Table S1: *Input parameter variation*

Varied parameter	**Value**	**Core starts** Myr	**Core ends** Myr	**Duration** Myr	**Esquel depth** km	**Imilac depth** km
r_{p}	600 km	1022	1201	179	31	22
r_{p}	150 km	61	86	25	52	51
r_{c}	200 km	95	157	62	27	25
r_{c}	50 km	199	240	41	93	69
d_{reg}	20 km	245	326	81	44	30
d_{reg}	0 km	159	230	70	64	57
k_{m}	4 W m^{-1} K^{-1}	132	185	53	77	67
k_{m}	1.5 W m^{-1} K^{-1}	330	400	70	42	36
c_{m}	2000 J kg^{-1} K^{-1}	293	383	90	37	32
c_{m}	600 J kg^{-1} K^{-1}	148	215	67	71	65
ρ_{m}	3560 kg m−3	177	249	71	62	55
ρ_{m}	2500 kg m−3	149	216	67	71	64
c_{c}	850 J kg^{-1} K^{-1}	172	242	71	64	57
c_{c}	780 J kg^{-1} K^{-1}	166	237	71	65	58
ρ_{c}	7800 kg m−3	172	242	71	64	57
ρ_{c}	7011 kg m−3	164	229	65	65	58
T_{init}	1820 K	213	283	70	57	51
T_{init}	1450 K	138	210	72	70	62
T_{surf}	300 K	176	250	74	58	52
T_{surf}	150 K	164	228	65	75	67
l_{c}	2.56×10^5 J K^{-1} kg^{-1}	172	239	67	64	57
T_{L}	1213 K	168	238	70	64	57

Note: Model results with maximised and minimised constant values for parameters. References for parameter choices given in Table X in the main text.

Table S2: *Sensitivity test of constant model*

Varied parameter	**Value**	**Core starts** Myr	**Core ends** Myr	**Duration** Myr	**Esquel depth** km	**Imilac depth** km
r_p +10%	275 km	210	296	86	64	56
r_p −10%	225 km	146	204	58	66	58
r_c +10%	138 km	167	241	74	58	53
r_c −10%	113 km	185	252	67	70	61
d_reg +1 km[a]	9 km	172	242	71	64	57
d_reg −1 km[a]	7 km	165	236	70	64	57
k_m +10%	3.3 W m^{-1} K^{-1}	157	221	64	68	60
k_m −10%	2.7 W m^{-1} K^{-1}	189	268	78	61	54
C_m +10%[b]	901 J kg^{-1} K^{-1}	180	252	72	61	54
C_m −10%[b]	737 J kg^{-1} K^{-1}	163	232	69	67	60
ρ_m +10%[b]	3675 kg m^{-3}	180	252	72	61	54
ρ_m −10%[b]	3007 kg m^{-3}	163	232	69	67	60
C_c +10%[c]	935 J kg^{-1} K^{-1}	179	248	70	63	57
C_c −10%[c]	765 J kg^{-1} K^{-1}	164	236	71	65	58
ρ_c +10%[c]	8580 kg m^{-3}	179	248	70	63	57
ρ_c −10%[c]	7020 kg m^{-3}	164	236	71	65	58
T_init +10%	1760 K	202	272	70	59	53
T_init −10%	1440 K	135	208	72	70	63
T_surf +10%	275 K	174	246	72	61	55
T_surf −10%	225 K	169	238	69	67	60
l_c +10%	2.97×10^5 J K^{-1} kg^{-1}	172	249	77	64	57
l_c −10%	2.43×10^5 J K^{-1} kg^{-1}	172	236	64	64	57
T_L +10%	1320 K	137	202	65	64	57
T_L −10%	1080 K	209	288	79	64	57

Note: Model results with parameters varied to ±10 % of the default value. References for parameter choices given in Table X in the main text. [a]Regolith thickness increased or decreased by 1 km as 10 % (0.8 km) is smaller than δr. [b]Increasing or decreasing C_m or ρ_m by 10 % in effect results in a change in ρc by 10 %. [c] As for [b] with core properties.