

Supplementary Information 3

Tables S3.1, S3.2

Stochastic modelling of deep magmatic controls on porphyry copper deposit endowment

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Table S3.1: Description of all parameters used in simulations for melt injection rate of 5 mm/a through a disk of 7500 m radius (equivalent to 0.0009 km³/a) (Supplementary Dataset 2).

A	Time = time since first injection starts (random between 0 and 5 Ma)
B	H ₂ O parent = wt.% content of H ₂ O in parent magma (random between 2 and 4 wt.%)
C	H ₂ O assimilant = wt.% content of H ₂ O in assimilant (random between 0.5 and 1 wt.%)
D	P (kbars) = pressure at which magma accumulation occurs (random between 1.5 and 9 kbars)
E	a Pressure = a parameter of the fifth order equation ($y=ax^5+bx^4+cx^3+dx^2+ex+f$) describing the total melt fraction as a function of P of saturation
F	b Pressure = b parameter of the second order equation ($y=ax^2+bx+c$) describing the total melt fraction as a function of P of saturation
G	c Pressure = c parameter of the second order equation ($y=ax^2+bx+c$) describing the total melt fraction as a function of P of saturation
H	P saturation = pressure at which magma is H ₂ O-saturated as a function of the second order polynomial equation P saturation = [a Pressure]*[H ₂ O in melt] ² + [b Pressure]*[H ₂ O in melt] + [c Pressure]
I	Delta P = P of magma formation minus pressure of H ₂ O saturation for that magma
J	H ₂ O in melt = wt.% content of H ₂ O in the melt
K	a crustal = a parameter of the second order equation ($y=ax^2+bx+c$) describing the dependence on time of crustal melt fraction produced at a random depth from parameterization of Annen et al. (2006) ¹ .
L	b crustal = b parameter of the second order equation ($y=ax^2+bx+c$) describing the dependence on time of crustal melt fraction produced at a certain depth from parameterization of Annen et al. (2006) ¹ .
M	c crustal = c parameter of the second order equation ($y=ax^2+bx+c$) describing the dependence on time of crustal melt fraction produced at a certain depth from parameterization of Annen et al. (2006) ¹ .
N	Crustal melt fraction Annen = crustal melt fraction parameterized from Annen et al. (2006) ¹ model.
O	Crustal melt fraction Annen logical test = logical test for crustal melt fraction calculated from Annen et al. (2006) ¹ model: if the parameterized value is <0 → 0, otherwise is the parameterized value.
P	Crustal melt fraction Annen logical test 2 = logical test 2 for crustal melt fraction calculated from Annen et al. (2006) ¹ model to avoid negative values below 1 Ma.
Q	Crustal melt fraction Annen logical test 3 = logical test 3 for crustal melt fraction calculated from Annen et al. (2006) ¹ model to avoid negative values below 0.25 Ma.
R	Magma rate = fixed magma rate at 5 mm/a (the magma rate used by Annen et al. (2006) ¹ for the parameterization of the crustal and residual melt fractions produced at different depths).
S	Magma rate time integrated = magma rate integrated over the random time of the same row.
T	Disk radius = fixed radius of 7500 m for a circular shape section through which the above flux rate is integrated. This radius is typical of crustal batholiths (Annen, 2009) ² . The integrated magma volume corresponds to 0.0009 km ³ /a, which is a typical average long-term flux for arc magmatism.
U	Volume of crustal melt integrated over time = volume of crustal melt produced by basaltic melt passing through a circle with radius equal to 7500 m at the depth value (pressure) for the same row.
V	Tons of crustal melt time integrated = the above volume multiplied by an average andesitic melt density of 2.6 gm/cm ³ . (Although density changes with melt composition we have assumed for simplicity an average andesitic melt density for melts ranging from basaltic to rhyolitic).
W	Crustal melt% Annen = % of crustal melt fraction from parameterization of Annen et al. (2006) ¹
X	a residual = a parameter of the second order equation ($y=ax^2+bx+c$) describing the dependence on time of residual melt fraction produced at a random depth from parameterization of Annen et al. (2006) ¹ .

Y	b residual = b parameter of the second order equation ($y=ax^2+bx+c$) describing the dependence on time of residual melt fraction produced at a random depth from parameterization of Annen et al. (2006) ¹ .
Z	c residual = c parameter of the second order equation ($y=ax^2+bx+c$) describing the dependence on time of residual melt fraction produced at a random depth from parameterization of Annen et al. (2006) ¹ .
AA	residual Melt fraction Annen = residual melt fraction parameterized from Annen et al. (2006) ¹ model
AB	residual Melt fraction Annen logical test = logical test for residual melt fraction parameterized from Annen et al. (2006) ¹ model to avoid negative values below 0.75 Ma.
AC	residual Melt fraction Annen logical test2 = logical test 2 for residual melt fraction parameterized from Annen et al. (2006) ¹ model to avoid negative values below 0.5 Ma.
AD	Magma rate (tons/Ma/km arc) = fixed magma rate at 5 mm/a (the magma rate used by Annen et al., 2006 ¹ , for the parameterization of the crustal and residual melt fractions produced at different depths).
AE	V residual melt fraction time integrated = volume of residual melt produced by basaltic melt passing through a circle with radius equal to 7500 m at the depth value (pressure) for the same row.
AF	Magma rate time integrated (tons/Ma/km arc) = magma rate integrated over the random time of the same row
AG	tons residual melt fraction time integrated = the above volume multiplied by an average andesitic melt density of 2.6 gm/cm ³ . (Although density changes with melt composition we have assumed for simplicity an average andesitic melt density for melts ranging from basaltic to rhyolitic).
AH	SiO ₂ total = SiO ₂ relationship to melt fraction (F) based on the empirical equation [$SiO_2 = 35.436F^2 - 68.859F + 82.439$]
AI	all melt % = sum of residual and crustal melts percentages
AJ	residual Melt% Annen = % of residual melt parameterized from Annen et al. (2006) ¹
AK	H ₂ O wt% in residual melt = H ₂ O wt.% concentration in the residual melt from random initial concentration (H ₂ O _{in} =2-4 wt.%) assuming a completely incompatible behavior for H ₂ O during magma fractionation ($=100 \cdot H_{2O_{in}} \cdot F^{-1}$, where F is the residual melt fraction)
AL	log test H ₂ O wt% in residual melt = H ₂ O wt.% in residual melt assuming that the minimum residual melt remaining after fractionation is 10%
AM	a H ₂ O = a parameter of the second order equation ($y=ax^2+bx+c$) describing the dependence on pressure of the H ₂ O content of a silicate melt of a random composition (=melt fraction) parameterized from the P-X dependency of H ₂ O solubility of VolataileCalc (Newman and Lowenstern, 2002) ³
AN	b H ₂ O = b parameter of the second order equation ($y=ax^2+bx+c$) describing the dependence on pressure of the H ₂ O content of a silicate melt of a random composition (=melt fraction) parameterized from the P-X dependency of H ₂ O solubility of VolataileCalc (Newman and Lowenstern, 2002) ³
AO	c H ₂ O = c parameter of the second order equation ($y=ax^2+bx+c$) describing the dependence on pressure of the H ₂ O content of a silicate melt of a random composition (=melt fraction) parameterized from the P-X dependency of H ₂ O solubility of VolataileCalc (Newman and Lowenstern, 2002) ³
AP	residual melt Annen logical test for H ₂ O solubility (F=100-10%) = logical test for residual melt fraction parameterized from Annen et al. (2006) ¹ model to avoid residual melt fractions <10%
AQ	H ₂ O solubility in melt (F =100-10 %) = H ₂ O solubility in the residual melt at the random pressure and residual melt fraction (logical test corrected) of the same row
AR	H ₂ O wt% in residual melt logical test 100-10% F range = effective H ₂ O wt% content of the residual melt corrected for oversaturation (i.e., if the theoretical amount of H ₂ O in the residual melt is higher than the maximum permissible H ₂ O content in that melt composition and at that specific P, then the latter value is taken as the effective H ₂ O content of that simulation and the remainder H ₂ O is in excess and must have been exsolved).

AS	Excess residual H ₂ O = H ₂ O in excess according to the above explanation
AT	H ₂ O wt% in crust = wt.% content of H ₂ O in assimilant (random between 0.2 and 1 wt.%)
AU	H ₂ O wt% in partial melt = H ₂ O wt.% concentration in the crustal melt from random initial concentration (H ₂ O _{in} =0.2-1 wt.%) assuming a completely incompatible behavior for H ₂ O during partial melting ($=100 \cdot H_{2O_{in}} \cdot F^{-1}$, where F is the crustal melt fraction)
AV	H ₂ O solubility (wt.%) with Annen crustal melt % = H ₂ O solubility in the crustal melt at the random pressure and crustal melt fraction (logical test corrected) of the same raw
AW	H ₂ O solubility (wt.%) with Annen crustal melt % logical test = effective H ₂ O wt% content of the crustal melt corrected for oversaturation (i.e., if the theoretical amount of H ₂ O in the crustal melt is higher than the maximum permissible H ₂ O content in that melt composition and at that specific P, then the latter value is taken as the effective H ₂ O content of that simulation and the remainder H ₂ O is in excess and must have been exsolved).
AX	Excess H ₂ O partial melt = H ₂ O in excess according to the above explanation
AY	H ₂ O residual (tons) = tons of H ₂ O dissolved in residual melt
AZ	Log test excess residual H ₂ O tons = tons of excess H ₂ O (logical test to avoid negative values, if negative means that excess H ₂ O is 0)
BA	Excess H ₂ O residual (tons) = tons of excess H ₂ O from residual melt (H ₂ O that has been liberated by the residual melt at specific P, time and composition values occurring in the same raw)
BB	H ₂ O crustal (tons) = tons of H ₂ O dissolved in crustal melt
BC	Excess H ₂ O crustal (tons) = tons of H ₂ O liberated by the crustal melt at specific P, time and composition values occurring in the same raw
BD	log test excess crustal H ₂ O tons = tons of excess H ₂ O (logical test to avoid negative values, if negative means that excess H ₂ O is 0)
BE	H ₂ O total in melt (tons) = sum of tons of H ₂ O dissolved in the residual and crustal melt
BF	Excess H ₂ O total in melt (tons) = sum of the tons of excess H ₂ O liberated by both the crustal and residual melt
BG	Excess total H ₂ O NEW log test = sum of the tons of excess H ₂ O liberated by both the crustal and residual melt avoiding negative values (logical tests for excess H ₂ O in crustal and residual melts)
BH	M melt - excess H ₂ O tons = mass in tons of the total melt (residual + crustal) minus the sum of excess H ₂ O (residual + crustal)
BI	M total melt ton = total tons of residual + crustal melts
BJ	% H ₂ O excess = wt% of total excess H ₂ O
BK	M H ₂ O excess ton = BV
BL	Kd = Cu KD between melt and fluid random values between 2 and 100
BM	Cu total melt ppm = CZ
BN	Cu tot ton = tons of Cu in melt
BO	Cu ppm res melt = ppm of Cu in H ₂ O-saturated melt (where part of the Cu has been lost to the exsolved H ₂ O)
BP	Cu ppm fluid = ppm Cu in the exsolved fluid of the oversaturated melt
BQ	Cu tot res melt Mt = Mt of Cu in the "residual" oversaturated melt (this is identical to the total Cu amount of melt only in undersaturated melts)
BR	Cu tot in excess fluid Mt = Mt of Cu that are lost by the oversaturated melt to the exsolved fluid
BS	50% Cu tot in excess fluid Mt = 50% of Mt of Cu that are lost by the oversaturated melt to the exsolved fluid
BT	Cu tot Mt = Mt of Cu in melt
BU	M res hydrous melt ton = tons of residual hydrous melt (this is equivalent to the tons of undersaturated melt)
BV	exsolvable H ₂ O tons = tons of H ₂ O dissolved in residual hydrous melt
BW	Kd = BL
BX	Kd = Cu KD between melt and fluid random values between 2 and 100
BY	Cu total melt ppm = ppm of Cu in total melt
BZ	Cu tot ton = tons of Cu in hydrous under and oversaturated melt
CA	Cu res melt = ppm of Cu in the hydrous melt after it exsolved H ₂ O at the saturation P

CB	Cu fluid = ppm of Cu in the fluid exsolved at saturation depth
CC	Cu tot res melt Mt = Mt of Cu in the hydrous melt after H ₂ O exsolution
CD	Cu tot in exsolvable fluid Mt = Mt of Cu in exsolvable fluid at saturation depth
CE	Cu tot Mt = Mt of Cu total in hydrous melt (melt + exsolved fluid)
CF	50% Cu fluid Mt = 50% of T
CG	Total melt (tons) = tons of total melt (residual + crustal)
CH	a Cu = a parameter of the second order equation ($y=ax^2+bx+c$, where y = Cu (ppm) and x = SiO ₂ (wt.%)) describing the Cu concentration variability at any SiO ₂ value parameterized from the median values of Cu and SiO ₂ from continental arc rocks (from Chiaradia, 2014) ⁴ .
CI	b Cu = b parameter of the second order equation ($y=ax^2+bx+c$, where y = Cu (ppm) and x = SiO ₂ (wt.%)) describing the Cu concentration variability at any SiO ₂ value parameterized from the median values of Cu and SiO ₂ from continental arc rocks (from Chiaradia, 2014) ⁴ .
CJ	c Cu = c parameter of the second order equation ($y=ax^2+bx+c$, where y = Cu (ppm) and x = SiO ₂ (wt.%)) describing the Cu concentration variability at any SiO ₂ value parameterized from the median values of Cu and SiO ₂ from continental arc rocks (from Chiaradia, 2014) ⁴ .
CK	Cu ppm = Cu ppm of melt
CL	Cu ppm melt = CZ
CM	Molar V H ₂ O = molar volume of H ₂ O at the random pressure of the corresponding row. This has been calculated
CN	H ₂ O% in hydrous melt= wt% of H ₂ O in over or undersaturated hydrous melt
CO	Moles of excess H ₂ O = moles of H ₂ O exsolved from oversaturated melts
CP	Volume cc excess H ₂ O = cubic centimeters of H ₂ O exsolved from oversaturated melts
CQ	Volume km ³ total melt = volume (km ³) of total melt
CR	Volume km ³ excess H ₂ O = volume (km ³) of H ₂ O exsolved from oversaturated melts
CS	Volume km ³ hydrous melt = volume (km ³) of hydrous melt
CT	Volume % excess H ₂ O = volume % of H ₂ O exsolved from oversaturated melts
CU	Ore Duration avg (Ma) = duration of the ore event based on the transfer of the average values of the magma volumes produced at the average transfer rate
CV	Cu flux exsolvable tons/a = Total of exsolvable Cu in undersaturated melts divided by the average ore duration
CW	50% Cu flux = same as above but divided by 2
CX	aa- = minimum value of the "aa parameter" describing the second order polynomial pressure dependency of the "aa parameter" (=a eq below; a eq = aa*pressure ² + ab*pressure + ac) in the third order polynomial equation describing the variation of Sr/Y values with melt fraction
CY	aa+ = maximum value of the "aa parameter" describing the second order polynomial pressure dependency of the "a parameter" (=a eq below; a eq = aa*pressure ² + ab*pressure + ac) in the third order polynomial equation describing the variation of Sr/Y values with melt fraction
CZ	aa = random value of the "aa parameter" between minimum and maximum values above describing the pressure dependency of the "a parameter" (=a eq below; a eq = aa*pressure ² + ab*pressure + ac) in the third order polynomial equation describing the variation of Sr/Y values with melt fraction
DA	ab- = minimum value of the "ab parameter" describing the second order polynomial pressure dependency of the "a parameter" (=ab eq below; a eq = aa*pressure ² + ab*pressure + ac) in the third order polynomial equation describing the variation of Sr/Y values with melt fraction
DB	ab+ = maximum value of the "ab parameter" describing the second order polynomial pressure dependency of the "a parameter" (=a eq below; a eq = aa*pressure ² + ab*pressure + ac) in the third order polynomial equation describing the variation of Sr/Y values with melt fraction
DC	ab = random value of the "ab parameter" between minimum and maximum values above describing the pressure dependency of the "a parameter" (=a eq below; a eq = aa*pressure ² + ab*pressure + ac) in the third order polynomial equation describing the variation of Sr/Y values with melt fraction

DD	ac- = minimum value of the “ac parameter” describing the second order polynomial pressure dependency of the “a parameter” (=a eq below; a eq = aa*pressure ² + ab*pressure + ac) in the third order polynomial equation describing the variation of Sr/Y values with melt fraction
DE	ac+ = maximum value of the “ac parameter” describing the second order polynomial pressure dependency of the “a parameter” (=a eq below; a eq = aa*pressure ² + ab*pressure + ac) in the third order polynomial equation describing the variation of Sr/Y values with melt fraction
DF	ac = random value of the “ac parameter” between minimum and maximum values above describing the pressure dependency of the “a parameter” (=a eq below; a eq = aa*pressure ² + ab*pressure + ac) in the third order polynomial equation describing the variation of Sr/Y values with melt fraction
DG	a eq = aa*pressure ² + ab*pressure + ac; a eq is the pressure-dependent variation of the a parameter in the third order polynomial equation (Sr/Y = [a eq]*[melt fraction] ³ + [b eq]*[melt fraction] ² + [c eq]*[melt fraction] + [d eq]) describing the variation of Sr/Y values with melt fraction
DH	ba- = minimum value of the “ba parameter” describing the second order polynomial pressure dependency of the “b parameter” (=b eq below; b eq = ba*pressure ² + bb*pressure + bc) in the third order polynomial equation describing the variation of Sr/Y values with melt fraction
DI	ba+ = maximum value of the “ba parameter” describing the second order polynomial pressure dependency of the “b parameter” (=b eq below; b eq = ba*pressure ² + bb*pressure + bc) in the third order polynomial equation describing the variation of Sr/Y values with melt fraction
DJ	ba = random value of the “ba parameter” between minimum and maximum values above describing the pressure dependency of the “b parameter” (=b eq below; b eq = ba*pressure ² + bb*pressure + bc) in the third order polynomial equation describing the variation of Sr/Y values with melt fraction
DK	bb- = minimum value of the “bb parameter” describing the second order polynomial pressure dependency of the “b parameter” (=b eq below; b eq = ba*pressure ² + bb*pressure + bc) in the third order polynomial equation describing the variation of Sr/Y values with melt fraction
DL	bb+ = maximum value of the “bb parameter” describing the second order polynomial pressure dependency of the “b parameter” (=c eq below; b eq = aa*pressure ² + ab*pressure + ac) in the third order polynomial equation describing the variation of Sr/Y values with melt fraction
DM	bb = random value of the “bb parameter” between minimum and maximum values above describing the pressure dependency of the “b parameter” (=b eq below; b eq = aa*pressure ² + ab*pressure + ac) in the third order polynomial equation describing the variation of Sr/Y values with melt fraction
DN	bc- = minimum value of the “bc parameter” describing the second order polynomial pressure dependency of the “b parameter” (=b eq below; b eq = aa*pressure ² + ab*pressure + ac) in the third order polynomial equation describing the variation of Sr/Y values with melt fraction
DO	bc+ = maximum value of the “bc parameter” describing the second order polynomial pressure dependency of the “b parameter” (=b eq below; b eq = aa*pressure ² + ab*pressure + ac) in the third order polynomial equation describing the variation of Sr/Y values with melt fraction
DP	bc = random value of the “bc parameter” between minimum and maximum values above describing the pressure dependency of the “b parameter” (=b eq below; b eq = aa*pressure ² + ab*pressure + ac) in the third order polynomial equation describing the variation of Sr/Y values with melt fraction
DQ	b eq = ba*pressure ² + bb*pressure + bc; b eq is the pressure-dependent variation of the b parameter in the third order polynomial equation (Sr/Y = [a eq]*[melt fraction] ³ + [b eq]*[melt fraction] ² + [c eq]*[melt fraction] + [d eq]) describing the variation of Sr/Y values with melt fraction
DR	ca- = minimum value of the “ca parameter” describing the second order polynomial pressure dependency of the “c parameter” (=c eq below; c eq = ca*pressure ² + cb*pressure + cc) in the third order polynomial equation describing the variation of

	Sr/Y values with melt fraction
DS	ca+ = maximum value of the “ca parameter” describing the second order polynomial pressure dependency of the “c parameter” (=c eq below; c eq = ca*pressure ² + cb*pressure + cc) in the third order polynomial equation describing the variation of Sr/Y values with melt fraction
DT	ca = random value of the “ca parameter” between minimum and maximum values above describing the pressure dependency of the “c parameter” (=c eq below; c eq = ca*pressure ² + cb*pressure + cc) in the third order polynomial equation describing the variation of Sr/Y values with melt fraction
DU	cb- = minimum value of the “cb parameter” describing the second order polynomial pressure dependency of the “c parameter” (=c eq below; c eq = ca*pressure ² + cb*pressure + cc) in the third order polynomial equation describing the variation of Sr/Y values with melt fraction
DV	cb+ = maximum value of the “cb parameter” describing the second order polynomial pressure dependency of the “c parameter” (=c eq below; c eq = ca*pressure ² + cb*pressure + cc) in the third order polynomial equation describing the variation of Sr/Y values with melt fraction
DW	cb = random value of the “cb parameter” between minimum and maximum values above describing the pressure dependency of the “c parameter” (=c eq below; c eq = ca*pressure ² + cb*pressure + cc) in the third order polynomial equation describing the variation of Sr/Y values with melt fraction
DX	cc- = minimum value of the “cc parameter” describing the second order polynomial pressure dependency of the “c parameter” (=c eq below; c eq = ca*pressure ² + cb*pressure + cc) in the third order polynomial equation describing the variation of Sr/Y values with melt fraction
DY	cc+ = maximum value of the “cc parameter” describing the second order polynomial pressure dependency of the “c parameter” (=c eq below; c eq = ca*pressure ² + cb*pressure + cc) in the third order polynomial equation describing the variation of Sr/Y values with melt fraction
DZ	cc = random value of the “cc parameter” between minimum and maximum values above describing the pressure dependency of the “c parameter” (=c eq below; c eq = ca*pressure ² + cb*pressure + cc) in the third order polynomial equation describing the variation of Sr/Y values with melt fraction
EA	c eq = ca*pressure ² + cb*pressure + cc; c eq is the pressure-dependent variation of the a parameter in the third order polynomial equation (Sr/Y = [a eq]*[melt fraction] ³ + [b eq]*[melt fraction] ² + [c eq]*[melt fraction] + [d eq]) describing the variation of Sr/Y values with melt fraction
EB	da- = minimum value of the “da parameter” describing the second order polynomial pressure dependency of the “d parameter” (=d eq below; d eq = da*pressure ² + db*pressure + dc) in the third order polynomial equation describing the variation of Sr/Y values with melt fraction
EC	da+ = maximum value of the “da parameter” describing the second order polynomial pressure dependency of the “cd parameter” (=d eq below; d eq = da*pressure ² + db*pressure + dc) in the third order polynomial equation describing the variation of Sr/Y values with melt fraction
ED	da = random value of the “da parameter” between minimum and maximum values above describing the pressure dependency of the “c parameter” (=d eq below; d eq = da*pressure ² + db*pressure + dc) in the third order polynomial equation describing the variation of Sr/Y values with melt fraction
EE	db- = minimum value of the “db parameter” describing the second order polynomial pressure dependency of the “d parameter” (=d eq below; d eq = da*pressure ² + db*pressure + dc) in the third order polynomial equation describing the variation of Sr/Y values with melt fraction
EF	db+ = maximum value of the “db parameter” describing the second order polynomial pressure dependency of the “d parameter” (=d eq below; d eq = da*pressure ² + db*pressure + dc) in the third order polynomial equation describing the variation of Sr/Y values with melt fraction
EG	db = random value of the “db parameter” between minimum and maximum values above describing the pressure dependency of the “d parameter” (=d eq below; d eq =

	$da \cdot \text{pressure}^2 + db \cdot \text{pressure} + dc$) in the third order polynomial equation describing the variation of Sr/Y values with melt fraction
EH	dc- = minimum value of the “dc parameter” describing the second order polynomial pressure dependency of the “d parameter” (=d eq below; $d \text{ eq} = da \cdot \text{pressure}^2 + db \cdot \text{pressure} + dc$) in the third order polynomial equation describing the variation of Sr/Y values with melt fraction
EI	dc+ = maximum value of the “dc parameter” describing the second order polynomial pressure dependency of the “d parameter” (=d eq below; $d \text{ eq} = da \cdot \text{pressure}^2 + cdb \cdot \text{pressure} + dc$) in the third order polynomial equation describing the variation of Sr/Y values with melt fraction
EJ	dc = random value of the “dc parameter” between minimum and maximum values above describing the pressure dependency of the “d parameter” (=d eq below; $d \text{ eq} = da \cdot \text{pressure}^2 + db \cdot \text{pressure} + dc$) in the third order polynomial equation describing the variation of Sr/Y values with melt fraction
EK	$d \text{ eq} = da \cdot \text{pressure}^2 + db \cdot \text{pressure} + dc$; d eq is the pressure-dependent variation of the a parameter in the third order polynomial equation ($Sr/Y = [a \text{ eq}] \cdot [\text{melt fraction}]^3 + [b \text{ eq}] \cdot [\text{melt fraction}]^2 + [c \text{ eq}] \cdot [\text{melt fraction}] + [d \text{ eq}]$) describing the variation of Sr/Y values with melt fraction
EL	$Sr/Y = [a \text{ eq}] \cdot [\text{melt fraction}]^3 + [b \text{ eq}] \cdot [\text{melt fraction}]^2 + [c \text{ eq}] \cdot [\text{melt fraction}] + [d \text{ eq}]$) describes the variation of Sr/Y values with melt fraction
EM	Sr/Y logtest = logical test to set to 0 the negative Sr/Y values
EN	Logtest Psaturation = logical test to exclude illogical simulations which correspond to pressure of saturation values higher than the pressure of accumulation and at the same time being characterized by excess H ₂ O at the pressure of accumulation

Table S3.2. Description of all parameters used in simulations for melt injection rate of 50 mm/a through a disk of 10000 m radius (equivalent to 0.016 km³/a) (Supplementary Dataset 2).

A	Time = time since first injection starts (ka): random between 51526 and 200000 a
B	H ₂ O parent = wt.% content of H ₂ O in parent magma (random between 2 and 4 wt.%)
C	H ₂ O assimilant = wt.% content of H ₂ O in assimilant (random between 0.5 and 1 wt.%)
D	P (kbars) = pressure at which magma accumulation occurs: linear function of time according to the underplating of magma at the fixed flux rate of 50 mm/a: =0.0000075*time+1.50015
E	SiO ₂ total = SiO ₂ relationship to melt fraction based on the empirical equation SiO ₂ =35.43629*F ² -68.8591*F+82.43897, where F = melt fraction
F	Melt fraction = fraction of melt (=AG: see below)
G	a Pressure = a parameter of the second order equation (y=ax ² +bx +c) describing the total melt fraction as a function of P
H	b Pressure = b parameter of the second order equation (y=ax ² +bx +c) describing the total melt fraction as a function of P
I	c Pressure = c parameter of the second order equation (y=ax ² +bx +c) describing the total melt fraction as a function of P
J	P saturation = pressure at which magma is H ₂ O-saturated as a function of the second order polynomial equation P saturation = [a Pressure]*[H ₂ O in melt] ² + [b Pressure]*[H ₂ O in melt] + [c Pressure]
K	Delta P = P of magma formation minus pressure of H ₂ O saturation for that magma
L	H ₂ O % in melt = wt.% content of soluble H ₂ O in the melt
M	Volume mobile magma km ³ = volume of mobile magma (melt fraction >60%) parameterized from Annen (2009) ² (=0.00657*time-338.52065)
N	% mobile melt = random value between 60 and 80%
O	Volume melt (km ³) = effective volume of 100% melt in km ³
P	Volume melt (m ³) = effective volume of 100% melt in m ³
Q	Mass melt (tons) = mass of melt for a density of 2.5 g/cm ³ (dacite)
R	Volume magma injected (km ³) = volume of injected magma at specific times parameterized from Annen (2009) ² (=0.01566*time+31.01613)
S	fixed rate (km ³ /a) =fixed magma flux of 0.016 km ³ /a
T	Volume magma injected (m ³) = W in m ³
U	Mass magma injected (tons) = volume magma injected multiplied by the density of magma (2.5)
V	% mass of melt = % of mass of melt with respect to the injected mass
W	% mass of melt = V
X	Tons melt = [Cell P below]*2.5
Y	Melt % = W
Z	Total melt % = V
AA	H ₂ O wt% in residual melt = H ₂ O wt.% in residual melt calculated for 30% residual melt according to: Residual H ₂ O=100*(H ₂ O parent)*30 ⁻¹
AB	log test H ₂ O wt% in residual melt =100*(H ₂ O parent)*(residual melt fraction) ⁻¹
AC	a H ₂ O = a parameter of the second order equation (y=ax ² +bx +c) describing the dependence on pressure of the H ₂ O content of a silicate melt of a random composition (=melt fraction) parameterized from the P-X dependency of H ₂ O solubility of VolatCalc (Newton and Lowenstern, 2002) ³ .
AD	b H ₂ O = b parameter of the second order equation (y=ax ² +bx +c) describing the dependence on pressure of the H ₂ O content of a silicate melt of a random composition (=melt fraction) parameterized from the P-X dependency of H ₂ O solubility of VolatCalc (Newton and Lowenstern, 2002) ³ .
AE	c H ₂ O = c parameter of the second order equation (y=ax ² +bx +c) describing the dependence on pressure of the H ₂ O content of a silicate melt of a random composition (=melt fraction) parameterized from the P-X dependency of H ₂ O solubility of VolatCalc (Newton and Lowenstern, 2002) ³ .
AF	dacite = % residual melt fraction for a dacite (fixed at 27%)
AG	residual melt Annen logical test for H ₂ O solubility (F=100-10%) = AK*S
AH	H ₂ O solubility in melt (F =100-10 %) = H ₂ O solubility in the residual melt at the random

	pressure and residual melt fraction (logical test corrected) of the same raw
AI	log test H ₂ O solub = AH
AJ	H ₂ O wt% in melt logical test 100-10% F range = H ₂ O wt% in residual melt logical test 100-10% F range = effective H ₂ O wt% content of the residual melt corrected for oversaturation (i.e., if the theoretical amount of H ₂ O in the residual melt is higher than the maximum permissible H ₂ O content in that melt composition and at that specific P, then the latter value is taken as the effective H ₂ O content of that simulation and the remainder H ₂ O is in excess and must have been exsolved).
AK	Excess H ₂ O % = log test H ₂ O wt% in residual melt - log test H ₂ O solubility
AL	H ₂ O residual (tons) = tons of H ₂ O in hydrous melt
AM	Excess H ₂ O (tons) = tons of exsolved H ₂ O from saturated melts
AN	log test excess H ₂ O (tons) = excess H ₂ O (tons) corrected to exclude spurious values from undersaturated melts
AO	new total hydrous melt = tons of hydrous melt
AP	H ₂ O in residual melt (tons) = AQ
AQ	Excess H ₂ O total in melt (tons) = AR
AR	total melt ton = V
AS	% H ₂ O excess = AP
AT	excess H ₂ O tons = tons of excess H ₂ O
AU	kD = KD fluid-melt for Cu with random range between 2 and 100
AV	Cu total melt ppm = BH
AW	Cu tot tons = tons of total Cu in magma
AX	Cu res melt ppm = Cu ppm in the residual magma after fluid exsolution
AY	Cu excess fluid ppm = Cu ppm in exsolved fluid
AZ	Cu tot res melt Mt = Mt of Cu in residual melt after fluid exsolution
BA	Cu tot in excess fluid Mt = Mt of Cu in exsolved fluid
BB	Cu tot Mt = AZ + BA
BC	melt tons = AO
BD	a Cu = a parameter of the second order equation ($y=ax^2+bx+c$, where $y = \text{Cu (ppm)}$ and $x = \text{SiO}_2 \text{ (wt.\%)}$; Fig. 1 below) describing the Cu concentration variability at any SiO ₂ value parameterized from the median values of Cu and SiO ₂ from continental arc rocks (from Chiaradia, 2014) ⁴
BE	b Cu = b parameter of the second order equation ($y=ax^2+bx+c$, where $y = \text{Cu (ppm)}$ and $x = \text{SiO}_2 \text{ (wt.\%)}$; Fig. 1 below) describing the Cu concentration variability at any SiO ₂ value parameterized from the median values of Cu and SiO ₂ from continental arc rocks (from Chiaradia, 2014) ⁴
BF	c Cu = c parameter of the second order equation ($y=ax^2+bx+c$, where $y = \text{Cu (ppm)}$ and $x = \text{SiO}_2 \text{ (wt.\%)}$; Fig. 1 below) describing the Cu concentration variability at any SiO ₂ value parameterized from the median values of Cu and SiO ₂ from continental arc rocks (from Chiaradia, 2014) ⁴
BG	Cu = Cu ppm in 2 nd residual melt after complete H ₂ O exsolution
BH	Cu ppm melt = BG
BI	Cu Mt tons in magma = Cu Mt in 2 nd residual melt after complete H ₂ O exsolution
BJ	M res hydrous melt ton = AO
BK	% H ₂ O in hydrous melt = AB
BL	exsolvable H ₂ O ton = tons of exsolvable H ₂ O in hydrous melt
BM	KD Cu = AU
BN	Cu total melt ppm = AV
BO	Cu tot ton = tons of Cu in residual melt
BP	Cu res melt = Cu ppm in residual melt
BQ	Cu fluid = Cu ppm in exsolvable fluid
BR	Cu tot res melt Mt = Mt of Cu in residual melt
BS	Cu tot in exsolvable fluid Mt = Mt of Cu in exsolvable fluid
BT	Cu tot Mt = Cu Mt total (sum of BW and BX)
BU	50% Cu fluid Mt = 50% of exsolvable Cu
BV	Molar V H ₂ O = molar volume of H ₂ O at the random pressure of the corresponding raw
BW	H ₂ O% in hydrous melt= wt% of H ₂ O in over or undersaturated hydrous melt

BX	Moles of excess H ₂ O = moles of H ₂ O exsolved from oversaturated melts
BY	Volume cc excess H ₂ O = cubic centimeters of H ₂ O exsolved from oversaturated melts
BZ	Volume km ³ excess H ₂ O = volume (km ³) of H ₂ O exsolved from oversaturated melts
CA	Volume km ³ total melt = volume (km ³) of total melt
CB	Volume % excess H ₂ O = volume % of H ₂ O exsolved from oversaturated melts
CC	Volume % H ₂ O logical test = logical test for Volume % excess H ₂ O (if >0 then = excess H ₂ O, if not = 0)
CD	Flux of Cu transported by excess fluid (t/a) = amount of Cu (tons) contained in excess fluid liberated at any time of the magma evolution divided by the time elapsed since onset of magmatic evolution
CE	aa- = minimum value of the "aa parameter" describing the second order polynomial pressure dependency of the "a parameter" (=a eq below; a eq = aa*pressure ² + ab*pressure + ac) in the third order polynomial equation describing the variation of Sr/Y values with melt fraction .
CF	aa+ = maximum value of the "aa parameter" describing the second order polynomial pressure dependency of the "a parameter" (=a eq below; a eq = aa*pressure ² + ab*pressure + ac) in the third order polynomial equation describing the variation of Sr/Y values with melt fraction .
CG	aa = random value of the "aa parameter" between minimum and maximum values above describing the pressure dependency of the "a parameter" (=a eq below; a eq = aa*pressure ² + ab*pressure + ac) in the third order polynomial equation describing the variation of Sr/Y values with melt fraction .
CH	ab- = minimum value of the "ab parameter" describing the second order polynomial pressure dependency of the "a parameter" (=ab eq below; a eq = aa*pressure ² + ab*pressure + ac) in the third order polynomial equation describing the variation of Sr/Y values with melt fraction .
CI	ab+ = maximum value of the "ab parameter" describing the second order polynomial pressure dependency of the "a parameter" (=a eq below; a eq = aa*pressure ² + ab*pressure + ac) in the third order polynomial equation describing the variation of Sr/Y values with melt fraction .
CJ	ab = random value of the "ab parameter" between minimum and maximum values above describing the pressure dependency of the "a parameter" (=a eq below; a eq = aa*pressure ² + ab*pressure + ac) in the third order polynomial equation describing the variation of Sr/Y values with melt fraction .
CK	ac- = minimum value of the "ac parameter" describing the second order polynomial pressure dependency of the "a parameter" (=a eq below; a eq = aa*pressure ² + ab*pressure + ac) in the third order polynomial equation describing the variation of Sr/Y values with melt fraction.
CL	ac+ = maximum value of the "ac parameter" describing the second order polynomial pressure dependency of the "a parameter" (=a eq below; a eq = aa*pressure ² + ab*pressure + ac) in the third order polynomial equation describing the variation of Sr/Y values with melt fraction .
CM	ac = random value of the "ac parameter" between minimum and maximum values above describing the pressure dependency of the "a parameter" (=a eq below; a eq = aa*pressure ² + ab*pressure + ac) in the third order polynomial equation describing the variation of Sr/Y values with melt fraction .
CN	a eq = aa*pressure ² + ab*pressure + ac; a eq is the pressure-dependent variation of the a parameter in the third order polynomial equation (Sr/Y = [a eq]*[melt fraction] ³ + [b eq]*[melt fraction] ² + [c eq]*[melt fraction] + [d eq]) describing the variation of Sr/Y values with melt fraction .
CO	ba- = minimum value of the "ba parameter" describing the second order polynomial pressure dependency of the "b parameter" (=b eq below; b eq = ba*pressure ² + bb*pressure + bc) in the third order polynomial equation describing the variation of Sr/Y values with melt fraction .
CP	ba+ = maximum value of the "ba parameter" describing the second order polynomial pressure dependency of the "b parameter" (=b eq below; b eq = ba*pressure ² + bb*pressure + bc) in the third order polynomial equation describing the variation of Sr/Y values with melt fraction .

CQ	ba = random value of the “ba parameter” between minimum and maximum values above describing the pressure dependency of the “b parameter” (=b eq below; b eq = $ba \cdot \text{pressure}^2 + bb \cdot \text{pressure} + bc$) in the third order polynomial equation describing the variation of Sr/Y values with melt fraction .
CR	bb- = minimum value of the “bb parameter” describing the second order polynomial pressure dependency of the “b parameter” (=b eq below; b eq = $ba \cdot \text{pressure}^2 + bb \cdot \text{pressure} + bc$) in the third order polynomial equation describing the variation of Sr/Y values with melt fraction.
CS	bb+ = maximum value of the “bb parameter” describing the second order polynomial pressure dependency of the “b parameter” (=c eq below; b eq = $aa \cdot \text{pressure}^2 + ab \cdot \text{pressure} + ac$) in the third order polynomial equation describing the variation of Sr/Y values with melt fraction .
CT	bb = random value of the “bb parameter” between minimum and maximum values above describing the pressure dependency of the “b parameter” (=b eq below; b eq = $aa \cdot \text{pressure}^2 + ab \cdot \text{pressure} + ac$) in the third order polynomial equation describing the variation of Sr/Y values with melt fraction .
CU	bc- = minimum value of the “bc parameter” describing the second order polynomial pressure dependency of the “b parameter” (=b eq below; b eq = $aa \cdot \text{pressure}^2 + ab \cdot \text{pressure} + ac$) in the third order polynomial equation describing the variation of Sr/Y values with melt fraction .
CV	bc+ = maximum value of the “bc parameter” describing the second order polynomial pressure dependency of the “b parameter” (=b eq below; b eq = $aa \cdot \text{pressure}^2 + ab \cdot \text{pressure} + ac$) in the third order polynomial equation describing the variation of Sr/Y values with melt fraction .
CW	bc = random value of the “bc parameter” between minimum and maximum values above describing the pressure dependency of the “b parameter” (=b eq below; b eq = $aa \cdot \text{pressure}^2 + ab \cdot \text{pressure} + ac$) in the third order polynomial equation describing the variation of Sr/Y values with melt fraction .
CX	b eq = $ba \cdot \text{pressure}^2 + bb \cdot \text{pressure} + bc$; b eq is the pressure-dependent variation of the b parameter in the third order polynomial equation ($Sr/Y = [a \text{ eq}] \cdot [\text{melt fraction}]^3 + [b \text{ eq}] \cdot [\text{melt fraction}]^2 + [c \text{ eq}] \cdot [\text{melt fraction}] + [d \text{ eq}]$) describing the variation of Sr/Y values with melt fraction .
CY	ca- = minimum value of the “ca parameter” describing the second order polynomial pressure dependency of the “c parameter” (=c eq below; c eq = $ca \cdot \text{pressure}^2 + cb \cdot \text{pressure} + cc$) in the third order polynomial equation describing the variation of Sr/Y values with melt fraction (s see above).
CZ	ca+ = maximum value of the “ca parameter” describing the second order polynomial pressure dependency of the “c parameter” (=c eq below; c eq = $ca \cdot \text{pressure}^2 + cb \cdot \text{pressure} + cc$) in the third order polynomial equation describing the variation of Sr/Y values with melt fraction .
DA	ca = random value of the “ca parameter” between minimum and maximum values above describing the pressure dependency of the “c parameter” (=c eq below; c eq = $ca \cdot \text{pressure}^2 + cb \cdot \text{pressure} + cc$) in the third order polynomial equation describing the variation of Sr/Y values with melt fraction .
DB	cb- = minimum value of the “cb parameter” describing the second order polynomial pressure dependency of the “c parameter” (=c eq below; c eq = $ca \cdot \text{pressure}^2 + cb \cdot \text{pressure} + cc$) in the third order polynomial equation describing the variation of Sr/Y values with melt fraction .
DC	cb+ = maximum value of the “cb parameter” describing the second order polynomial pressure dependency of the “c parameter” (=c eq below; c eq = $ca \cdot \text{pressure}^2 + cb \cdot \text{pressure} + cc$) in the third order polynomial equation describing the variation of Sr/Y values with melt fraction .
DD	cb = random value of the “cb parameter” between minimum and maximum values above describing the pressure dependency of the “c parameter” (=c eq below; c eq = $ca \cdot \text{pressure}^2 + cb \cdot \text{pressure} + cc$) in the third order polynomial equation describing the variation of Sr/Y values with melt fraction .
DE	cc- = minimum value of the “cc parameter” describing the second order polynomial pressure dependency of the “c parameter” (=c eq below; c eq = $ca \cdot \text{pressure}^2 + cb \cdot \text{pressure} + cc$) in the third order polynomial equation describing the variation of

	Sr/Y values with melt fraction .
DF	cc+ = maximum value of the “cc parameter” describing the second order polynomial pressure dependency of the “c parameter” (=c eq below; c eq = ca*pressure ² + cb*pressure + cc) in the third order polynomial equation describing the variation of Sr/Y values with melt fraction .
DG	cc = random value of the “cc parameter” between minimum and maximum values above describing the pressure dependency of the “c parameter” (=c eq below; c eq = ca*pressure ² + cb*pressure + cc) in the third order polynomial equation describing the variation of Sr/Y values with melt fraction .
DH	c eq = ca*pressure ² + cb*pressure + cc; c eq is the pressure-dependent variation of the a parameter in the third order polynomial equation (Sr/Y = [a eq]*[melt fraction] ³ + [b eq]*[melt fraction] ² + [c eq]*[melt fraction] + [d eq]) describing the variation of Sr/Y values with melt fraction .
DI	da- = minimum value of the “da parameter” describing the second order polynomial pressure dependency of the “d parameter” (=d eq below; d eq = da*pressure ² + db*pressure + dc) in the third order polynomial equation describing the variation of Sr/Y values with melt fraction .
DJ	da+ = maximum value of the “da parameter” describing the second order polynomial pressure dependency of the “cd parameter” (=d eq below; d eq = da*pressure ² + db*pressure + dc) in the third order polynomial equation describing the variation of Sr/Y values with melt fraction .
DK	da = random value of the “da parameter” between minimum and maximum values above describing the pressure dependency of the “c parameter” (=d eq below; d eq = da*pressure ² + db*pressure + dc) in the third order polynomial equation describing the variation of Sr/Y values with melt fraction .
DL	db- = minimum value of the “db parameter” describing the second order polynomial pressure dependency of the “d parameter” (=d eq below; d eq = da*pressure ² + db*pressure + dc) in the third order polynomial equation describing the variation of Sr/Y values with melt fraction .
DM	db+ = maximum value of the “db parameter” describing the second order polynomial pressure dependency of the “d parameter” (=d eq below; d eq = da*pressure ² + db*pressure + dc) in the third order polynomial equation describing the variation of Sr/Y values with melt fraction .
DN	db = random value of the “db parameter” between minimum and maximum values above describing the pressure dependency of the “d parameter” (=d eq below; d eq = da*pressure ² + db*pressure + dc) in the third order polynomial equation describing the variation of Sr/Y values with melt fraction .
DO	dc- = minimum value of the “dc parameter” describing the second order polynomial pressure dependency of the “d parameter” (=d eq below; d eq = da*pressure ² + db*pressure + dc) in the third order polynomial equation describing the variation of Sr/Y values with melt fraction .
DP	dc+ = maximum value of the “dc parameter” describing the second order polynomial pressure dependency of the “d parameter” (=d eq below; d eq = da*pressure ² + cdb*pressure + dc) in the third order polynomial equation describing the variation of Sr/Y values with melt fraction .
DQ	dc = random value of the “dc parameter” between minimum and maximum values above describing the pressure dependency of the “d parameter” (=d eq below; d eq = da*pressure ² + db*pressure + dc) in the third order polynomial equation describing the variation of Sr/Y values with melt fraction .
DR	d eq = da*pressure ² + db*pressure + dc; d eq is the pressure-dependent variation of the a parameter in the third order polynomial equation (Sr/Y = [a eq]*[melt fraction] ³ + [b eq]*[melt fraction] ² + [c eq]*[melt fraction] + [d eq]) describing the variation of Sr/Y values with melt fraction .
DS	Sr/Y = [a eq]*[melt fraction] ³ + [b eq]*[melt fraction] ² + [c eq]*[melt fraction] + [d eq]) describes the variation of Sr/Y values with melt fraction .
DT	Sr/Y logtest = logical test to set to 0 the negative Sr/Y values

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