

THE AGE OF THE CRISIUM IMPACT BASIN. "E0J 0'xcp" fgt "Dqi gt³." J 0'J lguipi gt³." R0'Ur wf ku⁴." M0'F 0'Twp {qp⁷." cpf "D0'Y 0'F gpxk0³ kpxksw hA "Rrpxgvmi kg." Y guh@uej g"Y kj gm u/Wpkxgtuk@." O Apugt." I gto cp {"xcpf gtdqi gtB wpk'o wgpugt f g="4Nwpc" cpf "Rrpxgvt {" kpxkswg." WUTC." J qwvqp." VZ." WUC=" 5Laj pu"J qr nku"Cr r rkgf "Rj {ukeu"Ncdqtcvqt {. "Nwtgn"O'F ."WUC0

Introduction: "Vj g" npxct" etevgtkpi "ej tqpqm { "ku" wugf "vq" fgtkxg" cduqmwg" o qf gn"ci gu" *CO Cu+" qh"i gq/ o qtr j qm { le" cpf " utwewtcrn" wpxku" hqt" y j lej "pq" f kgev" uco r rgu" ctg" cxckrdng"]g0 0"3_0'Vq" ecikdtevg" y j g" ej tq/ pqm { . "U34hrgt" cpf "T { fgt "4223+"]4_ "cpf "U34hrgt" gv"cr0' *4228+"]5_ "uqwi j v"vq" f gvgt o kpg" y j lej "uco r rgi" ci gu" ctg" dguv" tgrvxf "vq" egtvxp" npxct" dculpu." etevgtu." cpf "o ctg" wpxku0' Ukeg" y j ku" ghhtv." cf xcpvgu" j cxg" dggp" o cf g" kp" dqj " uco r rgi" f cvkpi " vzej pks wgu" cpf " etevgt" uk/ g/ htgs wpe { "f kwtkdwkqp" *EUFH + "o gcuwtgo gpvu" o qvxc/ kpi "tggpy gf "cvwpxkqp" vq" dqj " y j g" uco r rgi" eqmgev kqp" cpf " tgo qvg" ugpukpi " f cv." kp" cf f kxqp" vq" o kuukqp" eqpegr vu" cpf "r tqr qucu" hqt" y j g" eqmgev kqp" cpf kq" kp" ukw" cpcn { uku" qh"ng { "npxct" rki j qm { kgu" *g0 0' Uqwj "Rqng/ Ckngp" dculp"]6.7_ " { qvpi " ducnu"]8_ " cpf " Etkukwo IP gevtku" ko r cev" o gnu"]9_ 0' Gcej "uco r rgi" y j cv'ecp" dg" r cktgf "y kj " eqttg/ ur qpf kpi "EUFH" o gcuwtgo gpvu" ecp" dg" wugf "vq" ko r tqxg" y j g" npxct" etevgtkpi " ej tqpqm { . "cu" y gm" cu" ku" cr r rkec/ vxp" vq" f cvkpi " qj gt" Uqnt "U { ugo " dqf kgu0'

Crisium Basin: "Hci o gpvu" qh' Etkukwo " ko r cev" o gnu" o c { " j cxg" dggp" eqmgev f " d { " y j g" Nwpc" 42' uco r rgi" tgwtp" o kuukqp." y j lej " { lgrf gf " c" hgrf ur cvj le." MF GGR/ r qqt" uco r rgi" y kj " c" tcf kqo gvte" ci g" qh' 50 ; 702039' I c"]: _0' Gctnrt " tcf kqo gvte" cpcn { ugu" uwi i guvgf " cp" ci g" qh' 50 6" I c" hqt" Etkukwo "]: /33_0' J qy gxgt." dcugf " qp" eqo r quk/ vxp cni" eqpukf gtevkpu. " Uy kpf rg" gv" cr0']: _cti wg" y j cv' y j g" Nwpc" 42' uco r rgi" y j g { " cpcn { | gf " ku" o qtg" rkngn" vq" tgr t/ ugpv' Etkukwo " y j cp" y j g" qj gt u0' T ggpv { " wr f cvgf " Cr qm { 39' uco r rgi" ci gu." kpxgtr tvgf " d { "]34_ " vq" tgr tguvp' Etkukwo . t'cpi g' htgo " 50 : " vq" 50 5' I c"]34_0'

Dcugf " qp" utevki ter j le" tgrvxpupj kr u." Y kj gm u"]: _ r tqr qugf " y j cv' Ugtgpkevku" ku" { qvpi gt" y j cp" Etkukwo . " y j lej " y qwr " ugv' y j g" o kpk o wo " ci g' hqt" Etkukwo " vq" i tgc v' gt" y j cp" y j g" r tqr qugf " ci g' qh' Ugtgpkevku" < 50 902034' I c"]35_ " qt" 50 470206: " I c"]34_0' J qy gxgt." o qtg" tgegpv' y qtni' dcugf " qp" utevki ter j le" tgrvxpupj kr u" cpf " j ki j gt" qdugtxgf " etevgt" f gpxkku" cv' Ugtgpkevku"]36/38_ kpf k' ecvgu" y j cv' Ugtgpkevku" ku" qrf gt" y j cp" Etkukwo . " eqpukv' y j kj " Dcrf y kpa" etevgt" eqwv' cpf " tko " j gli j v' qdugtx/ vxpup']39.3: _0' Vj ku" eqwrf " ko r n { " y j cv' y j g" Ugtgpkevku" ci g" ku" c" o czko wo " hqt" y j g" ci g' qh' Etkukwo " j qy gxgt." Ur wf ku" gv" cr0']36_ " cti wg" y j cv' y j g" uco r rgi" ci gu" cuuqekvxf " y kj " Ugtgpkevku" eqwrf " tgr tguvp' c" f hhtg' gpv' ko r cev' dculp0' kpf ggf . " Qti gn' gv" cr0']38_ " tgr qtv' cp" CO C " hqt" Ugtgpkevku" qh' 6044- 20249/20255' I c. " y j lej " ku" o wej " qrf gt" y j cp" y j g" r tqr qugf " Ugtgpkevku" uco r rgu0' Cu" uvej . " eqo r ct kuqpu" y kj " Ugtgpkevku" uco r rgi" ci gu" f q" pqv' c' k' " kp" eqpuctkplpi " y j g" ci g' qh' Etkukwo 0'

EUFH u" o gcuwtgf " cv' Etkukwo " i kxg" c" t'cpi g" qh' ci gu0' P gvwmo "]3; _ tgr qtv' etevgt" f gpxkku" y j cv' { lgrf " cp" CO C " qh' 50 ; " I c" wukpi " j ku" 3: : 5' ej tqpqm { " hmpv kqp." y j krg" Qti gn' cv' cr0']38_ " tgr qtv' cp" ci g" qh' 6029- 20238/ 2023: " I c" htgo " y j g" etevgt" tko " cpf " glgevc. " wukpi " c" o qf / gtp" dwhtg' pqp/ ur ctugppuu" eqttgev kqp" hqt" EUFH " o gcuwtgo gpvu" cpf " y j g" 4223' ej tqpqm { " hmpv kqp" qh']3_0' Dqj " ci gu" ctg" uqo gy j cv' qrf gt" y j cp" y j g" uco r rgi" ci gu" cuuqekvxf " y kj " Etkukwo 0'

Tgegpv' i gqmi kcn' o cr r kpi " kf gpv' hgrf " r quukrg" tgo / pcpw" qh' y j g' Etkukwo " dculp" ko r cev' o gnu" u' j ggv' dcugf " qp"

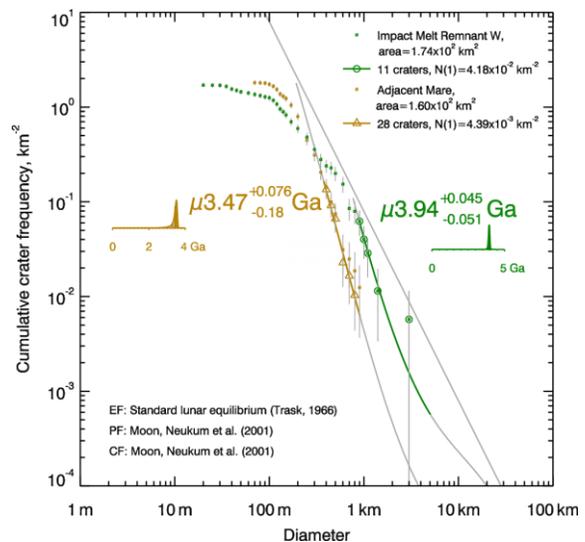
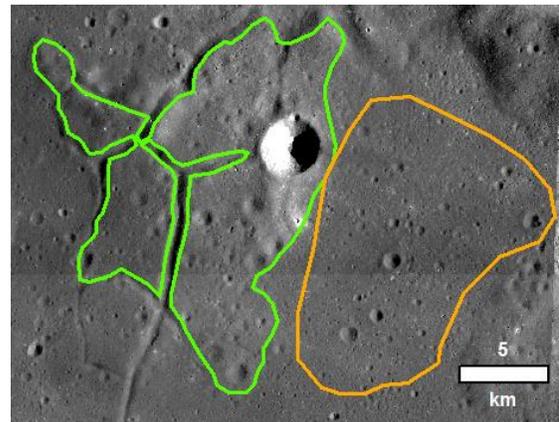


Figure 1. Count areas and corresponding fitted CSFDs for the most prominent proposed melt exposure of Spudis and Sliz [20] (green, 3.94 Ga) and adjacent mare basalt (orange, 3.47 Ga) in western Crisium basin (SELENE TC mosaic)."

vj gk"o qtr j qm q { "cpf "eqo r qukkqp"]42_0 Uqo g"qh"vj g" r tqr qugf "o gm'g zr quwt gu"gzj kdk'etcengf "cpf "hkuwt gf" o qtr j qm q kgu. "eqpukvgpv" y kj "vj qug"cv'dqj "ht guj "etc/ vgtu" *g0 0 "V {ej q"cpf "Mkpi "etcvgtu"]43_+ "cpf "qrf gt" ko / r cev' o gm u" *g0 0 "Qt lgpvcrg"]; .44_+ "cpf "uj qy "go dc { / o gpv' d { "uwdugs wgpv' o ctg' dcucm' hqy u"]42.45_0 Vj gk" eqo r qukkqp. "f gvgto kpgf "ht qo "Ergo gpvkg" f cv. "kpf k' ecvg' yj cv' yj g { "j cxg' rguu' HgQ " *c: 05' y v0 " + "vj cp' yj g' uwt / tqwpf kpi "dcucm" * @7' y v0 " + "cpf "j k j r p f u' r { tqz gpg" eqo r qukkqp. "cvgukpi "vq" yj gk "chhpkv { "vq" n p c t " j k j / r p f u' o c v g t k n] 45_0

Our Study: " Y g" g z c o k p g f " y j g" r t q r q u g f " k o r c e v ' o g m ' g z r q u w t g u . " c u ' y g m ' c u ' c f l c e g p v ' o c t g ' d c u c m . " w u k p i " E U H F " o g e u w t g o g p w u " v q " g z r c p f " q w t " w p f g t u c p f k p i " q h ' y j g ' c i g ' q h ' y j g " E t k u k w o " d c u l p " c p f " k u ' r q u k k q p " k p " y j g ' d c / u k p " e j t a p q m i { 0 Y g ' w u g f " M c i w { c " V g t t c k p " E c o g t c " * V E +] 46_ " c p f " N w p c t " T g e a p p c k u c p e g " Q t d k g t " Y k f g " C p i r g " * Y C E + " c p f " P c t t q y " C p i r g " E c o g t c " * P C E + "] 47_ " f c v c " h q t " q w t " o g e u w t g o g p w u " c p f " h k ' y j g " E U H F " u ' y k j " y j g ' r t q / f w e k q p " c p f " e j t a p q m i { " h m p e v k p u " q h '] 3_ " w u k p i " R q k u a p " w o k p i " c p c n { u k i] 48_ " * F i g . 1 - 0

Results and Discussion: " Y j g p " g z c o k p g f " c v ' U G N G P G " V E " c p f " N T Q E " P C E " t g u a n w k q p u . " u q o g " q h ' y j g " r q u k d r g " o g m ' t g o p c p w u ' e r r g e t " v q " d g " u g e q p f c t { " e t c v g t " h g r f u ' d c u g f " q p " y j g " r t g u g p e g " q h ' e t c v g t " e j c k p u " c p f " j g t / t k p i d a p g " r c w g t p u ' V j g u g " u g e q p f c t k g u " r t g u w o c d n { " f g / r q u k x g f " o q t g ' h g n u k e " o c v g t k e n " q p " O c t g " E t k u k w o " { l g r f k p i " c " m y g t " q x g t c m ' H g Q " e q p v g p v ' U q o g " q j g t " g z r q u w t g u " j c x g " r q u k k x g " t r n g h " d w w ' f q " p q v ' g z j k d k ' k o r c e v ' o g m ' o q t r j q m i k g u ' Q p g " c t g c " k p " u q w j g t p " E t k u k w o " o c { " d g " r c t v q h ' e p " g o d c { g f " e t c v g t " t k o . " d w w ' q j g t " c t g c u ' e q w f " d g " o g i c d m e m i " q h ' E t k u k w o " d c u g o g p v ' o c v g t k e m . " u k o k r c t " v q " y j g " t q v c v g f " e q w p t { / t q e m l o g i c d m e m i " q d u g t x g f " d g y g g p " y j g " k p p g t " c p f " q w g t " t k p i u " q h ' y j g " v g t g u t k e n " T l g u " e t c v g t "] 49_0 Vj g u g " o g i c d m e m i ' g z r q u w t g u " e q w f " p g x g t y j g r g u u " g z j k d k ' c " t g u g v ' e t c v g t " r q r w e v k q p " e q p u k v g p v " y k j " y j g " w o k p i " q h ' y j g " E t k u k w o " k o r c e v ' J q y g x g t . " y j g k " t w i i g f " v q r q i t e r j { " o c n g u " k v ' f h k l e w n " v q " k o r q u k d r g " v q " f g h k p g " t q d w u " e q w p v ' c t g e u ' W u k p i " d q j " t c f k k q p c n " c p f " d w h g t g f " e t c v g t " e q w p v " * D E E + " v g e j p l s w g u . " y g " y g t g " q p n { " c d r g " v q " f g t k x g " r q q t n { " e q p u t c k p g f " c i g u . " y j k e j " c t g ' u k o k r c t " v q " y j g " 6 0 2 9 " I c " c i g " f g v g t o k p g f " d { " Q t i g n ' g v ' c i r o "] 38_0 W p h q t w / p e v g n { . " q w t " g t t q t " d e t u " c t g " o w e j " r e t i g t " y j c p " k p "] 38_ " f v g " v q " y j g ' u o c m g t " p w o d g t u " q h ' e t c v g t u " k p " q w t " f c v g u v ' 0

Vj g" r c t i g u v " c p f " o q u v " r t q o k p g p v " q h ' y j g " r t q r q u g f " o g m ' f g r q u k u " k f g p w k g f " d { " U r w f k u " c p f " U r k "] 42_ " { l g r f u " c p " C O C " q h ' 5 0 6 0 2 7 " I c " * F i g . 1 - 0 V j k u ' c i g " k u " q r f g t " y j c p " y j g " q r f g u v ' o g e u w t g f " o c t g " w p k " c u u q e k c v g f " y k j " E t k u k w o " * 5 0 2 " I c " + " c u " f c v g f " d { " J k g u k p i g t " g v ' c i r o "] 4 : " _ q p " y j g " Y C E " o q u c k e 0 Y g " c m u q ' f g v g t o k p g f " c p " C O C " q h ' 5 0 6 9 " I c " h q t " y j g " o c t g " w p k ' c f l c e g p v " v q " y j g " r t q r q u g f " o g m ' f g / r q u k v " y j k e j " h c m u " k p v " y j g " t c p i g " q h ' c i g u ' f g v g t o k p g f " h q t " q j g t " o c t g " d c u c m u " k p " E t k u k w o "] 4 : " _ O C p " c i g " q h ' e 5 0 6 1 " I c " k u " q p " y j g " q r f " u k f " q h ' y j g " w r f c v g f " t c f k q o g t l e " c i g u " f g /

t k x g f " h t q o " u c o r r g u " y q w i j v ' v q " q t k i k p c v g " h t q o " E t k u k w o 0 J q y g x g t . " y j g u g " u c o r r g " c i g u " c p f " q w t " t g u w n " c t g " { q w p i g t " y j c p " y j g u g " f g t k x g f " d { " q j g t " y q t n g t u " x l c " e t c v g t " u c v k u k e u "] 38.3 ; _ 0 I k x g p " y j g " g z r q u w t g u " o q t r j q m i l e c n ' c h h k p k v { " v q " h q y q t / h t c e w t g f " e t c v g t u " c p f " q x g t r t k p v k p i " d { " g l g e v c " h t q o " y j g " e t c v g t " R t q e n w u "] 4 ; _ " e q o d l p g f " y k j " k u " { q w p i g t " c i g " e q o r c t g f " y k j " y j g " C O C u " f g v g t o k p g f " q p " y j g " g l g e v c " d r c p n g v " k ' k u " r q u k d r g " y j c v ' y j k u " g z r q u w t g " t g r t g u g p w u " y j g " h t u v / x q r e c p k u o " k p " E t k u k w o " d c u l p . " t c y j g t " y j c p " c p " k o r c e v ' o g m ' w p k 0 C n g t p c v g n { . " y j g t g " o c { " d g " c " o g e j c p k u o . " u w e j " c u " v c t i g v ' r t q r g t v { " q t " u g r h / u g e q p f c t { " e t c v g t k p i " g h h g e v u . " y j c v ' e c w u g u " y j g " g l g e v c / d c u g f " c i g u " v q " d g " q r f g t " y j c p " o g m / d c u g f " c i g u "] 52.53_ "

Conclusions and Implications: I k x g p " y j g " w p e g t / v c k p v { " k p " q w t " o g e u w t g o g p w u " q p " y j g " o g i c d m e m i r k m g " g z / r q u w t g u . " c p f " y j g " r q u k d k r k v { " y j c v ' y j g " y g u g t p o q u v ' g z r q / u w t g " o k i j v ' t g r t g u g p v ' r q u v / d c u l p " x q r e c p k u o . " y j g " e c p " e q p / u t c k p " y j g " c i g " q h ' y j g " E t k u k w o " d c u l p " v q " * 5 0 6 1 " I c "] y j k u " y q t m " c p f " 0 6 0 9 " I c "] 38_ " w u k p i " E U H F " o g e u w t g o g p w u 0

Q w t " y q t n i k m w u t c v g u " c p " g u a p v k e n " r g o g p v " q h ' u c o r r g " u k g " u g r e v k q p " h q t " n w p c t " e j t a p q m i { " o k u k q p u 0 P q v " q p n { " u j q w f " y j g " r p f k p i " u k g " j c x g " y j g " i t g c v g u v " r q u k d k r k v { " q h " r t q x k f k p i " y j g " f g u k t g f " u c o r r g . " d w w ' k v " c n u q " u j q w f " g p / e q o r c u u " c p " e t g c " y j c v ' o g g w u " E U H F " o g e u w t g o g p v ' t g / s w k t g o g p w u " v q " r t q x k f g " c " o g e c p k i h w l " e c r k d t c v k q p " r q k p v " h q t " y j g " n w p c t " e t c v g t k p i " e j t a p q m i { 0 Y j g p " g x c n e v k p i " r q v g p v k e n " r e p f k p i " u k g u . " E U H F " o g e u w t g o g p w u " e c p " r t q / x l f g " x e n c w d n g " k p h q t o c v k q p " c d q w " u k g " x l c d k r k v { 0 I k x g p " y j g " w p e g t v c k p v g u " y j c v ' t g o c l p " h q t " f g v g t o k p k p i " y j g " c i g " q h ' y j g " E t k u k w o " d c u l p " x l c " y j g " e w t g p v " u c o r r g " e q m g e v k q p " c p f " E U H F " o g e u w t g o g p w u . " d q j " t g w t p g f " q t " k p " u k w " u c o r r g " c p e n { u k i " h t q o " c " y g m ' f g h k p g f " r e p f k p i " u k g " y q w f " d g " x c n / w e d n g " h q t " d g w g t " e q p u t c k p k p i " E t k u k w o " a i " c i g " c p f " t g h k p k i " k u ' r q u k k q p " k p " y j g " n w p c t " d c u l p " u g s w p e g 0

References: "] 3_ " P g w n w o " g v ' c i r o " * 4 2 2 3 + " S p a c e S c i R e v " ; 8 . " 7 7 0] 4_ " U 0 4 h r g t " c p f " T { f g t " * 4 2 2 3 + " S p a c e S c i R e v " ; 8 . ; 0] 5_ " U 0 4 h r g t " g v ' c i r o " * 4 2 2 8 + " N e w V i e w s o f t h e M o o n , R e v M i n G e o c h e m 8 2 . " 7 3 ; 0] 6_ " I q m h h i " g v ' c i r o " * 4 2 3 2 + " L E A G M e e t i n g . " 5 2 9 4 0] 7_ " I q m h h i " g v ' c i r o " * 4 2 3 9 + " L P S C 4 8 . " 3 5 2 2 0] 8_ " N c y t e p e g " g v ' c i r o " * 4 2 3 5 + " L E A G M e e t i n g . " 9 2 6 : 0] 9_ " E q j g p " g v ' c i r o " * 4 2 3 : + " L P S C 4 9 0] : " _ " U y k p f r e g " g v ' c i r o " * 3 ; ; 3 + " P L P S C 4 3 . " 3 8 9 0] ; _ " Y k j g m u " * 3 ; ; 9 + " U S G S P r o f P a p 3 2 6 8 / C . " 9 3 " r r 0] 3 2_ " E c t f q i c p " c p f " V w t p g t " * 3 ; 9 9 + " P h i l T r a n s R S o c L o n d o n " C 4 : 6 . " 3 8 9 0] 3 3_ " F g w u e j " c p f " U 0 4 h r g t " * 3 ; ; 9 + " G C A 7 3 . " 3 ; 7 3 0] 3 4_ " U e j o k w ' g v ' c i r o " * 4 2 3 9 + " I c a r u s 2 9 8 . " 4 0] 3 5_ " R q f q u m i g v ' c i r o " * 3 ; 9 5 + I E C " 5 9 . " : 9 0] 3 6_ " U r w f k u ' g v ' c i r o " * 4 2 3 3 + " I I T " 3 3 8 . " 3 2 0 2 4 ; 4 2 3 3 I G 2 2 5 ; 2 5 0] 3 7_ " H c u g w g v ' c i r o " * 4 2 3 4 + " J G R " 3 3 9 . " 3 2 0 2 4 ; 4 2 3 3 I G 2 2 5 ; 7 3 0] 3 8_ " Q t i g n ' g v ' c i r o " * 4 2 3 : + " J G R . " r e v i s e d 0] 3 9_ " D e r f y k p " * 3 ; ; 9 + " K e c t w u " 9 3 . " 3 0] 3 : " _ " D e r f / y k p " * 3 ; ; 9 + " K e c t w u " 9 3 . " 3 ; / 4 ; 0] 3 ; _ " P g w n w o " * 3 ; ; 5 + " N A S A T M - 7 7 5 5 8 . " 3 7 5 " r r 0] 4 2_ " U r w f k u " c p f " U r k " * 4 2 3 9 + " G R L . " 3 2 0 2 2 4 4 2 3 8 1 N 2 9 3 6 4 ; 0] 4 3_ " J q y c t f " c p f " Y k n j k t g " * 3 ; 9 7 + " J R e s U S G S " 5 . " 4 5 9 0] 4 4_ " U e q w g v ' c i r o " * 3 ; 9 : + " U S G S M a p " K 3 2 5 6 0] 4 5_ " U r k " c p f " U r w f k u " * 4 2 3 8 + " L P S C " 6 9 . " 3 8 9 : 0] 4 6_ " J c t w { c o c " g v ' c i r o " * 4 2 2 : + " E a r t h P l a n e t S p a c e 6 0 . " 4 6 5 0] 4 7_ " T q d k p u q p " g v ' c i r o " * 4 2 3 2 + " S p a c e S c i R e v " 1 5 0 . " : 3 0] 4 8_ " O k e c g n i g v ' c i r o " * 4 2 3 8 + " I c a r u s " 4 9 9 . " 4 9 ; 0] 4 9_ " U w t o " g v ' c i r o " * 4 2 3 6 + " M A P S 5 0 . " 3 6 3 0] 4 : " _ " J k g u k p i g t " g v ' c i r o " * 4 2 3 3 + " L P S C 4 2 . " 4 3 9 ; 0] 4 ; _ " T w p { q p " g v ' c i r o " * 4 2 3 : + " L P S C 4 9 . " 3 7 5 8 0] 5 2_ " x c p " f g t " D a i g t v g v ' c i r o " * 4 2 3 9 + " I c a r u s 2 9 8 . " 6 ; 0] 5 3_ " _ " c p g w k ' g v ' c i r o " * 4 2 3 9 + " I c a r u s 2 9 8 . " 8 6 0