## """FKUVTKOWVKQP "QH"XQNECPKE"GTWRVKQPU"KP "UK, G"VQ"UVWF["QH'OGEJ CPKUOU'QH'OCI OC" CI I TGI CVKQP "KP"VJ G"GCTVJ )U"NKVJ QURJ GTG"CPF"J C\ CTF"RTGFKEVKQP"" Ivanov, V.V.

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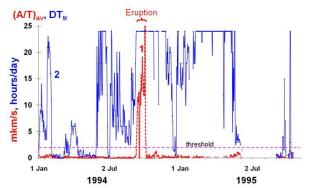
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## The distributions of eruptions in size for the volcanoes Klyuchevskoy and Karymsky

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Kp"Hki 0'3"vq"yi g"rghv."yi g"dgj cxkqt"qh"xqrecpke"vtgo qt"r ctco gvgtu"qp"Mn{ wej gxumq {"xqrecpq"ku"uj qy p" htqo "3; ; 6"vq"3; ; 70 Kp"yi g"hki wtg"vq"yi g"tki j v."yi g"f kuxlkdwkqp"qh"yi g"f wtcvkqp"qh"vtgo qt"gr kuqf gu"qxgt"c"37/ {gct"vko g"kpvgtxcn"ku"uj qy p0' Kl'hqmqy u"htqo "yi g"hki wtg"yi cv'yi g"f wtcvkqp"qh"yi g"cevkxcvkqpu"ku"f kuxlkdwgf" ceeqtf kpi "vq"yi g"r qy gt"rcy "y kyi "yi g"vcpi gpv'qh"yi g"urqr g"qh"yi g"tgr gcvcdkrk{ "ewtxg" $\gamma$ ?"2075"Õ'2084"\*; 7' +0' Hqt"yi g"Mct {o um{ "xqrecpq"cp"cpcmi qwu"f kuxlkdwkqp"y kyi " $\gamma$ ?"2082"Õ'2085"\*; 7' +"y cu"qdvckpgf 0'Ukpeg"yi g" xcrwg"qh"yi g"r ctco gygt"T $^4$ "?"20 8/20 9"ku"emqug"vq"3"yi cv'kpf kecvgu'yi cv'hqt"dqyi "f kuxlkdwkqpu'yi g"r qy gt"rcy "ku"



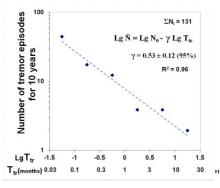


Fig. 1. Klyuchevskoy volcano. Left: The daily average values of the ratio of amplitudes to the periods (A/T)av., dotted curve 1) and daily duration of volcanic tremor ( $DT_{tr}$ , solid curve 2). Right: Distribution of the duration of tremor episodes in 1994- June 2009. Activation was considered if  $DT_{tr} > 2$  hours per day.

yj g"dguv'crrtqzko cvkqp0"Vj g"rqy gt"f kuntkdwkqp"ku"c"rctcf qzkecn"f kuntkdwkqp."ukpeg"hqt"kv'yj g"uvcvkunkecn" gzrgevcvkqp"cpf "xctkcpeg"f kxgti g."y j kej "kornkgu"cp"kphkpkg"gpgti { "qh'yj g"rtqeguu"™P gy o cp."4227+0" Vj gtghqtg."kv'ku'korqtvcpv'vq"gzrmckp"yj g"rj { ukecn'o gej cpkuo u'yj cv'i gpgtcvg'uwej "f kuntkdwkqpu0"

### Possible mechanisms of generation and aggregation of magma in the subduction zone of Kamchatka

Cu'qpg'qh''y g''cr r necpu. 'y g''eqpulf gt''the mechanism of aggregation of magma by merging small floating cracks filled with magma and rising in the lithosphere of the Earth into larger ones. 'y j kej 'y cu' kpxguki cygf 'gzr gtko gpycm( 'kp'y qtm'\*Vcncf c.'3; ; 6+0"'

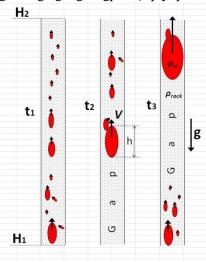


Fig. 2. Simplified schematic image of the absorption process by large floating cracks filled with magma, smaller cracks in the vertical pipelike region of the lithosphere (magmatic channel). In this area, the strength of the rocks has been significantly reduced. Pictured in the plane of the cracks.  $\mathbf{H} - \text{depth}$ ,  $\mathbf{t} - \text{conditional time}$ ,  $\boldsymbol{\rho_m}$  u  $\boldsymbol{\rho_{rock}}$ -density of magma and rocks, respectively,  $\mathbf{g}$ - acceleration of gravity $\mathbf{0}$ "

 $H_2 < H_1$ ,  $\rho_m < \rho_{rock}$ ,  $t_1 < t_2 < t_3$ .

Ukpeg"yi g"tcvg"qh"tkug"\*V+"qh"c" hrqcvkpi "etcen"if gr gpf u"qp"ku" j gki j v\*h+"kp"c"xgt {"uvtqpi "\*hqwtyi +" f gi tgg"\*Vcncf c."3; ; 6."hqto wrc" \*3; +

V ~ h<sup>4</sup>, "\*3+"

mti gt'hnqckpi "etcemi'tkug'hcuvgt."
cduqtdkpi "uo cngt"qxgtn{kpi "
etcemi'\*Fig.2+0'Wprkng'COVcncfc."
y g''dgrkgxg''y cv''y g'hrqckpi "etcemi"
pqv''qpn{"gpreti g. "dw''y gtg'ku''cp"
cxcrepej g/rkng''pcwtg''qh''y gkt"
ci i tgi cvkqp0'Vj ku''o c{"ftcuvkecm{"
ej cpi g''y g''rcy "qh''y gkt"
fkntkdwkqp''kp''uk g''htqo "y g''kpkkcn''
gzr qpgpvkcn''qt''pqto cn''q''y g''

r qy gt 'hcy 'qpg0'

This conceptual model allows wu'\q"gzr rc\p the existence of the pause that occurs after the termination of an eruption. "Vj ku'ku'f wg'\q"y g'go r v\ \pi "qh'\y g'o ci o cv\c"ej cppgn\htqo "o ci o c"qxgt "ku'eqpu\f gtcdrg" rgpi y "cu'c"t guwn'qh'y g'cduqtr \qp"qh'c"y j qrg"gej grap "qh'uo crrgt "cpf "j ki j gt 'hrqc\pi "etcenu"d $\{$  "qh'uqo g" rcti gt 'hrqc\pi "hkuwtg'\f cr '\p"Fig.2+OIt also follows from this model that the magnitude and time of the beginning of the future eruption have a random character, which makes it difficult to predict them.

# Analysis of the distribution of ejected tephra for volcanoes of the world and Kamchatka and forecast estimates

Hqt"\j g"gtwr \lqpu"qh"\j g"y qtrf"cpf "\j g"y j qrg"qh"\Mco ej cwrc."\y g"uwrf \lqpt"\j g"f \kwt\kdwk\qpu"qh"\glgevgf " \wr j tc"\\* $V_T$ +"ecrewrcyf "htqo "\j g"gzr rqukxg"\xqrecp\e"\qpf gz"\VEI"\P gy j cm"\Ugrh"\3; : 4+"ceeqtf \kpi "\q"\hqto wc""

$$V_T(km^3) \approx 10^{(VEI-4.3)}$$
 (for  $VEI \ge 2$ ), \*5+

y j kej ''y cu'f gf wegf ''d { ''wu'htqo ''y g'f cwc''qh''Vcdrg'8''qh''y ku''ctvkerg0'Vj g'xcnwgu''qh''VEI y gtg''cpcn{| gf 'htqo '' 3: 22''q'4238.''y j kej ''y gtg''cngp''htqo ''y g'f cwcdcug''qh''y g''Uo kej uqpkcp''Kpuvkwwkqp''\*I nqdcn'Xqrecpkuo '' Rtqi tco +0''''

Vj g'f kutkdwkqpu'qh'VEI'cpf ''y g'eqttgur qpf kpi ''xqnxo g''qh'ki pgqwu'\gr j tc'\* $V_T$ +'hqt''y g''gtwr kqpu''qh''y g'' y qtnf ''cpf 'Mco ej cvnc''htqo ''y g''dgi kppkpi ''qh''y g''3; y ''egpwt { ''q''4238''ctg''i kxgp''kp''Hki 050'Vj g { ''ctg'' crrtqzko cvgf ''d { ''c''hkpgct''f gr gpf gpeg''qh''y g''hqto ''

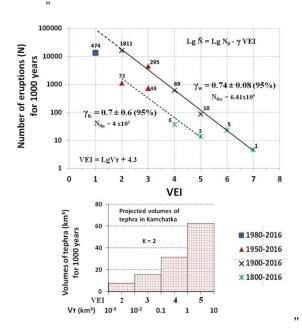


Fig 3. "Top graphs: The distributions of VEI and the corresponding volumes of tephra  $(V_T, km^3)$  ejected during volcanic eruptions of the world (solid line) and Kamchatka (dashed line) in IXX - the beginning of the XXI century. "The numbers above the dots indicate the number of eruptions in the sample for each VEI. "The lower histogram: the most probable volumes of tephra, which will be ejected by all volcanoes of Kamchatka in the next 1000 years.

J gpeg''y g'f gr gpf gpeg'qh'y g'pwo dgt''qh''gtwr wqpu'' $\tilde{N}$ ''ecp'' dg''y tkwgp''kp''y g'hqto ''qh''y g'hqmy kpi ''r qy gt'hwpewqp''qh''  $V_T$ ''y ky ''y g''kpf gz''qh''gzr qpgpv'\* $\gamma$ +"

$$\tilde{N} = (N_0 \cdot 10^{-4.3 \, \gamma})(V_T)^{-\gamma}$$
"." \*7+"

y j gtg" $\tilde{N}$ "kı"y g"r tgf kevgf "pwo dgt"qh"ytwr vkqpu"pqto crk gf" hqt "3222"{gctu."y"ku"y g"vcpi gpv'qh"y g"urqr g"cpi rg"qh"y g" tgr gcvcdkrk{"ewtxg"\*2">y">3+:" $N_0$ "kı"y g"kpkkcrixcrwg" f gr gpf kpi "qp"y g"cevkxk{"rgxgri'qh"y g"xqrecpke"| qpg."Lg" kı"y g"f geko cri'qi ctky o 0"Vj g"eqo r ctcvkxgr{"rcti g"xcrwgu" qh"y g"r ctco gygt" $T^4$ "? "20; "cpf" 20, 4."y j kej "ctg"erqug"vq" 3."ej ctcevgtk kpi "y g"f gxkcvkqp"qh"y g"f cvc"htqo "y g" r qy gt"rcy."cmqy "wu"q"uvcy"y cv'dqy "f kuxkdwkqpu"ctg" y gmf guetklgf "d{"c"r qy gt "rcy 0"Qdxkqwrf."y g"r qy gt" rcy "qh"y g"uk g"f kuxkdwkqp"qh"gtwr vkqpu"hqt"c"egtvckp" xqrecpke"| qpg'ku'y g"tguwry'qh'c'uwr gtr qukkqp"qh'uwej "f kuxkdwkqpu"hqt"xqrecpqgu"eqo r qukpi "y ku"| qpg0"

Htqo ''y g'f cvc''qh'Hki (5''cpf ''y g''gzr tguukqp''\*7+.''y g'' hqmqy kpi ''eqpenwukqpu''ecp''dg'f tcy p<''

3+"Vj g'htgs wgpe { "qh'qeewttgpeg"qh'xqrecple" gtwr wqpu'hp' Mco ej cwnc "kp' vj g'tcpi g"\textbf{VEI}"? "4"/"7"ku'cdqw' 32' "qh' vj g'i rqdcn' vj kej "ku's wksg'c "qv."ukpeg' vj g''rgpi vj "qh' vj g"xqrecple"cte"qh' Mco ej cwnc "ku'qpn { "cdqw' 4' "qh' vj g" uwo "qh' vj g''rgpi vj u'qh''cm' vj g''xqrecple "cteu'qp' Gct vj 0' Rtguwo cdn { . 'vj ku'tcwq' y kn'dg' xcnt f'hqt"\textbf{VEI}"? "8"/"90'

4+ Vj g'f kutkdwkqp''qh'vj g''glgevgf ''vgr j tc'\* $V_T+$ 'hqt'' vj g''gtwr vkqpu''qh'vj g''xqrecpqgu''qh'vj g''y qtrf ''cpf''

Mco ej cvnc"qdg{u"y g"htcevcn"r qy gt "ncy "qh"f kutkdwkqp"y ky "enqug"vcpi gpvu"qh"y g"unqr g"cpi  $ng"\gamma$ ? "209/2097"" \*Hki wtg"5. "wr r gt "i tcr j +0"Vj g"f cvc"hqt "Mco ej cvnc"j cxg"c"o wej "y kf gt "f kur gtukqp" y cp" y g"i mqdcn"f cvc0"Ukpeg" y" >3. "y g"htcevkqp"qh"uxtqpi "cpf "xgt { "f cpi gtqwu"gtwr vkqpu"ku"uki pkhecpv0"Vj gtghqtg. "y g{ "uj qwrf"dg"cwtkdwgf"pqv" vq"pcwtcn"f kucugtu. "dw"vq"catastrophes0" "

Hatgecuv'guvko cvgu'hat "Mco ej cvnc''ctg'i kxgp''kp''vj g'hamay kpi ''vcdng0'

Vcdrg" Vjg"oquv'r tqdcdrg'kpvgtxcnu'dgwyggp"gtwrwkqpu'cpf "vjg'xqnwogu'qh'glgevgf"vgrjtc'hqt'hwwwtg'kp''Mcoejcwnc''

XGK	Vj g'cxgtci g'kpygtxcn'dgyy ggp"gtwr vkqpu"	Xqnwo g'qh'ki pgqwu'\gr j tc'hqt"3222"{gctu"
7"	; 2"{ gctu"	82'ho <sup>5</sup> "
8"	572"{ gctu'*gzvtcr qrcvkqp+"	342"mo <sup>5</sup> "sgz vtcr qrcvkqp+"
9"	3622"{ gctu'*gzyter arcykap+"	462"mo <sup>5</sup> "*vzyter arcykan+"

#### References

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P gy j cm"E0C0"Ugrh"U0'Vj g"xqrecpke"gzr rqukxkv{"kpf gz"\*XGKk-"cp"guvko cvg"qh"vj g"gzr rqukxg"o ci pkwf g"hqt" j kurqtkecn'xqrecpkuo "I1'Iqwtpcn'qh'I gqr j {u0T gu03; : 40'X0': 90'Kuvvg'E40''Rr 03453ô 345: 0'

P gy o cp'O 0G0L0Rqy gt'ircy u.'Rctgvq'f kıvtkdwkqpu'cpf'\ kr høu'ircy (Eqpvgo r qtct { 'Rj {ukeu.''Ugr vgo dgtó Qevqdgt''42270'Xqr0'68.''P q07.''RR0'545''ó'5730'

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