


Figure A4.3 Result of classification process for Science Goal 4d.

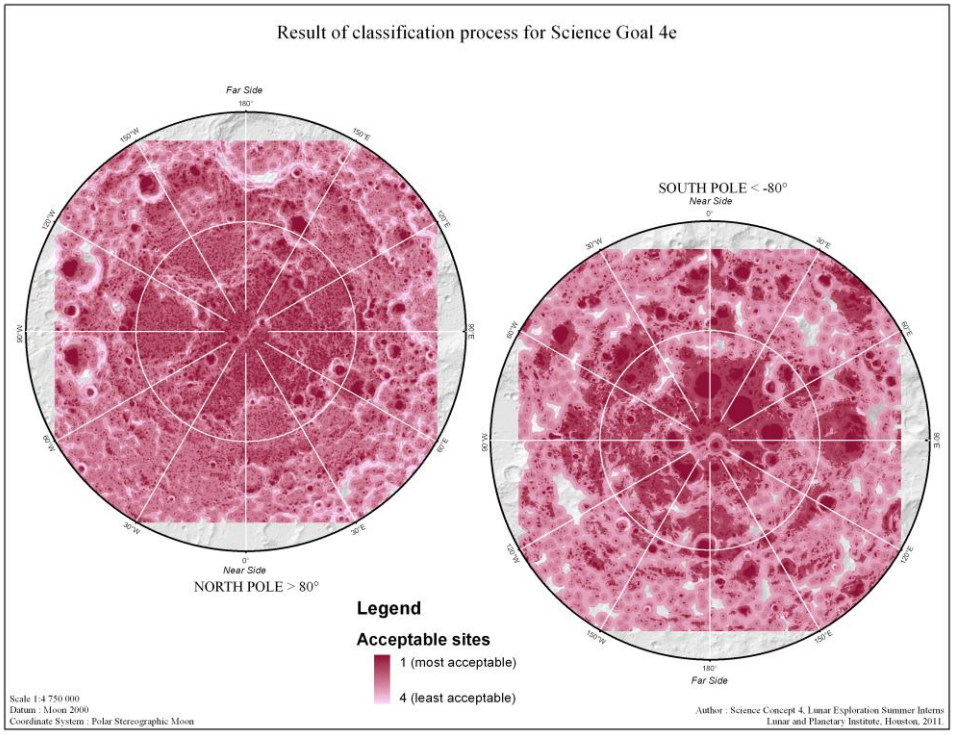


Figure A4.4 Result of classification process for Science Goal 4e.

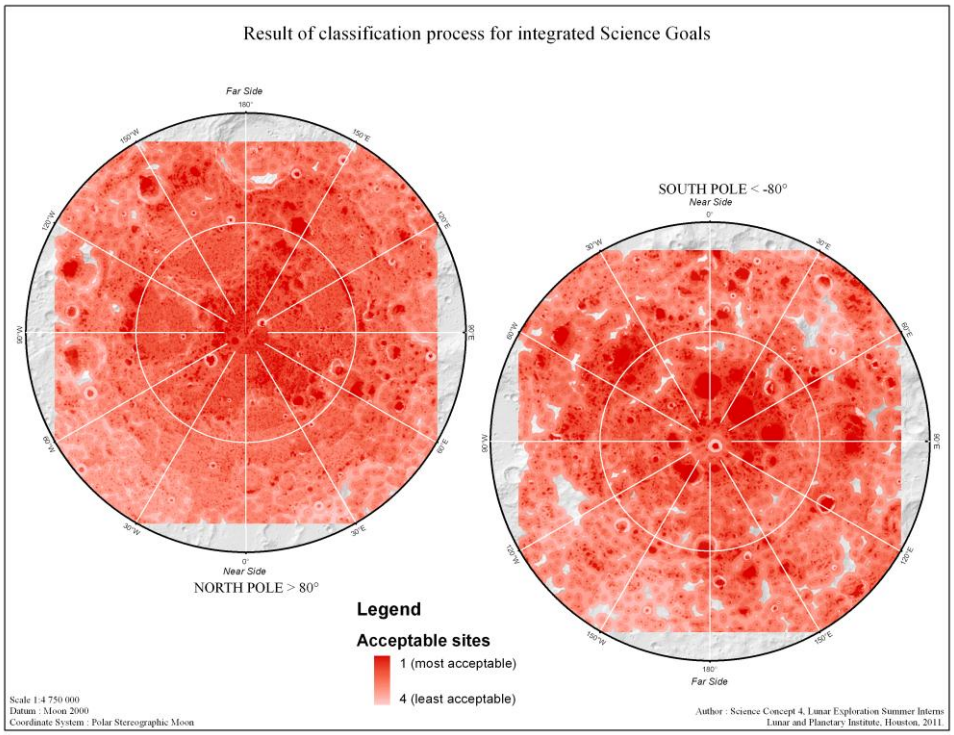


Figure A4.5 Result of classification process for all Science Goals of Science Concept 4.

SCIENCE CONCEPT 5

No appendix material for Science Concept 5.

SCIENCE CONCEPT 6

TABLE A6.1 Fresh, complex craters ideal for studying impact lithology.

Name	Diameter (km)	Terrane	Age	Morphology	LAT	LONG
Dionysius	18	Highlands	Copernican	Flat Floored	2.8	17.3
Giordano Bruno	22	Highlands	Copernican	Central Peak	35.9	102.8
Proclus	28	Highlands	Copernican	Central Peak	16.1	46.8
Necho	30	Highlands	Copernican	Central Peak	-5	123.1
Faraday C	30	Highlands	Copernican	Central Peak	-43.3	8.1
Schomberger A	31	Highlands	Copernican	Central Peak	-78.8	24.4
Thales	31	Highlands	Copernican	Central Peak	61.8	50.3
Petavius B	33	Highlands	Copernican	Central Peak	-19.9	57.1
Gassendi A	33	Highlands	Copernican	Central Peak	-15.5	-39.7
Godin	34	Highlands	Copernican	Central Peak	1.8	10.2
Guthnick	36	Highlands	Copernican	Central Peak	-47.7	-93.9
Pasteur D	36	Highlands	Copernican	Central Peak	-8.8	108.8
Milne N	37	Highlands	Copernican	Central Peak	-35.5	110.8
Das	38	Highlands	Copernican	Central Peak	-26.6	-136.8
Harpalus	39	Highlands	Copernican	Central Peak	52.6	-43.4
Palitzsch B	39	Highlands	Copernican	Central Peak	-26.4	68.4
Perrine E	40	Highlands	Copernican	Central Peak	42.8	-124.9
Glushko (Earlier Olbers A)	43	Highlands	Copernican	Central Peak	8	-78
Virtanen	44	Highlands	Copernican	Central Peak	15.5	176.7
Rutherfurd	48	Highlands	Copernican	Central Peak	-60.9	-12.1
Crookes	49	Highlands	Copernican	Central Peak	-10.3	-164.5
Anaxagoras	50	Highlands	Copernican	Central Peak	73.4	-10.1
Taruntius	56	Highlands	Copernican	Central Peak	5.6	46.5
Carpenter	59	Highlands	Copernican	Central Peak	69.4	-50.9
Ohm	64	Highlands	Copernican	Central Peak	18.4	-113.5
Zucchius	64	Highlands	Copernican	Transitional	-61.4	-50.3
Eudoxus	67	Highlands	Copernican	Central Peak	44.3	16.3
Philolaus	70	Highlands	Copernican	Central Peak	72.1	-32.4
Jackson	71	Highlands	Copernican	Central Peak	22.4	-163.1
Sharonov	74	Highlands	Copernican	Central Peak	12.4	173.3
Stevinus	74	Highlands	Copernican	Central Peak	-32.5	54.2

King	76	Highlands	Copernican	Central Peak	5	120.5
Hayn	87	Highlands	Copernican	Central Peak	64.7	85.2
RoberFlat Flooredon	88	Highlands	Copernican	Central Peak	21.8	-105.2
Tycho*	102	Highlands	Copernican	Central Peak	-43.4	-11.1
Klute W	13	Highlands	Eratosthenian	Central Peak	38.2	-143
Steno Q	29	Highlands	Eratosthenian	Central Peak	29.3	157.8
Horrocks	30	Highlands	Eratosthenian	Central Peak	-4	5.9
Tedinger Y	31	Highlands	Eratosthenian	Central Peak	58.1	175.1
Coulomb N	32	Highlands	Eratosthenian	Central Peak	50.6	-115.8
Hommel B	33	Highlands	Eratosthenian	Central Peak	-55.3	37
Petrie	33	Highlands	Eratosthenian	Central Peak	45.3	108.4
Wilsing C	33	Highlands	Eratosthenian	Central Peak	-19	-153
Reichenbach A	34	Highlands	Eratosthenian	Central Peak	-28.3	49
Zhukovskiy Z	34	Highlands	Eratosthenian	Central Peak	10	-166.8
Grachev	35	Highlands	Eratosthenian	Central Peak	-3.7	-108.2
Pogson F	35	Highlands	Eratosthenian	Central Peak	-42	114.6
von der Pahlen H	35	Highlands	Eratosthenian	Central Peak	-27.1	-127.5
Chebyshev U	36	Highlands	Eratosthenian	Central Peak	-33.5	-133.6
Foster P	36	Highlands	Eratosthenian	Central Peak	20.2	-143.5
Stearns	36	Highlands	Eratosthenian	Central Peak	34.8	162.6
Grotrian	37	Highlands	Eratosthenian	Central Peak	-66.5	128.3
Plante	37	Highlands	Eratosthenian	Central Peak	-10.2	163.3
Zeno B	37	Highlands	Eratosthenian	Central Peak	44	71
Nicholson	38	Highlands	Eratosthenian	Central Peak	-26.2	-85.1
Harriot W	39	Highlands	Eratosthenian	Central Peak	35	111.7
Wright	39	Highlands	Eratosthenian	Central Peak	-31.6	-86.6
Cepheus	39	Highlands	Eratosthenian	Central Peak	40.8	45.8
Cichus	40	Highlands	Eratosthenian	Central Peak	-33.3	-21.1
Herschel	40	Highlands	Eratosthenian	Central Peak	-5.7	-2.1
Newcomb	41	Highlands	Eratosthenian	Central Peak	29.9	43.8
Hayn E	42	Highlands	Eratosthenian	Central Peak	67.1	66.4
Innes	42	Highlands	Eratosthenian	Central Peak	27.8	119.2
Rothmann	42	Highlands	Eratosthenian	Central Peak	-30.8	27.7
Rozhdestvenskiy K	42	Highlands	Eratosthenian	Central Peak	82.7	-144.6
Sirsalis	42	Highlands	Eratosthenian	Central Peak	-12.5	-60.4
Amici T	43	Highlands	Eratosthenian	Central Peak	-9.7	-174
Dante E	43	Highlands	Eratosthenian	Central Peak	26.7	-177
Agrippa	44	Highlands	Eratosthenian	Central Peak	4.1	10.5

Leuschner	49	Highlands	Eratosthenian	Central Peak	1.8	-108.8
Rowland J	49	Highlands	Eratosthenian	Central Peak	53.1	-155.5
Rydberg	49	Highlands	Eratosthenian	Central Peak	-46.5	-96.3
Hainzel A	53	Highlands	Eratosthenian	Central Peak	-40.3	-33.9
Scoresby	55	Highlands	Eratosthenian	Central Peak	77.7	14.1
Cavalerius	57	Highlands	Eratosthenian	Central Peak	5.1	-66.8
Hamilton	57	Highlands	Eratosthenian	Central Peak	-42.8	84.7
Moiseev	59	Highlands	Eratosthenian	Central Peak	9.5	103.3
Ricco	65	Highlands	Eratosthenian	Central Peak	75.6	176.3
Kirkwood	67	Highlands	Eratosthenian	Central Peak	68.8	-156.1
Plutarch	68	Highlands	Eratosthenian	Central Peak	24.1	79
Werner	70	Highlands	Eratosthenian	Central Peak	-28	3.3
Morse	77	Highlands	Eratosthenian	Central Peak	22.1	-175.1
Fabricius	78	Highlands	Eratosthenian	Central Peak	-42.9	42
Olcott	81	Highlands	Eratosthenian	Transitional	20.6	117.8
Geminus	85	Highlands	Eratosthenian	Central Peak	34.5	56.7
Aristoteles	87	Highlands	Eratosthenian	Central Peak	50.2	17.4
Theophilus	110	Highlands	Eratosthenian	Central Peak	-11.4	26.4
Moretus	111	Highlands	Eratosthenian	Central Peak	-70.6	-5.8
Langrenus	127	Highlands	Eratosthenian	Central Peak	-8.9	61.1
Pythagoras	142	Highlands	Eratosthenian	Transitional	63.5	-63
Hausen	167	Highlands	Eratosthenian	Transitional	-65	-88.1
Petavius	188	Highlands	Eratosthenian	Transitional	-25.1	60.4
Compton	162	Highlands	Lower Imbrian	Peak Ring	55.3	103.8
Hilbert	151	Highlands	Nectarian	Central Peak	-17.9	108.2
Sommerfeld	169	Highlands	Nectarian	Central Peak	65.2	-162.4
Schiller*	180	Highlands	Nectarian	Central Peak	-51.9	-39
Drygalski	149	Highlands	Pre-Nectarian	Central Peak	-79.3	-84.9
Longomontanus	157	Highlands	Pre-Nectarian	Central Peak	-49.6	-21.8
Keeler	160	Highlands	Pre-Nectarian	Transitional	-10.2	161.9
Joliot	164	Highlands	Pre-Nectarian	Central Peak	25.8	93.1
Gauss	177	Highlands	Pre-Nectarian	Transitional	35.7	79
Mach	180	Highlands	Pre-Nectarian	Central Peak	18.5	-149.3
d'Alembert	248	Highlands	Pre-Nectarian	Peak Ring	50.8	163.9
Milne	272	Highlands	Pre-Nectarian	Peak Ring	-31.4	112.2
Bailly	287	Highlands	Pre-Nectarian	Peak Ring	-66.5	-69.1
Mandel'shtam F	17	Highlands	unknown	Flat Floored	5.2	166.2
Ryder	17	Highlands	unknown	Flat Floored	-44.5	143.2

Byrgius A	19	Highlands	unknown	Flat Floored	-24.5	-63.7
Poincare X	19	Highlands	unknown	Flat Floored	-54.06	160.886
Cleostratus J	20	Highlands	unknown	Flat Floored	61.3	-83.8
Bouguer	22	Highlands	unknown	Flat Floored	52.3	-35.8
Lalande	24	Highlands	unknown	Central Peak	-4.4	-8.6
Moore F	24	Highlands	unknown	Central Peak	37.4	-175
Unnamed	25	Highlands	unknown	Central Peak	37	-175
Stefan L	26	Highlands	unknown	Central Peak	44.6	-107.7
Unnamed	28	Highlands	unknown	Central Peak	44.2	-108.1
Saha E	28	Highlands	unknown	Central Peak	-0.2	107.6
Unnamed	31	Highlands	unknown	Central Peak	27	-93
Laue G	36	Highlands	unknown	Central Peak	27.8	-93.2
Tsiolkovsky	180	Highlands	unknown	Central Peak	-20.4	129.1
Fabry	184	Highlands	unknown	Central Peak	42.9	100.7
Schwarzschild	212	Highlands	unknown	Peak Ring	70.1	121.2
Dawes	18	Mare	Copernican	Flat Floored	17.2	26.4
Pytheas	20	Mare	Copernican	Central Peak	20.5	-20.6
Triesnecker	26	Mare	Copernican	Central Peak	4.2	3.6
Kepler	31	Mare	Copernican	Central Peak	8.1	-38
Marius A	15	Mare	Eratosthenian	Flat Floored	12.6	-46
Bessel	15	Mare	Eratosthenian	Flat Floored	21.8	17.9
Diophantus	17	Mare	Eratosthenian	Central Peak	27.6	-34.3
Peirce	18	Mare	Eratosthenian	Flat Floored	18.3	53.5
Flamsteed	20	Mare	Eratosthenian	Central Peak	-4.5	-44.3
Delisle	25	Mare	Eratosthenian	Central Peak	29.9	-34.6
Arago	26	Mare	Eratosthenian	Central Peak	6.2	21.4
Reiner	29	Mare	Eratosthenian	Central Peak	7	-54.9
Delmotte	32	Mare	Eratosthenian	Central Peak	27.1	60.2
Reinhold	42	Mare	Eratosthenian	Central Peak	3.3	-22.8
Maunder	55	Mare	Eratosthenian	Central Peak	-14.6	-93.8
Harding	22	Mare	unknown	Central Peak	43.5	-71.7
Briggs B	25	Mare	unknown	Central Peak	28.1	-70.9
Unnamed	27	Mare	Unknown	Central Peak	28.1	-70.5
Lichtenberg	20	Mixed	Copernican	Central Peak	31.8	-67.7
Mosting	24	Mixed	Copernican	Central Peak	-0.7	-5.9
Burg	39	Mixed	Copernican	Central Peak	45	28.2
Aristarchus	40	Mixed	Copernican	Central Peak	23.7	-47.4
Aristillus	55	Mixed	Copernican	Central Peak	33.9	1.2
Copernicus	93	Mixed	Copernican	Central Peak	9.7	-20.1

Picard	22	Mixed	Eratosthenian	Central Peak	14.6	54.7
Euler	27	Mixed	Eratosthenian	Central Peak	23.3	-29.2
Lambert	30	Mixed	Eratosthenian	Central Peak	25.8	-21
Archytas	31	Mixed	Eratosthenian	Central Peak	58.7	5
Timocharis	33	Mixed	Eratosthenian	Central Peak	26.7	-13.1
Manilius	38	Mixed	Eratosthenian	Central Peak	14.5	9.1
Plinius	43	Mixed	Eratosthenian	Central Peak	15.4	23.7
Eratosthenes	58	Mixed	Eratosthenian	Central Peak	14.5	-11.3
Bullialdus	60	Mixed	Eratosthenian	Central Peak	-20.7	-22.2
Harding	24	Mixed	Unknown	Central Peak	43.3	-73.3
Menelaus	26	Mixed	unknown	Central Peak	16.3	16
O'Day	71	SPA	Copernican	Central Peak	-30.6	157.5
Wiechert J	34	SPA	Eratosthenian	Central Peak	-85.6	-177
Finsen	72	SPA	Eratosthenian	Central Peak	-42	-177.9
Birkeland	82	SPA	Eratosthenian	Central Peak	-30.2	173.9
Zeeman	190	SPA	Nectarian	Central Peak	-75.2	-133.6
Von Karman	180	SPA	Pre-Nectarian	Central Peak	-44.8	175.9
Antoniadi	143	SPA	Upper Imbrian	Peak Ring	-69.7	-172

SCIENCE CONCEPT 7

No appendix material for Science Concept 7.

SCIENCE CONCEPT 8

No appendix material for Science Concept 8.

SOUTH POLE-AITKEN BASIN

Table A9.1 The locations of basins greater than 140 kilometers in diameter found inside the 2500 km diameter of SPA and their corresponding ages and distance from the lunar South Pole.

Basin	Radius (km)	LAT	LONG	Distance from South Pole (km)	Estimated Age
Amundsen-Ganswindt	167.5	-81	120	**272.9**	Pre-Nectarian
Antoniadi	71.5	-69.534	-173.155	620.5	Upper Imbrian
Apollo	268.5	-36.296	-152.001	1628.3	Pre-Nectarian
Ashbrook	78	-81.446	-111.01	**259.4**	Pre-Nectarian
Australe	440	-52	95	1152.2	Pre-Nectarian
Brouwer	79	-36.402	-125.605	1625.1	Nectarian
Chebyshev	89	-34.253	-133.396	1690.2	Nectarian
Drygalski	74.5	-79.699	-85.729	**312.3**	Pre-Nectarian
Gagarin	132.5	-19.694	149.226	2131.7	Pre-Nectarian
Grissom-White	300	-43.45	-159.797	1411.4	Pre-Nectarian
Hausen	83.5	-65.461	-88.165	744.0	Eratosthenian
Ingenii	280	-43	165	1425.0	Pre-Nectarian
Jules Verne	71.5	-35.022	146.734	1666.9	Pre-Nectarian
Keeler-Heaviside	250	-10	162	2425.6	Pre-Nectarian
Leibnitz	122.5	-38.681	178.968	1556.0	Pre-Nectarian
Lippmann	80	-55.801	-114.565	1036.9	Pre-Nectarian
Oppenheimer	104	-35.946	-166.033	1638.9	Nectarian
Pavlov	74	-28.8	142.5	1855.6	Nectarian
Planck	157	-58.058	135.87	968.5	Pre-Nectarian
Poincare	159.5	-56.7	163.6	1009.7	Pre-Nectarian
Roche	80	-42.514	136.158	1439.8	Nectarian
Schrödinger	156	-74.642	132.163	**465.7**	**Lower Imbrian**
Sikorsky-Rittenhouse	155	-69.218	112.062	630.1	Nectarian
Van de Graaff	116.5	-27.4	172.2	1898.0	Nectarian
Vertregt	93.5	-19.8	171.1	2128.5	Pre-Nectarian
Von Karman	90	-44.8	175.9	1370.5	Pre-Nectarian
Von Karman M	112.5	-48.002	177.543	1273.4	Pre-Nectarian
Zeeman	95	-75.498	-135.99	**439.7**	Nectarian
Zwicky	75	-15.224	167.192	2267.2	Pre-Nectarian

Table A9.2 Named craters within SPA Basin given an estimated age in the Crater Database (*Losiak et al., 2009*). *C.f.*, Figs. 8.10 and 8.11.

Crater Name	Radius (km)	LAT	LONG	Distance from South Pole (km)	Estimated Age
Amundsen-Ganswindt	167.5	-81.00	120.00	272.9	Pre-Nectarian
Apollo	268.5	-36.296	-152.001	1628.5	Pre-Nectarian
Australe	440	-52.00	95.00	1152.3	Pre-Nectarian
Barbier	33	-24.12	157.65	1997.9	Pre-Nectarian
Blackett	70.5	-37.67	-115.59	1586.8	Pre-Nectarian
Boguslawsky	48.5	-72.719	42.817	524.0	Pre-Nectarian
Boussingault	71	-70.29	54.16	597.8	Pre-Nectarian
Daedalus R	20.5	-7.70	175.20	2495.6	Pre-Nectarian
Drygalski	74.5	-79.70	-85.73	312.4	Pre-Nectarian
Gagarin	132.5	-19.69	149.23	2131.9	Pre-Nectarian
Galois	111	-14.23	-152.78	2297.7	Pre-Nectarian
Galois Q	66	-15.20	-154.70	2268.2	Pre-Nectarian
Grissom-White	300	-43.45	-159.80	1411.6	Pre-Nectarian
Heaviside	82.5	-10.16	166.74	2420.9	Pre-Nectarian
Helmholtz	47	-68.458	64.818	653.2	Pre-Nectarian
Ingenii	280	-43.00	165.00	1425.2	Pre-Nectarian
Jules Verne	71.5	-35.02	146.73	1667.1	Pre-Nectarian
Keeler-Heaviside	250	-10.00	162.00	2425.9	Pre-Nectarian
Leibnitz	122.5	-38.681	178.968	1556.2	Pre-Nectarian
Lippmann	80	-55.80	-114.57	1037.0	Pre-Nectarian
Orlov Y	63	-22.80	-175.10	2037.7	Pre-Nectarian
Planck	157	-58.06	135.87	968.6	Pre-Nectarian
Poincare	159.5	-56.70	163.60	1009.8	Pre-Nectarian
Vertregt	93.5	-19.80	171.10	2128.7	Pre-Nectarian
Von Karman	90	-44.8	175.9	1370.6	Pre-Nectarian
Von Karman M	112.5	-48.00	177.54	1273.5	Pre-Nectarian
Zwicky	75	-15.22	167.19	2267.5	Pre-Nectarian
Abbe	33	-57.69	174.30	979.6	Nectarian
Aitken Y	17.5	-12.14	172.72	2360.9	Nectarian
Amici N	19.5	-12.15	-172.75	2360.6	Nectarian
Amici R	17	-11.74	-175.55	2373.0	Nectarian
Amundsen	50.5	-84.33	83.94	172.0	Nectarian
Anders	20	-41.71	-143.36	1464.4	Nectarian
Anuchin	28.5	-48.75	101.17	1250.9	Nectarian
Bailly	143.5	-66.70	-68.07	706.6	Nectarian
Bailly A	19	-69.34	-59.29	626.6	Nectarian
Bailly B	32.5	-68.75	-62.83	644.5	Nectarian
Barbier U	19	-23.02	154.92	2031.1	Nectarian
Barringer	34	-28.64	-150.44	1860.6	Nectarian
Bergstrand	21.5	-18.88	176.17	2156.6	Nectarian
Bhabha	32	-55.73	-165.29	1039.1	Nectarian
Bose	45.5	-54.17	-169.65	1086.6	Nectarian
Boussingault A	36	-69.94	53.49	608.4	Nectarian
Boyle	28.5	-53.49	177.57	1107.0	Nectarian

Boyle Z	26	-51.67	177.26	1162.4	Nectarian
Brouwer	79	-36.40	-125.61	1625.3	Nectarian
Buffon	53	-41.00	-133.58	1486.0	Nectarian
Cabannes Q	24.5	-63.64	-175.40	799.4	Nectarian
Cabeus B	30.5	-82.24	-53.57	235.5	Nectarian
Carver	29.5	-43.49	127.12	1410.3	Nectarian
Cassegrain	27.5	-51.96	112.93	1153.5	Nectarian
Cassegrain B	19.5	-49.54	114.19	1226.9	Nectarian
Chaffee	24.5	-39.48	-154.62	1532.0	Nectarian
Chaffee F	17.5	-39.38	-153.08	1535.0	Nectarian
Chamberlin	29	-58.66	95.56	950.2	Nectarian
Chebyshev	89	-34.25	-133.40	1690.4	Nectarian
Clark F	13.5	-38.70	122.61	1555.5	Nectarian
Coblentz	16.5	-38.18	126.29	1571.4	Nectarian
Cori	32.5	-50.85	-153.02	1187.2	Nectarian
Crocco	37.5	-47.15	149.92	1299.4	Nectarian
Crommelin C	22	-66.40	-144.80	715.6	Nectarian
Crookes D	20.5	-9.60	-162.80	2438.0	Nectarian
Cyrano	40	-20.50	157.03	2107.6	Nectarian
Daedalus G	16.5	-6.91	-177.66	2519.5	Nectarian
Demonax	64	-78.29	59.55	355.0	Nectarian
Denning	22	-16.40	142.60	2231.8	Nectarian
Dryden T	17.5	-33.38	-158.91	1716.9	Nectarian
Dryden W	15	-31.00	-158.50	1789.1	Nectarian
Eijkman	27	-63.44	-142.84	805.4	Nectarian
Fechner	31.5	-58.28	124.61	961.8	Nectarian
Galois A	27	-13.51	-152.37	2319.4	Nectarian
Galois L	25.5	-15.40	-151.92	2262.3	Nectarian
Galois U	17.5	-13.20	-154.70	2328.8	Nectarian
Ganswindt	37	-79.39	110.88	321.8	Nectarian
Garavito Q	21	-49.60	153.60	1225.1	Nectarian
Garavito Y	26	-45.79	155.67	1340.6	Nectarian
Geiger R	20	-15.59	156.19	2256.2	Nectarian
Grave	20	-17.15	150.03	2209.2	Nectarian
Grissom	29	-47.30	-147.97	1294.9	Nectarian
Hagen J	23.5	-49.33	137.56	1233.3	Nectarian
Haret C	15	-57.80	-173.98	976.5	Nectarian
Holetschek R	34.5	-29.26	146.67	1842.0	Nectarian
Icarus J	16	-7.58	-171.09	2499.2	Nectarian
Idel'son	30	-81.283	111.884	264.3	Nectarian
Jarvis	19	-35.55	-148.34	1651.2	Nectarian
Jeans X	22	-53.33	89.03	1111.8	Nectarian
Jules Verne C	15	-33.30	149.42	1719.4	Nectarian
Jules Verne P	31	-38.11	144.99	1573.6	Nectarian
Karrer	25.5	-52.36	-142.47	1141.4	Nectarian
Kugler N	21	-53.80	103.70	1097.7	Nectarian
Lampland K	23.5	-33.22	132.52	1721.7	Nectarian
Leavitt	33	-45.20	-140.01	1358.6	Nectarian

Lebedev K	11	-50.04	108.92	1211.8	Nectarian
Leeuwenhoek	62.5	-29.71	-179.21	1828.3	Nectarian
Lemaitre	45.5	-61.71	-150.39	857.8	Nectarian
Lemaitre F	16	-61.75	-148.98	856.6	Nectarian
Lemaitre S	17	-61.94	-157.15	850.8	Nectarian
Levi-Civita S	21.5	-24.28	138.41	1992.7	Nectarian
Lodygin	31	-17.73	-146.65	2191.4	Nectarian
Lyman V	18.5	-62.83	152.38	823.8	Nectarian
Mariotte R	16.5	-30.57	-141.99	1802.1	Nectarian
Mariotte U	17	-28.49	-143.17	1865.3	Nectarian
McKellar	25.5	-16.04	-170.98	2242.8	Nectarian
McKellar T	22.5	-15.10	-173.00	2271.2	Nectarian
McKellar U	18.5	-14.05	-174.89	2303.0	Nectarian
Mendel	69	-49.06	-109.63	1241.6	Nectarian
Mendel V	33	-46.98	-116.63	1304.5	Nectarian
Milne M	27	-35.98	112.15	1638.1	Nectarian
Mohorovicic	25.5	-19.14	-164.92	2148.7	Nectarian
Moulton	24.5	-60.81	97.11	885.2	Nectarian
Moulton H	22	-61.03	100.25	878.5	Nectarian
Nassau	38	-25.23	177.13	1963.9	Nectarian
Neujmin	50.5	-27.00	125.00	1910.4	Nectarian
Neujmin P	19	-28.60	123.87	1861.7	Nectarian
Neumayer	38	-71.13	70.19	572.2	Nectarian
Neumayer A	15.5	-74.96	73.71	455.9	Nectarian
Newton	39	-76.47	-17.54	410.4	Nectarian
Numerov	56.5	-70.58	-162.90	588.8	Nectarian
Obruchev	35.5	-38.90	162.10	1549.5	Nectarian
Oppenheimer	104	-35.95	-166.03	1639.1	Nectarian
Oppenheimer F	17.5	-35.35	-160.63	1657.3	Nectarian
Oppenheimer H	16.5	-37.10	-163.42	1604.0	Nectarian
Orlov	40.5	-26.13	-175.37	1936.8	Nectarian
Pavlov	74	-28.80	142.50	1855.8	Nectarian
Petzval	45	-62.99	-110.81	818.9	Nectarian
Pikel'ner K	18	-51.06	125.00	1180.8	Nectarian
Pingre S	35	-60.53	-82.10	893.8	Nectarian
Pirquet	32.5	-20.23	139.36	2115.8	Nectarian
Pizzetti	22	-35.21	118.91	1661.5	Nectarian
Planck B	23	-55.54	136.89	1044.9	Nectarian
Plummer	36.5	-24.97	-154.85	1971.9	Nectarian
Plummer N	21	-27.62	-155.94	1891.7	Nectarian
Pogson	25	-42.45	110.66	1441.9	Nectarian
Poincare R	26	-60.20	155.00	903.6	Nectarian
Poincare Z	17.5	-54.06	163.98	1090.0	Nectarian
Prandtl	45.5	-59.77	140.97	916.7	Nectarian
Priestley	26	-56.77	107.93	1007.7	Nectarian
Priestley K	17.5	-58.94	109.86	941.9	Nectarian
Racah	31.5	-13.86	-179.99	2309.0	Nectarian
Ramsay	40.5	-40.16	144.72	1511.3	Nectarian

Riedel	23.5	-49.23	-140.06	1236.2	Nectarian
Roche	80	-42.51	136.16	1439.9	Nectarian
Scobee	20	-31.57	-149.61	1771.7	Nectarian
Sierpinski	34.5	-27.02	154.56	1909.7	Nectarian
Sikorsky	49	-65.78	103.50	734.3	Nectarian
Sikorsky-Rittenhouse	155	-69.22	112.06	630.2	Nectarian
Sniadecki	21.5	-22.76	-168.94	2039.1	Nectarian
Stark	24.5	-25.36	134.33	1960.0	Nectarian
Stromgren	30.5	-22.13	-132.38	2058.1	Nectarian
Subbotin	33.5	-29.37	135.27	1838.7	Nectarian
Tseraskiy	28	-48.84	142.09	1248.2	Nectarian
Tseraskiy K	22.5	-52.56	143.54	1135.3	Nectarian
Tseraskiy P	16.5	-51.08	139.00	1180.1	Nectarian
Van de Graaff	116.5	-27.40	172.20	1898.2	Nectarian
Vertregt L	19	-21.17	171.23	2087.2	Nectarian
von der Pahlen	28	-25.14	-132.77	1966.9	Nectarian
Waterman	38	-25.90	128.00	1943.7	Nectarian
Wiechert	20.5	-83.93	163.00	183.9	Nectarian
Wiechert P	18.5	-85.15	149.70	146.9	Nectarian
Wilsing W	18	-18.59	-159.54	2165.3	Nectarian
Wilsing Z	15	-20.89	-155.07	2095.5	Nectarian
Zeeman	95	-75.50	-135.99	439.7	Nectarian
Alder	38.5	-48.75	-178.32	1250.8	Lower Imbrian
Boguslawsky F	15	-75.27	52.67	446.5	Lower Imbrian
Bolyai D	17	-32.68	128.07	1738.2	Lower Imbrian
Borman	25	-39.44	-148.30	1533.3	Lower Imbrian
Crocco G	21	-47.61	152.11	1285.5	Lower Imbrian
Dawson	22.5	-67.29	-135.46	688.8	Lower Imbrian
Doppler	55	-13.01	-159.97	2334.5	Lower Imbrian
Fenyi (Fanyi)	19	-45.31	-104.74	1355.2	Lower Imbrian
Grissom M	19	-49.31	-148.42	1233.8	Lower Imbrian
Keeler	80	-9.97	161.52	2426.7	Lower Imbrian
Mendel J	29	-51.78	-107.07	1159.0	Lower Imbrian
Oppenheimer U	19	-34.86	-168.19	1671.9	Lower Imbrian
Pauli	42	-44.90	136.96	1367.6	Lower Imbrian
Pavlov G	21.5	-29.33	145.56	1839.8	Lower Imbrian
Racah N	17.5	-17.35	178.81	2203.1	Lower Imbrian
Rumford	30.5	-29.18	-169.90	1844.2	Lower Imbrian
Schrödinger	156	-74.64	132.16	465.7	Lower Imbrian
van der Waals W	23	-41.71	117.49	1464.5	Lower Imbrian
Walker W	22	-24.94	-164.09	1973.0	Lower Imbrian
Watson G	17	-63.49	-120.14	803.8	Lower Imbrian
Wexler	25.5	-68.72	89.79	645.3	Lower Imbrian
Zeeman Y	16.5	-72.67	-138.13	525.5	Lower Imbrian
Aitken	67.5	-16.61	172.87	2225.3	Upper Imbrian
Aitken Z	16.5	-15.21	173.06	2267.8	Upper Imbrian
Antoniadi	71.5	-69.53	-173.16	620.6	Upper Imbrian
Bjerknes	24	-38.57	113.33	1559.6	Upper Imbrian

Carver L	16.5	-45.88	128.39	1337.8	Upper Imbrian
Chant	16.5	-40.43	-109.22	1503.1	Upper Imbrian
De Forest	28.5	-77.15	-164.01	389.8	Upper Imbrian
De Roy X	15	-52.70	-101.30	1131.1	Upper Imbrian
de Vries	29.5	-20.08	-177.08	2120.1	Upper Imbrian
Doerfel	34	-69.29	-108.83	628.1	Upper Imbrian
Doerfel S	16	-70.03	-120.64	605.4	Upper Imbrian
Dryden	25.5	-33.55	-156.20	1711.9	Upper Imbrian
Drygalski P	15	-81.13	-99.38	268.9	Upper Imbrian
Fizeau	55.5	-58.35	-134.31	959.9	Upper Imbrian
Geiger	17	-14.61	158.24	2286.1	Upper Imbrian
Hale	41.5	-74.16	90.83	480.4	Upper Imbrian
Holetschek	19	-27.79	150.87	1886.4	Upper Imbrian
le Gentil	64	-74.05	-74.94	483.8	Upper Imbrian
le Gentil A	16.5	-74.67	-52.08	465.0	Upper Imbrian
Leibnitz S	14	-40.10	171.76	1513.2	Upper Imbrian
Lundmark G	17.5	-40.41	155.47	1503.9	Upper Imbrian
Lyman	42	-65.09	161.88	755.3	Upper Imbrian
Maksutov	41.5	-41.09	-168.66	1483.1	Upper Imbrian
Mariotte	32.5	-28.89	-139.10	1853.2	Upper Imbrian
Neumayer M	15.5	-71.54	79.91	559.8	Upper Imbrian
Oresme V	25.5	-40.95	165.08	1487.3	Upper Imbrian
Pikel'ner	23.5	-48.44	123.86	1260.2	Upper Imbrian
Plummer M	20.5	-26.80	-154.64	1916.5	Upper Imbrian
Schomberger	42.5	-76.70	24.90	403.3	Upper Imbrian
Stetson E	19	-39.91	-117.16	1518.8	Upper Imbrian
White	19.5	-45.17	-159.07	1359.5	Upper Imbrian
Zelinskiy	26.5	-28.96	166.62	1851.1	Upper Imbrian
Amici T	21.5	-10.11	-174.17	2422.6	Eratosthenian
Birkeland	41	-30.42	173.84	1806.8	Eratosthenian
Bok	22.5	-20.66	-171.73	2102.5	Eratosthenian
Chebyshev U	18	-33.89	-133.89	1701.4	Eratosthenian
Doppler B	18.5	-11.80	-159.40	2371.3	Eratosthenian
Finsen	36	-42.56	-177.99	1438.7	Eratosthenian
Grotrian	18.5	-66.19	127.65	722.1	Eratosthenian
Hausen	83.5	-65.46	-88.17	744.1	Eratosthenian
Holetschek Z	15	-26.49	150.85	1926.0	Eratosthenian
Jules Verne G	21	-35.36	149.73	1656.9	Eratosthenian
Keeler S	15	-11.31	157.73	2386.1	Eratosthenian
Lovell	17	-37.16	-142.53	1602.2	Eratosthenian
Oppenheimer V	16	-32.56	-172.97	1741.8	Eratosthenian
Plante	18.5	-10.32	163.01	2416.2	Eratosthenian
Pogson F	17.5	-42.31	115.03	1446.0	Eratosthenian
von der Pahlen H	17.5	-27.46	-127.89	1896.4	Eratosthenian
Wiechert J	17	-85.25	-178.83	144.1	Eratosthenian
Wilsing C	16.5	-18.85	-152.91	2157.4	Eratosthenian
Crookes	24.5	-10.648	-165.204	2406.2	Copernican
Das	19	-26.84	-137.01	1915.3	Copernican

O’Day	35.5	-30.63	157.07	1800.4	Copernican
Schomberger A	15.5	-78.47	23.45	349.7	Copernican

TABLE A9.3 Locations and ages of complex craters within SPA, whose central peaks may be used to determine if the SPA melt sheet differentiated. The depth of origin values for the crater central peaks (CP) were extrapolated from Fig. 24 in Cintala and Grieve (1998a). An asterisk indicates craters with probable central peaks that are barely visible in high-resolution (~100 m/pix) Clementine data.

ID #	Name	Latitude	Longitude	Diameter (km)	Estimated Age (Wilhelms and Byrne, 2009)	CP min. depth of origin (km)
1	O'Day	-30.626	157.073	71	Copernican (Eratosthenian?)	11.385
2	Birkeland	-30.416	173.836	82	Eratosthenian	13.342
3	Finsen	-42.555	-177.99	72	Eratosthenian	11.561
4	Hausen	-65.461	-88.165	167	Eratosthenian	29.207
5	Antoniadi	-69.534	-173.155	143	Upper Imbrian	24.618
6	De Forest	-77.146	-164.011	57	Upper Imbrian	8.938
7	Dryden	-33.546	-156.199	51	Upper Imbrian	7.908
8	Hale	-74.159	90.829	83	Upper Imbrian	13.521
9	Lyman	-65.093	161.88	84	Upper Imbrian	13.701
10	Maksutov*	-41.089	-168.664	83	Upper Imbrian	13.521
11	Mariotte	-28.886	-139.1	65	Upper Imbrian	10.330
12	Oresme V	-40.951	165.081	51	Upper Imbrian	7.908
13	White	-45.166	-159.071	39	Upper Imbrian	5.885
14	Doerfel S	-70.034	-120.64	32	Upper Imbrian (Lower Imbrian?)	4.732
15	Fizeau	-58.345	-134.314	111	Upper Imbrian (Lower Imbrian?)	18.624
16	Plummer M*	-26.798	-154.643	41	Upper Imbrian (Lower Imbrian?)	6.218
17	Alder	-48.751	-178.315	77	Lower Imbrian	12.449
18	Grissom M	-49.311	-148.422	38	Lower Imbrian	5.719
19	Oppenheimer U	-34.864	-168.186	38	Lower Imbrian	5.719
20	Pauli	-44.9	136.964	84	Lower Imbrian	13.701
21	Rumford	-29.182	-169.898	61	Lower Imbrian	9.632
22	Wexler	-68.719	89.789	51	Lower Imbrian	7.908
23	Carver	-43.49	127.119	59	Nectarian (Lower Imbrian?)	9.284
24	Langmuir	-36.197	-128.726	91	Nectarian (Lower Imbrian?)	14.964
25	Leavitt	-45.196	-140.013	66	Nectarian (possibly younger)	10.505
26	Leavitt Z	-42.964	-139.619	65	Nectarian (dual impact with Leavitt?)	10.330
27	Amundsen	-84.327	83.935	101	Nectarian	16.785
28	Barringer	-28.641	-150.44	68	Nectarian	10.856
29	Bhabha	-55.732	-165.291	64	Nectarian	10.155
30	Bose	-54.166	-169.648	91	Nectarian	14.964
31	Boyle	-53.494	177.566	57	Nectarian	8.938
32	Buffon	-40.995	-133.576	106	Nectarian	17.702
33	Demonax	-78.293	59.551	128	Nectarian	21.790
34	Eijkman	-63.441	-142.839	54	Nectarian	8.422
35	Hopmann*	-51.108	158.825	88	Nectarian	14.421
36	Numerov	-70.584	-162.9	113	Nectarian	18.994
37	Orlov	-26.128	-175.373	81	Nectarian	13.163
38	Prandtl*	-59.769	140.971	91	Nectarian	14.964
39	Sniadecki	-22.756	-168.94	43	Nectarian	6.553
40	Zeeman	-75.498	-135.99	190	Nectarian	33.667
41	Drygalski	-79.699	-85.729	149	Pre-Nectarian	25.759
42	Von Karman*	-44.8	175.9	180	Pre-Nectarian	31.721
43	Davisson	-38.147	-175.077	87	~~~~~~~	14.241

44	Oresme Q	-44.553	166.972	23	~~~~~~~~	3.289
45	Stoney	-55.812	-156.506	45	~~~~~~~~	6.889

TABLE A9.4 Complex craters within SPA, whose central peaks may be used to determine if the SPA melt sheet differentiated that fall within various estimates for the transient crater (TC) diameter as well as the 500 km and 1000 km traverse limits.

ID #	Name	Lower TC estimate calculated from Spudis, 1993 (1160km)	Upper TC estimate calculated from Spudis, 1993 (1470km)	Petro and Pieters (2002) TC estimate	TC defined by LROC Tier 2 site & SPA center	1000km traverse limit	500km traverse limit
1	O'Day						
2	Birkeland						
3	Finsen	X	X	X			
4	Hausen					X	
5	Antoniadi	X	X	X		X	
6	De Forest		X			X	X
7	Dryden						
8	Hale					X	X
9	Lyman	X	X	X		X	
10	Maksutov*	X	X	(partial)			
11	Mariotte						
12	Oresme V	X	X	X			
13	White	X	X				
14	Doerfel S					X	
15	Fizeau		(partial)			X	
16	Plummer M*						
17	Alder	X	X	X			
18	Grissom M		X				
19	Oppenheimer U		X				
20	Pauli						
21	Rumford						
22	Wexler					X	
23	Carver						
24	Langmuir						
25	Leavitt						
26	Leavitt Z						
27	Amundsen					X	X
28	Barringer						
29	Bhabha	X	X	X			
30	Bose	X	X	X	X		
31	Boyle	X	X	X	X		
32	Buffon						
33	Demonax					X	X
34	Eijkman		X			X	
35	Hopmann*	X	X	X			
36	Numerov	X	X	X		X	
37	Orlov						
38	Prandtl*		X	X		X	
39	Sniadecki						
40	Zeeman		(partial)			X	X
41	Drygalski					X	X
42	Von Karman*	X	X	X			
43	Davisson	X	X	(partial)			
44	Oresme Q	X	X	X			

45	Stoney	X	X	X			

TABLE A9.5 Smaller basins (and craters within those basins) in SPA where the size limits of melt sheet differentiation can be tested. Basins are listed in bold while their interior craters are listed in plain text. Melt thickness values are extrapolated from Fig. 3 in Warren *et al.* (1996). Minimum depth of origin values for central peaks (CP) are extrapolated from Fig. 24 in Cintala and Grieve (1998a). Depth of crater excavations values are extrapolated from Fig. 22 in Cintala and Grieve (1998b).

Name	Estimated Age (Wilhelms and Byrne, 2009)	Diam. (km)	Lat	Long	Melt Thickness (km)	Central Peak Depth of Origin (km)	Transient Crater Diameter (km)	Depth of Excavation (km) into Pre-existing Melt Sheet	1000km traverse limit
Antoniadi	Upper Imbrian	143	-69.534	-173.155	1.18	24.62	101.38		X
un-named crater	~~~~~	12.2	-70.422	-172.563		N/A	12.59	1.79	X
Apollo	Pre-Nectarian	537	-36.296	-152.001	8.88		311.13		
Borman	Lower Imbrian	50	-39.436	-148.299			41.61	6.08	
Chaffee	Nectarian	49	-39.479	-154.624			40.90	5.97	
Dryden	Upper Imbrian	51	-33.546	-156.199		7.91	42.32	6.18	
Buffon	Nectarian	106	-40.995	-133.576	0.74		78.66		
Buffon D	~~~~~	20	-40.594	-132.198			19.14	2.75	
Leibnitz	Pre-Nectarian	245	-38.681	178.968	2.68		160.00		
Leibnitz R	~~~~~	19	-39.761	175.997			18.33	2.63	
Leibnitz X	~~~~~	19	-36.945	177.069			18.33	2.63	
Lippmann	Pre-Nectarian	160	-55.801	-114.565	1.40		111.51		(partial)
Lippmann P	Nectarian	29	-56.302	-115.242			26.23	3.79	
Oppenheimer	Nectarian	208	-35.946	-166.033	2.08		139.27		
Oppenheimer U	Lower Imbrian	38	-34.864	-168.186		5.72	32.98	4.79	
Planck	Pre-Nectarian	314	-58.058	135.87	3.91		197.44		(partial)
Planck Z	Pre-Nectarian	72	-55.894	134.745			56.68	8.35	
Prandtl	Nectarian	91	-59.769	140.971		14.96	69.12	10.24	X

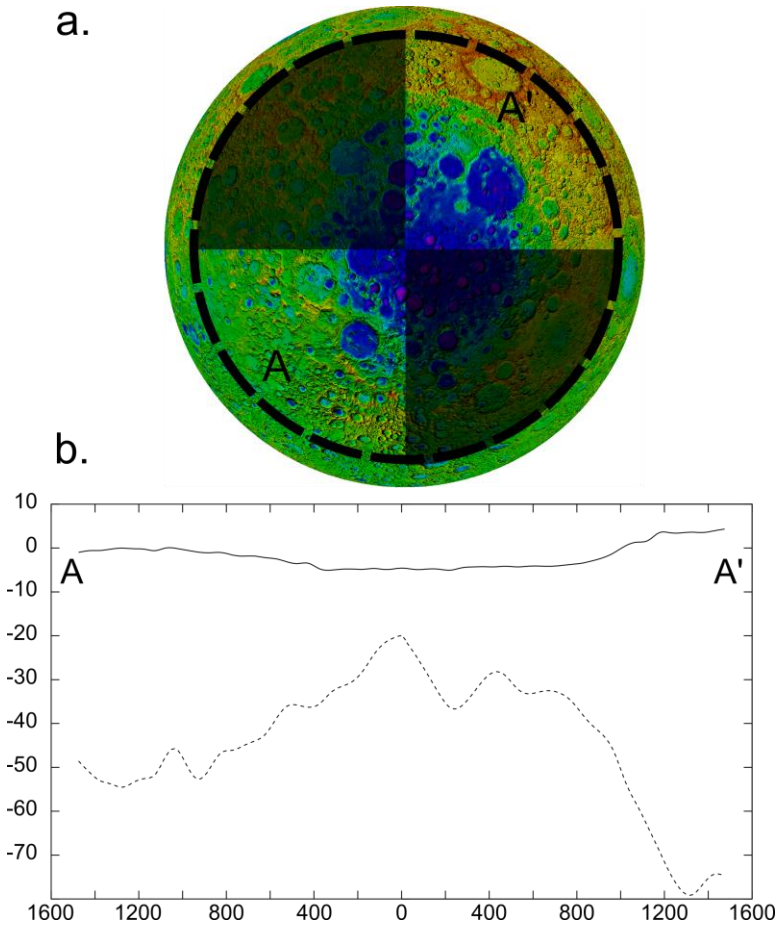


Figure A9.1 Crustal thickness profile of SPA (b), averaged over the northeast and southwest quarters of the basin (a). Solid line indicates topography; dashed line indicates moho depth. The Moho depth model used in this study [*Wieczorek et al.*, 2006] attempts to account for suspected vertical compositional stratification in the lunar crust, by assuming a dual-layered crust. The model calculates the depth of the interface between the crust and mantle (the Moho) from the global average height for the lunar crust. This value was then combined with topographic data obtained by Kaguya in order to obtain a map of crustal thickness. This data was projected using the USGS program ISIS (Version 3.1.20), and then imported into ArcGIS (Version 9.3) for further analysis. Using this data, profiles were obtained of both the Moho depth and topography. These were taken at 5° intervals, from the approximate center of the basin (-56° latitude; 180° longitude), to a distance of 1500 km. The resulting values were then exported to a spreadsheet, where they could first be combined into a single list of x (distance from the center of the basin in km) and y (elevation or Moho depth in km) values. These values were then sorted by x values, and averaged at 50 km intervals to generate a radially averaged profile generated (Fig. 8.18). In order to gain a better appreciation of the variation in crustal thickness at different points around the basin a second set of averaged profiles were generated for specific regions of the basin. The largest variations in topography and crustal thickness are observed in the north east quadrant of the basin which includes the large (538 km) multi-ring impact basin Apollo, and borders the farside highlands where the highest topographic values on the Moon can be found. The south west quadrant of the basin, by comparison, has less exaggerated variations in topography and crustal thickness on average. For this reason, these two areas were chosen to produce complimentary radially averaged profiles of the basin (Figure 70). The topography and Moho depth values were processed in the same way as is described above, however this time including only the values for the quadrant in question.

ARCGIS DATABASE

http://www.lpi.usra.edu/CLSE/Lunar-Landing-Site-Study/

ArcGIS database compiled by members of the LPI-JSC Lunar Exploration Summer Intern Program, edited by Daniel D. Durda.