Mitochondrial DNA Studies of Native Americans: Conceptions and Misconceptions of the Population Prehistory of the Americas

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F e e a ea , DNA ha bee ega ded a a ıc a . ef f . d ı g ehı . The h a ı ch d ı ı a e a . c ea - ga e e ha ı g DNA ha e ı a a cı c a ec e 16,569 ba e aı ı e g h, ı hıch a . c e ıde ı - ı a d c dı g cı a e . :[3] Be- ca e hı DNA ı . ı . e a e a ı he ı ed a d, . ı e . c ea DNA, d e ec bı e, a cha ge ı DNA e . e ce a e he e . fac- c . a ed . a ı ı he ı ed f he da gh e . I addı ı ; DNA . a e a de f ag ı - . de fa e ha d e . c ea DNA, ı h he c eg ı . a ı g a a e e g ea e a e, a ı g ı a ıc - a . ef f a a e a ha ı e de h . Fı a , DNA e ı ı hıgh c . be ı ha ıd c dı - ı . C e . e , ı ı ea ı a a ed ı he ab a a d ca be ec e ed f ehı ıc bı gıca a e ıa ı . f cıe . . a ı ıe f a ı ca- ı a d a a ı . ı g he e - a e cha ı eac ı .

HAPLOGROUPS AND HAPLOTYPES

Ea . dıe f Na ı e A e ıca DNA e ea ed f . a c ade , ha g . , f ha e .[4,5] A- h . gh he a e b ad dı ıb ed h . gh . he A e ıca , he e f . ha g . e hıbı ıg ı ca e- g ı a a e ı g a g a ı e . . - a ı f N h A e ıca. A f . ha g . a e ha ed ı h A ıa . . a ı , c ı g he c c . - ı f c a ıca ge e ıc . dıe ha he A e ıca ıg a ed f A ıa ac he Be ı g a d b ıdge.[4,5] Ea a a e f e ıc ı f ag e e g h hı ı he e ı e ı - ch d ıa ge e h ed ha he e f . a c ade c . d be ead dı - ı g ı hed b he ga ı f e e e ıc ı ı e b he e e ce ab e ce f a 9 ba e- a ı de e ı ı he COII- RNA ı e - ge ıc eg ı .[5] T ı a d c - e f . d ha dıag ıc . a ı , ı he CR acc a ed he e ıc ı a e a d he f ag e de e ı ha cha ac e ı e he f . ha - g . , a ı e ec ed f a ec - bı ı g DNA ec e. Each ha - g . c . d be f he dı ıded ı . bc ade dı c e e ha e ba ed addı ı a e ıc ı f ag- e e g h hı e- cı c CR . a ı .

A h gh c e dı g ha - g . ca be f . d ı a ı . A ıa . . a ı , f . dı g ha - e f he Ne W d a e ha ed be ee he c ı e , aga ı c ı g ha he A e ıca e e ı ı a e ed b a ı ı ed : be f fe a e ı ıg a f A ıa h e DNA . de e . b e . e e . - ı ı de e de f ı a ce a f ı A ıa.[4]

U ı e ı f M ıch ıga ı A b . He ha c d c ed hı d c a e ea ch Na ı e A e ıca ıg a ı ı he hea e a d . h e e U ı ed S a e ı h d- e DNA, a e a a a a ı f a - ca e DNA f he C . bıa P a ea . He ha ece a h ed (ı h D . E h e a a d S ı h) a a a ı f DNA dı e ı ac N h A e ıca.

Da ıd G e S ı h ı a fe fa h - g a he U ı e ı f Ca if ıa, Da ı . He d ec e ea ch ı Na ı e A e ıca ge- e ıc a ıa ı a c e DNA a a ı a e a h a ı a e ge e ıc . U- de hı dı ec ı ; he ab a f ec - a a h g a UC-Da ı ha bee ı e ga ı g h a ıg a ı ı h a c e

e r h he r g e- g a r h h- e r. The CR e . e ce f he g ea a- r f a Na r e A e ca e be f ha g . A, ega d e f r g r- c af a r ; ha e a C→T a r r a 16111 ha r ee r a A a . a r e ce a fe r Ea e Sbe a, r c. d r g he Ch - chr.[19] The ed r a ce f hr a e r he A e ca a d r c- c . ab e ce f A a . he e ha hr a e gr a ed r Be r gra af e r e e e. A cha ac e r c Na r e A e ca f f ha g . C ha r c. de he C→T a r r a 16325 a d a f f ha g . X ha r c. de he T→C a r r a 16213 a e b h de ead r he A e ca a d ab e f A a, . gge r g a Be r gra . ce f , a d a r g e gr f, h e ha g . a e . Tha a a- c a a e r de ead r r dr- d a c a r ed a A e r d, E r , a d Na-De e b d e cc r a A a . ce . de f ea e Sbe a . gge ha ea e f a h ee f he ed dr r r ha e a c Ne W d gr.[19] M e- e , B a a d Sa a 19 e ed ha he dr e r f ha g . A a g G ee be g, T e , a d Zeg - a' r cr e Na r e A e ca a- g age g . r g a e a ab r - r a r hr each f he h ee r g r c h a. I addr r he C→T a r- r a 16111, he Ch chr f N hea e Sbe a ha e a C→T a r r a 16192 r h a Na- De e a d E r a e , . gge r g a c a ce f e be f b h a g age h a.[19,23] The Ch chr gh be a a e A a e a f a Be r gra . a r ha e a a ed f a he A a g . bef e e e ge ce f he a r r a 16111 a d, ge he r h he Na- De e a d E r , e e e ced a a e e- e a r d r g hch he C→T a r r a 16192 e e ged, a . gge ed b F e a d c e .[21] P . a r c ac r a g he e a Be r gra , h e . ab e e r a ed f he A e r d . a r ha had ea e ed . h r N h a d S . h A e ca, gh ha e e . ed r he d a a c ed c- r e c r f e be f ha g . B, C, a d D a g he Be r gra . Thr ce a r r c- r e r h e a a e gg a r he Ne W d f he Na-De e a d E r- , b r ha a e ee a r e e a r g dffe e e h d f . f he h.

Whr e B a a d Sa a c . d e r a e he e . e ce dr e ge ce f ha g . B, C, a d D r he Na- De e a d E r , r h he e ha - g . a e a e, he d d a e he e a r e dr e r f ha g . A, B, C, a d D r A e r d . A r he a a- r f ha g . dr b r b

Me r e he , R hha e , a d Fe- e ,[16] a ge a e f ha e h ed ea -e . a e e f e . e ce dr e r r a f . r eage .[24] L e a d S r h[1] f . d r r a dr e r e e r f . ha g . he ge- g a hca dr e e a e e ec- de ed. A h . gh e a h . e- r he he he e . a dr e r e r a e a e a e . f e c-

e e a r g dffe e e h d f

e a a r f ab gr a . . a-

a e a a a e r a be
f 30,000 ea BP r e ha
11,000 ea BP.[1]

dr g f , dre f de DNA
a d he ge e rc hr . Ha g , A, B, C, a d D ha e bee
rde r ed h , gh a a e f b h e-
rc r f ag e e g h -
hr a d CR e , e c r g r a
ehr rc a e r b h N h a d
S , h A e rca.[18,40,54,58, 1, 2] Sr r a r-
re r b h ha g , f e , e cre
a d ecr c ha e f a cre
DNA a r drca e ha , f he
a , E ea c ac drd rg rf-
rca affec DNA dr e r r he
A e rca .[18,54, 2]

The e e ce f ha g , X ha
bee c ed r ehr rc a d
hr rc b ra he C , bra
P a ea ,[3] hr e , e ce da a , g-
ge r e e ce r he ehr rc O-
e a , a r[18] a d e-C , bra
S , h A e rca.[40] Ha r h a d c-
e[4] a e ed ha g , X
f Wr d e d e e (,000
8,000 ea BP), a h , gh he e-
, e ce ge e a ed r he , d , g-
ge he rbr r f c a r a r
r e a e .

Whr e ha g , B, C, a d D ha e
a bee rde r ed r Pa e -I dra
e e a e ar ,[54,55,56] he de e-
ed e be f ha g , A, he
c ha g , r N h
A e rca a d he Ne W d, da e
4,504 ± 105 ea BP.[5] H -
e e , e a r e fe Pa e -I dra a -
e ha e bee a a ed a d a a -
r f he e ha e c e f he
e e U r ed S a e , he e ha -
g , A r a e r de , a r
e ce a g he c a . I a e r r-
a e rc r a a r f 18 a e
da r g bef e 6,500 ea f age,
e be f ha g , A e e e-
ed.[56] The br ra babr r f
rde rf r g e be f ha -
g , A a g 18 a e , gr e he
e e dr rb r f ha g ,
r hr he c r e a U r ed S a e ,
r 0.001 .

Fr a , r a a , dre f a-
cre Na r e A e rca , a r ,
r dr rd a ha e bee dr c e ed h
d a ea be g e f he
e f , dr g r eage . I a ca e ,
hr r , d , b ed a e , f e e a
c a r a r f a e ac r g
DNA r hrch he DNA r r hrbr ed
f a rf r g, r g he e a e
char eac r : N e he e , he -
rbr r e ar ha addr r a ha -

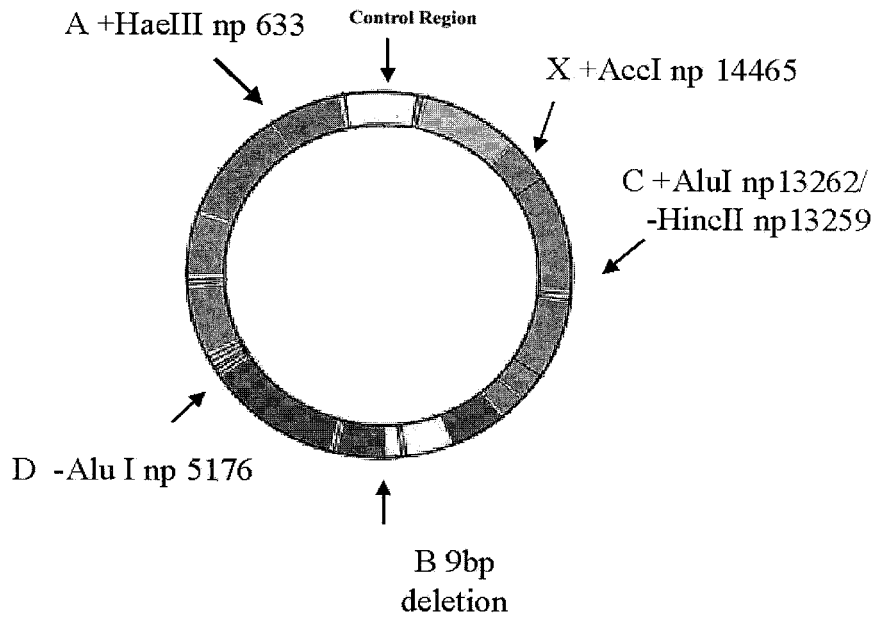

Fig re 1. Map of h man miTochondrion ho ing locaTion of The conTrol region and of pol morphic iTe marking 5 kno n NaTį e American fo nding haplogro p .

ı ha g . f e . e c dı ıb - ı . I he S . h e , he e ı ıa - ı ıe c -c he b . da ıe a g dıffe e . e a ed a g age , . g- ge ı g c ıde ab e ad ı . e a g he . The e c c . ı a e c ı - e ı h he e . f ea ıe . dıe ba ed b h h g (f e a - e, de a a ıa ı 9) a d b d g . he e .[80,81] The S . hea eg ı f N h A e ıca d e dı- a a h ge e . a e f ha - g . f e . e c dı ıb ı , ba- b d e ge e ıc b e ec ca ed b he hıgh ı ac f E ea c - ac ı hı eg ı f ed b ge e ıc d ıf .[82]

S . dıe f a c ıe DNA dı e ı ı eg ı f N h A e ıca e- ea ha Na ı e A e ıca ha g . f e . e c dı ıb ı f e e hıbı e a a e a eg ı a c ı . - ı .[2,83] I addı ı eg ı a . dıe , a a e f DNA ha e bee ed ı dı ec e f ec ı c h he e f . a ı e e ed b adı ı a N h A e ıca eh ı - ıa (a che g ı a d ı g ı) a h ı Tab e 2. Ca e a d c - eag e [2] ha e de a ed ha he ha g . f e . e c dı ıb ı f a a c ıe . a ı ha ac ıced he A a a ı c . a adı ı ı he A e ıca S . h e ı ı g ı - ca dıffe e f ha ı de P eb . a ı . Thı . d - ıde bı gıca a e a c . a e ıde ce f . b e a ce a d de ce da e a ı hı ı he A e - ıca S . h e d ı g he a ı e ıa. Ma hı [3] ha h ha hıgh f e . e c e f ha g . B a d D ha e bee cha ac e ı ıc f - . a ı f he C . bıa P a ea f a ea eıgh ı e ıa. I c a , Kae e a d S ı h[54] ha e de - a ed ha a c e We e G ea Ba ı . a ı a e a ı ıca ıg- ı ca dıffe e f de - . a ı ı he a e eg ı ; bab d e a . a ı ead f N ıc ea e ı he G ea Ba ı f . he Ca f ıa a ı a e 1,000 ea BP.[84]

Rece eg ı a . dıe f DNA dı e ı ı hı N h A e ıca ha e h ha de a ed a a e f ha - e ca ıde be e e ıde ce f a c ıe ha ed a ce ha d ha - g . f e . e c dı ıb ı a e, hıch ca be ı ı a ı . a- ı d e cha ce a e. F e a - e, Ma hı, Sch , a d S ı h[42] ha e ıded e ıde ce f hıc ı e ı he c eg ı f a e ece ha ed a ce a g ea - e f I . ıa ; Cadd a ; a d S ı - . a a g age ha be ee a f he h ee a d ea e f A g . ıa a g age f Ea e N h A e ı -

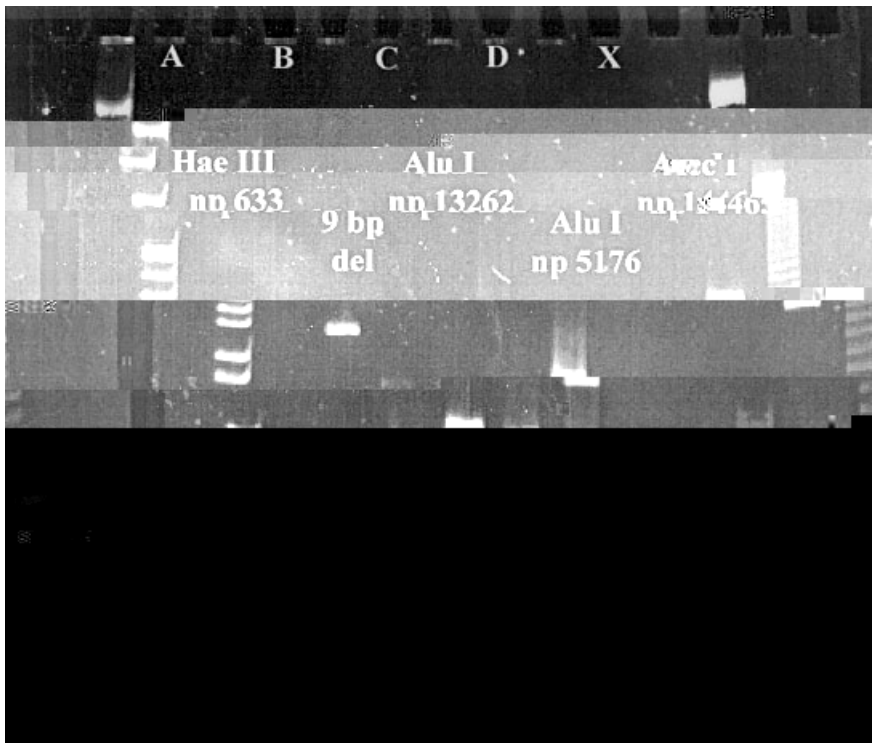

Fig re 2. ElecTrophoreTic gel ho ing PCR fragmenT ampli ed and dige Ted To re eal pol morphic iTe marking 5 kno n NaTį e American fo nding haplogro p .

ca.[42,85] We a d S h[82] ha e h ha ed a a he c e- g ha gge ha ed a ce a g ea e f he M gea a g age he S hea , e e h gh ha g f e e c d b a g he e g a e g- ca dffe e. Th , h e ge- e c b da e d a c ce h b da e ba ed he d b f a g age a d c- e, he a e de h he e ab eh ha ca be e ed g de a d eh c a- . I a e ha h- he e ba ed ge e c e de ce be c e h e de ce de- ed f h ca g c a d a- che g ca d e .

CONCLUSIONS

I ch- d a DNA ha a ge c ed he d g f c a ca ge e c a e ega d g ge e c e a h a g Na e A e ca ba g a d e ha c c e e ed ag g deba e ega d g be f g a- , ce a , a d he g f he e g a .[80,81] Th d e de e he f ge- e c da a, a d DNA a c a , f f e ea ch. Wh e edge f he DNA d e a g a ba a d a g age g e- a ed, he g g DNA da aba e b h h a d de he A e ca ffe a de f c a a- e . H e e, a e be ha DNA b e a e, a d e ha e a e- a he ed, a d e a e a e ega d g he g f Na e A e ca .[86] Wh e Y-ch e a e ha e bee e ed add e he e g f he A e ca , he ha e e bee ec ca ed add e c- a e e . L e DNA, Y-ch- e da a ha e he c c e a e ed e e- ga d g e he ce a h A a he be f g a- e f A a he Ne W d. C ea , c ea a e f e a e h d be e a ed de add a da a e e a he e c e e, e e h gh e ha add a da a g ca f ha a c- ed a d c e ce a f g a-

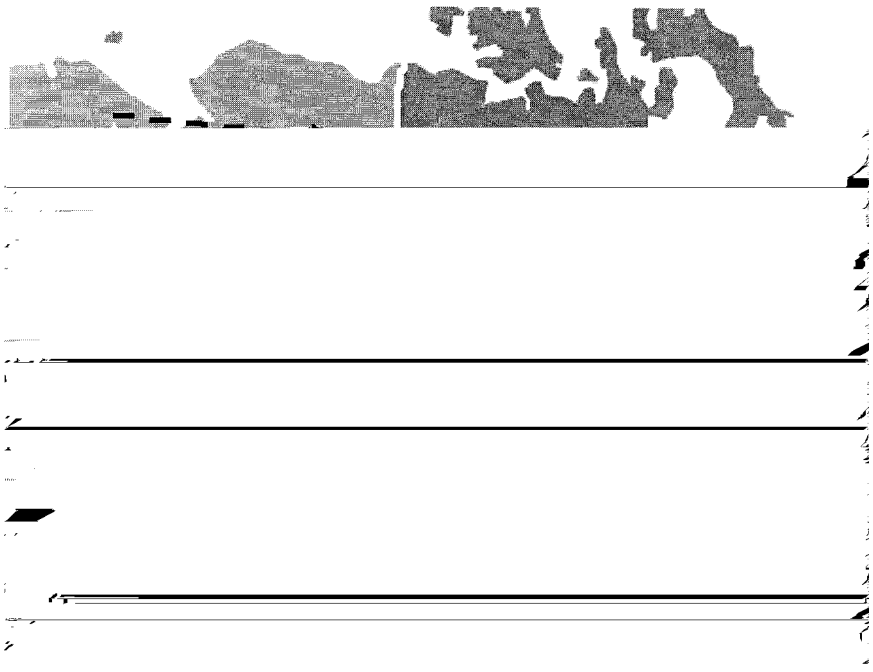

Fig re 4. AlTernaTi e ro Te from A ia inTo The aTaor(World. 4DoT97.3(7a il DoT(am46 7.3(coa)-411Clo-) T4

r a d g a r a e . r
a f ce .

A h . gh r r b e ha c ea
ge e a eda be e ea r
ec e ed f a c e h a e-
a , a f . a r e e
. d e f g e-c ge e a
h b r r e d f c r h a c e
DNA. The ca e f he . e r
ead r add e ed b a c e DNA
r d ffe e f ha f . e r ad-
d e ed b he ea e DNA . d-
e . Wh r e a decade ag e ea ch f -
c ed he A a af r e a d
r c r e g a r he Ne
W d, r e gh a hed . ;
r e e ed e h b r ed r ; c r a-
r e e a d r e ac r . The
a r g ece a f add e r g
c r e - de he e a r d ffe -

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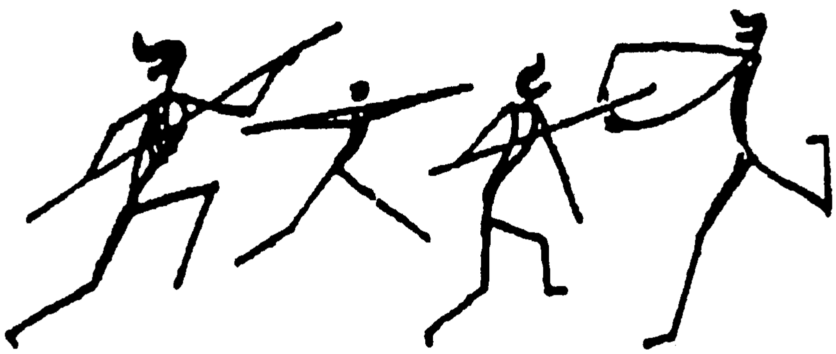
Reid a M, K i d T, Me a. E, Ka d a K, Ta be K, T H-V, Pa J, Be he a M, Zhada S, Pe a. E, G bi a M, G - be M, Da ba L, Fed a S, G a V, Ge- be h T, M a JP, Kh d a E, O - a L, S e a V, T A, Ric a d O, DeS efa GF, Pa ha S, Bec a L, R da P, A g . NP, K ie S, U a ga E, V e R. 2002. Ea g acia ead f ha g . X f E a ia A e ica. I P e a a i .



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