

# Genetic structure of the Japanese and the formation of the Ainu population

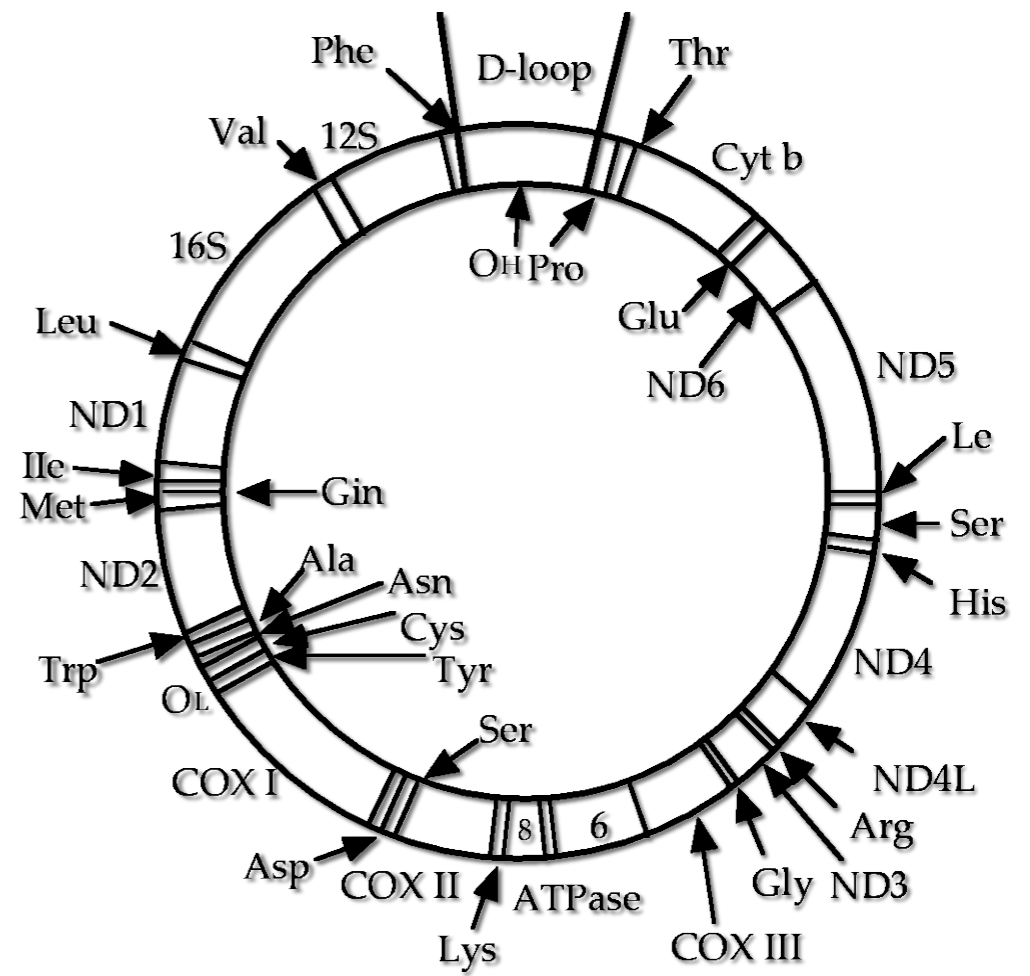
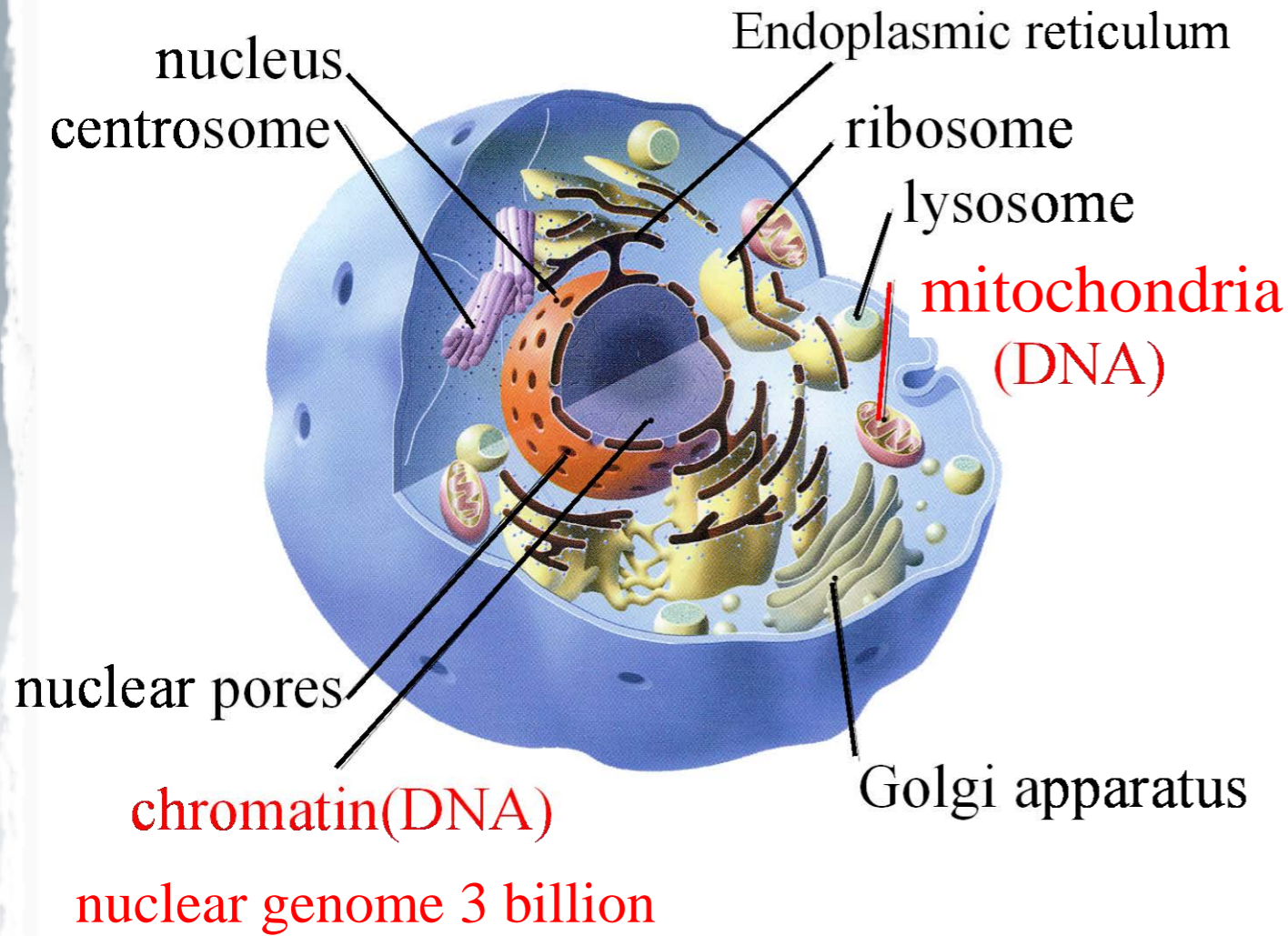


Ken-ichi Shinoda

National Museum of Nature and Science, Tokyo

# Mitochondrial DNA

## Schematic drawing of a cell



## Structures of mtDNA

16,569 base pair

# History of the analysis

1980's

Analysis of the DNA digested with restriction enzymes.

1990's

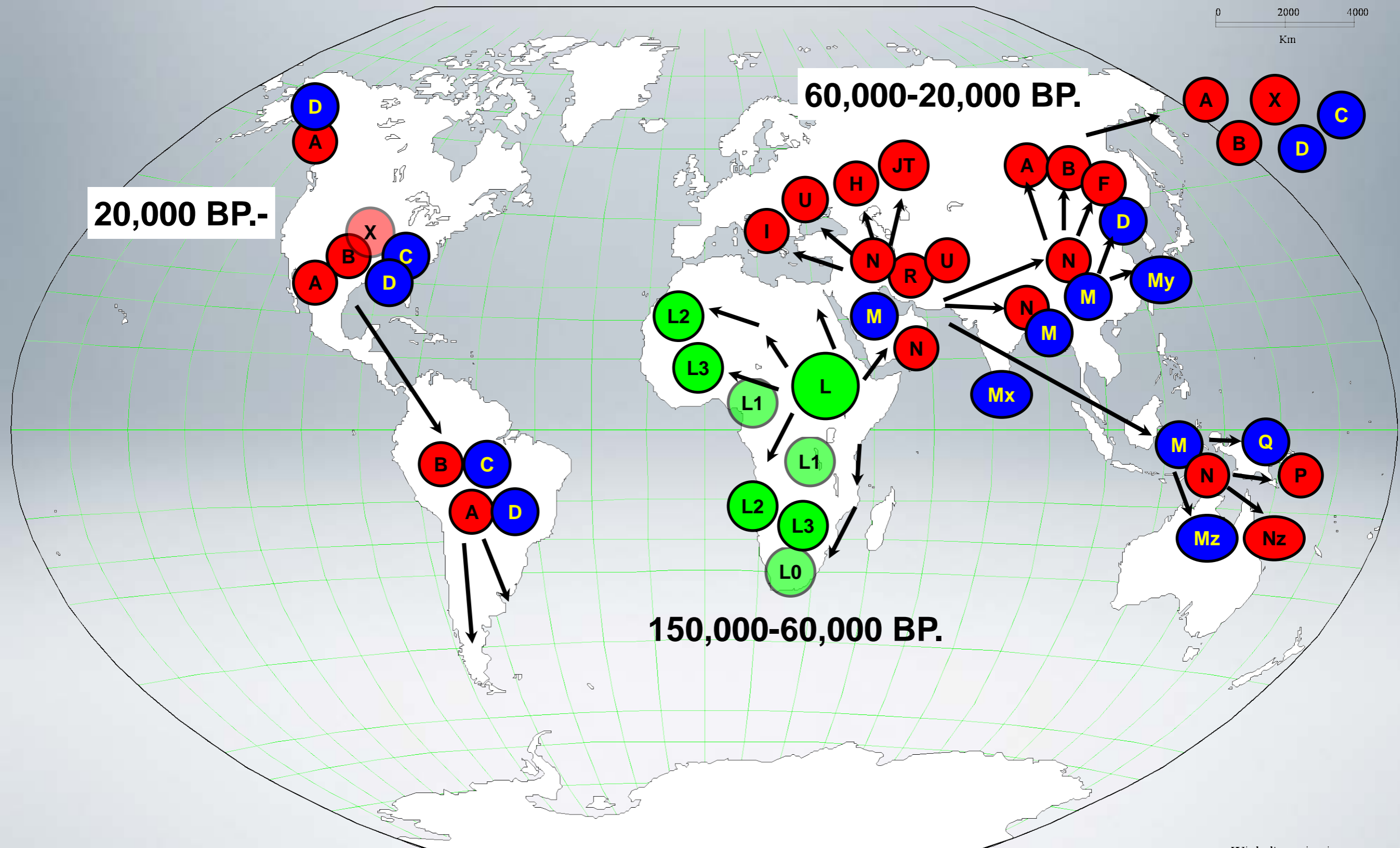
Analysis of sequence in a region of the mitochondrial genome that undergoes frequent mutation.

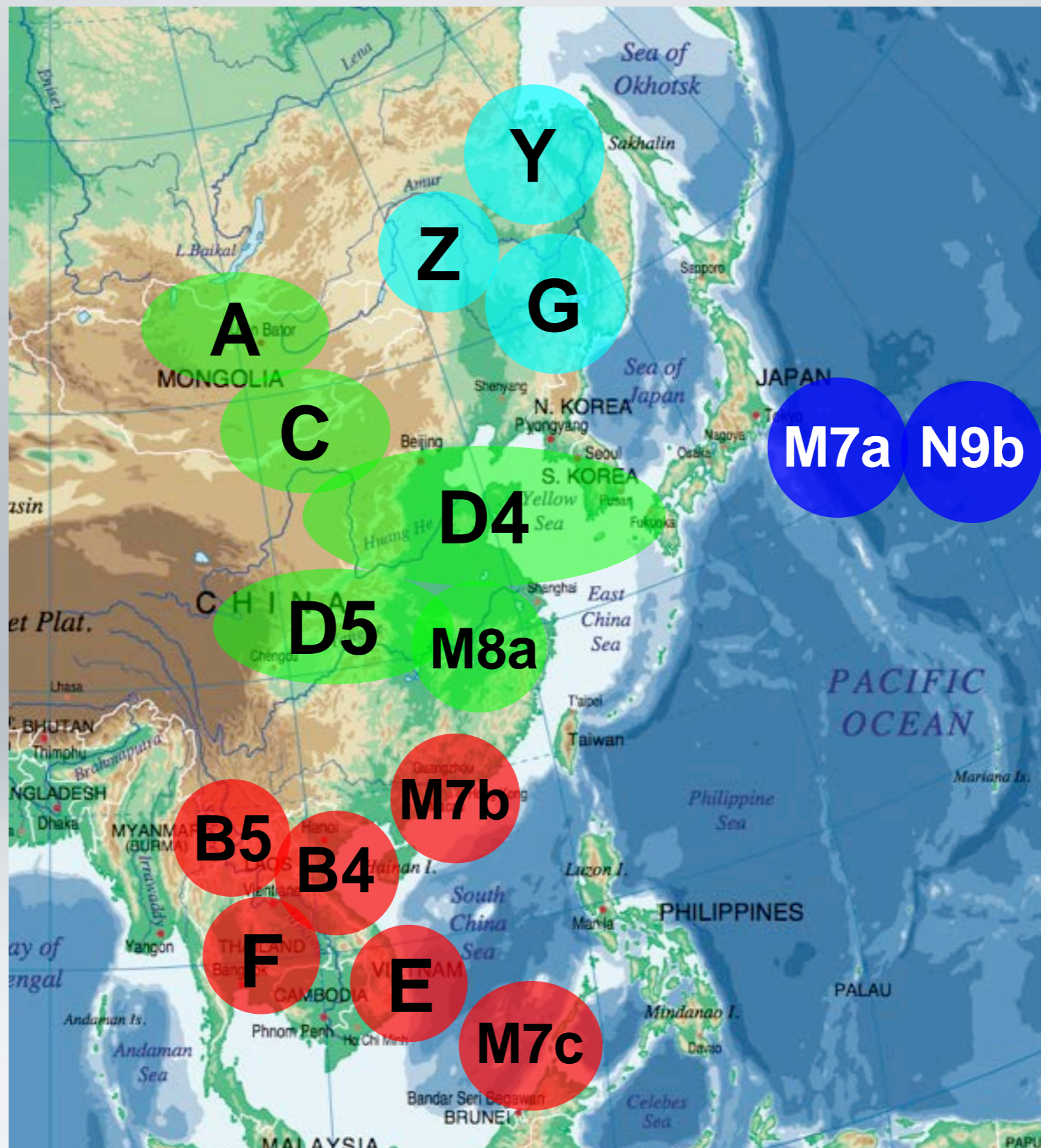
21th century

Analysis of the complete DNA sequence of mitochondrial genomes.



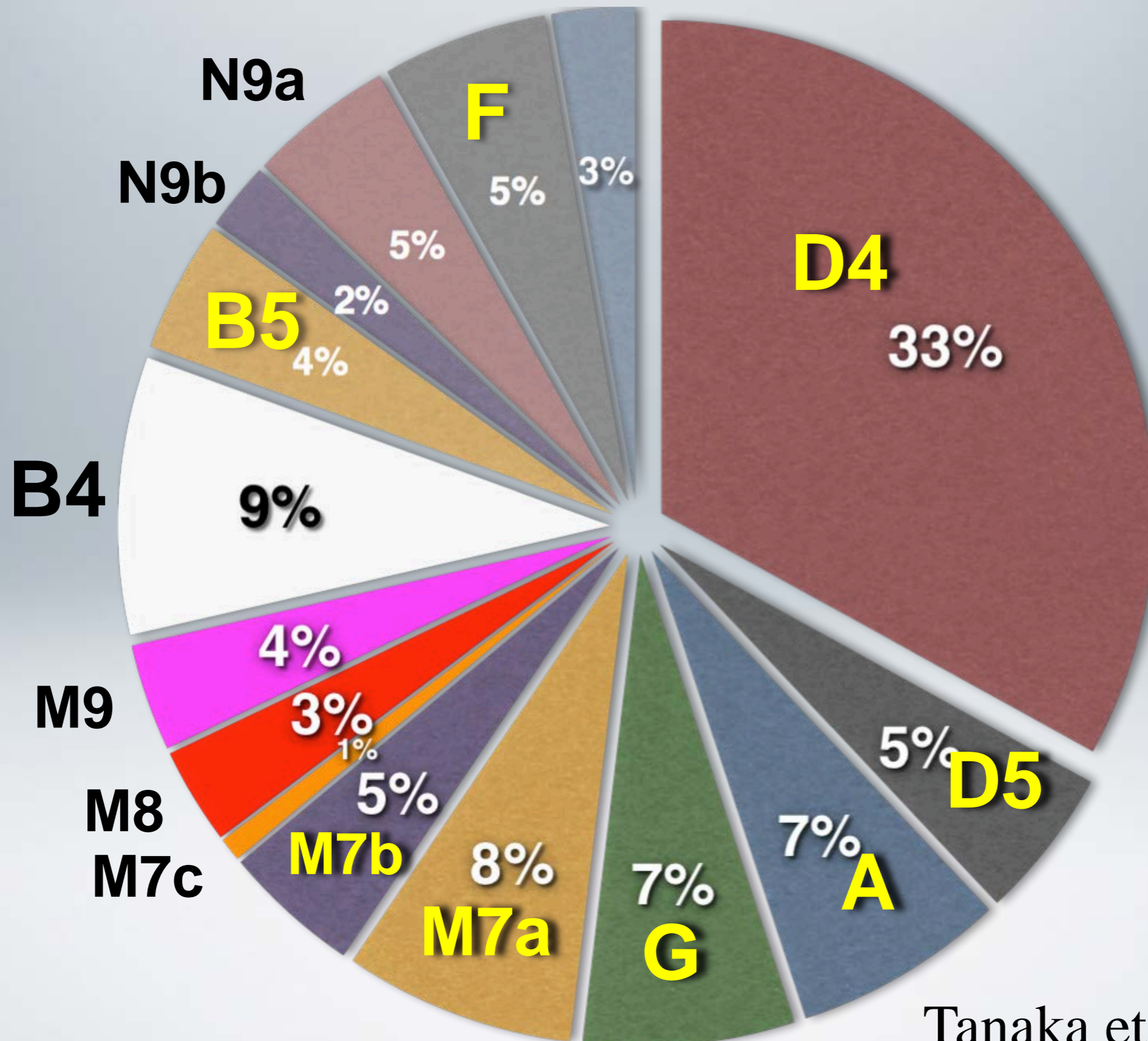
# Human migration and formation of mitochondrial DNA haplogroups



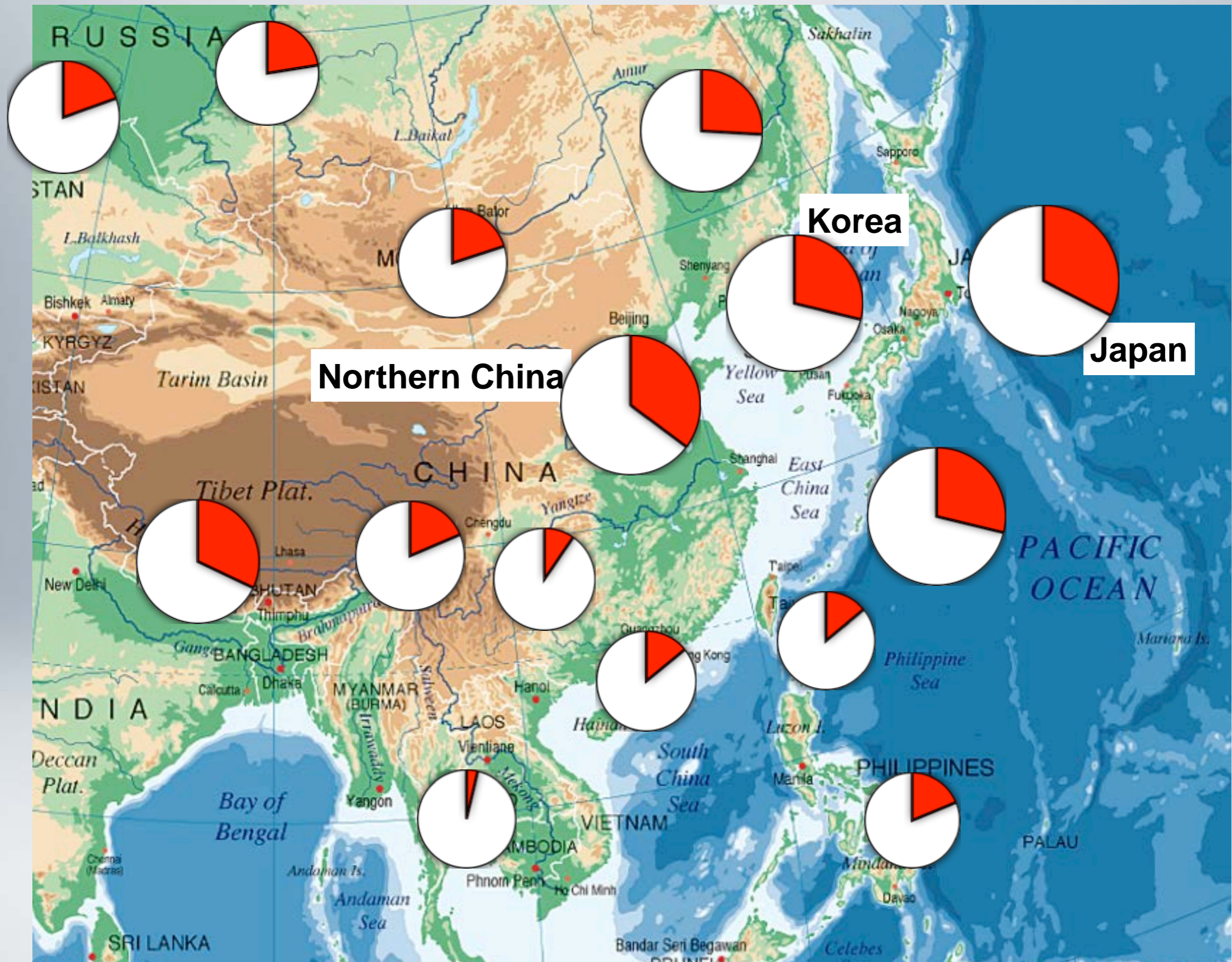


Distribution center of each haplogroup

# MtDNA haplogroup frequencies of mainland Japanese



Tanaka et al. 2004



**Frequency distribution of haplogroup D4 in each population**

# Jomon vs. Yayoi

40,000 BP.

15,000 BP.

B.C. 1,000

A.D. 300

Paleolithic

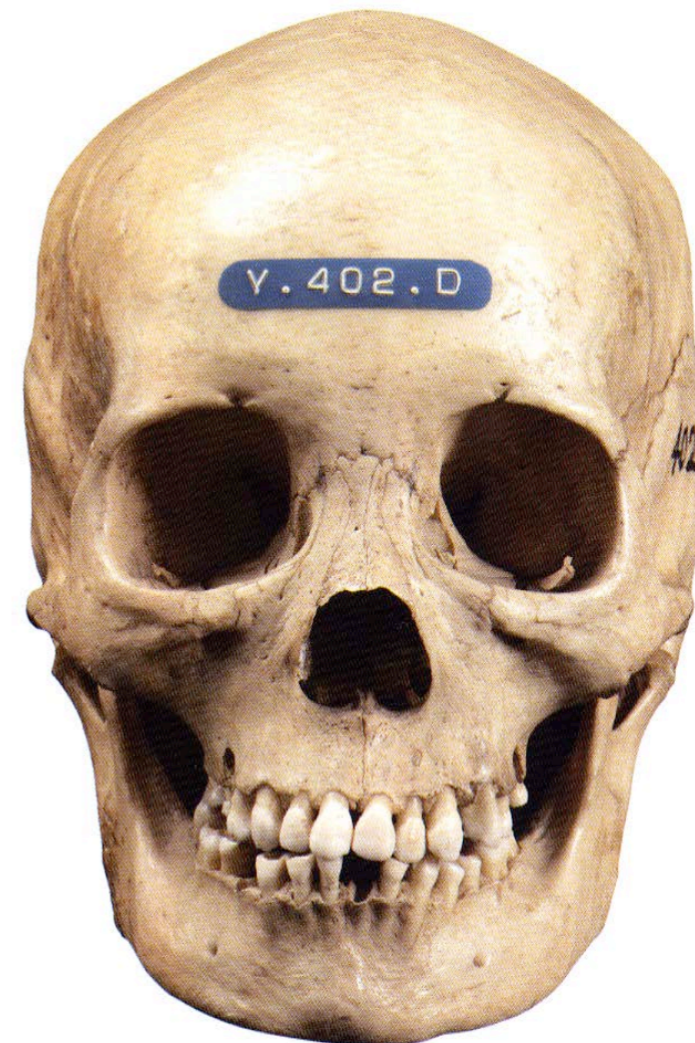
Jomon

Yayoi

Historic



Jomon female



Immigrant Yayoi female



**Jomon**

**Yoyoi**

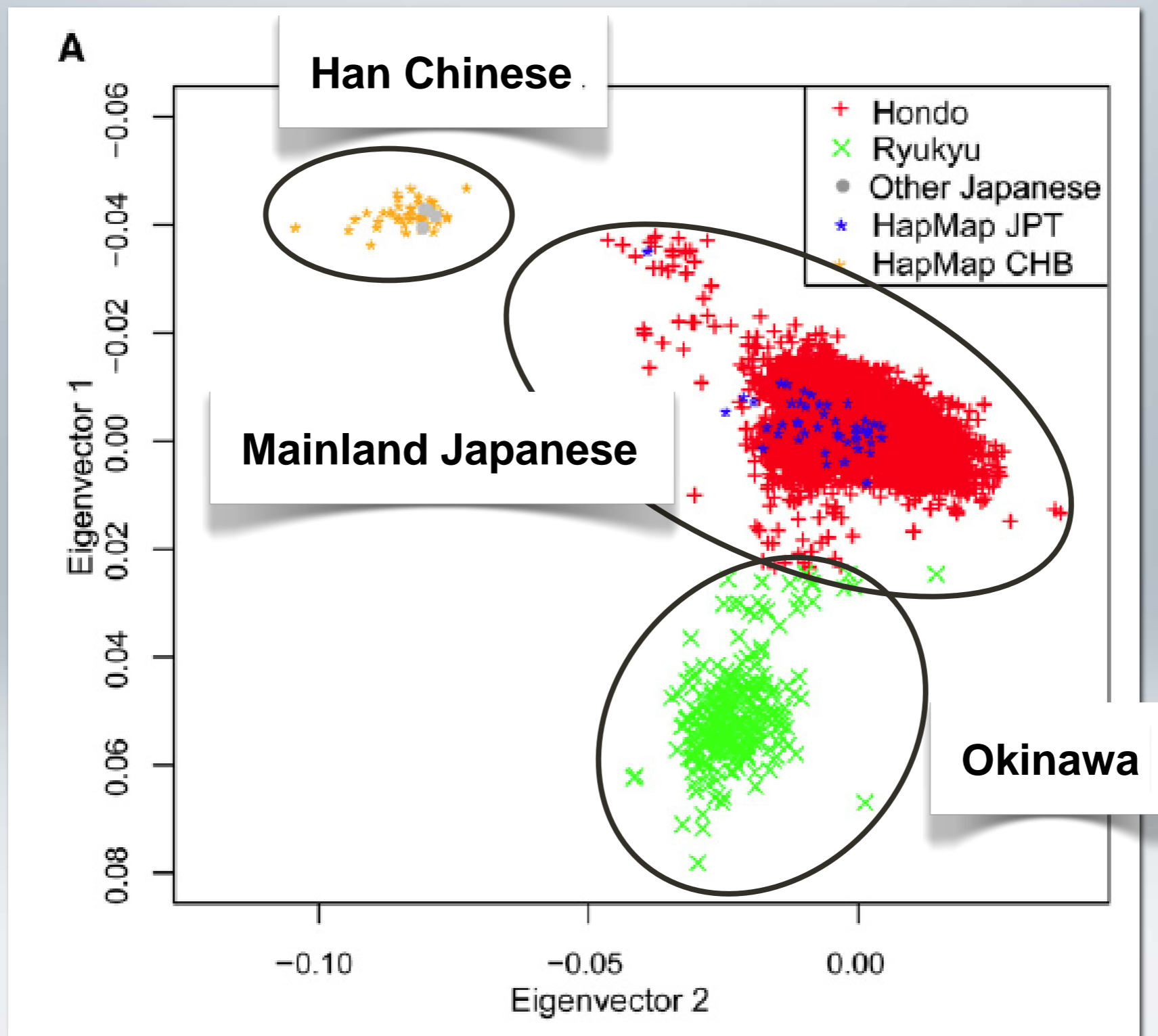
縄文  
JOMON

VS

弥生  
YAYOI



# Relatedness between 7003 Japanese Individuals



For the Japanese individuals, there were two main clusters: the Hondo cluster (red plus signs) and the Okinawa cluster (green crosses).

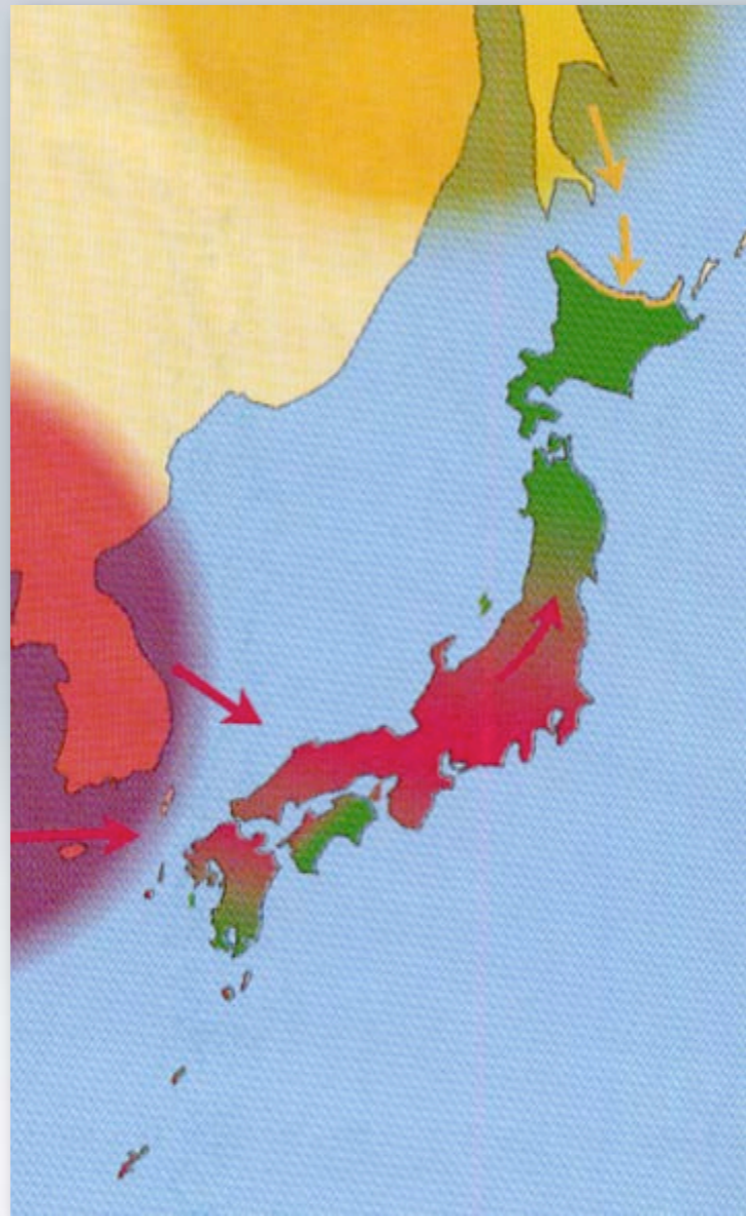
# Dual structure model

(K. Hanihara 1991)

(Okhotsk 5-10 century)



Palaeolithic to Jomon  
40,000-12,000 BP.

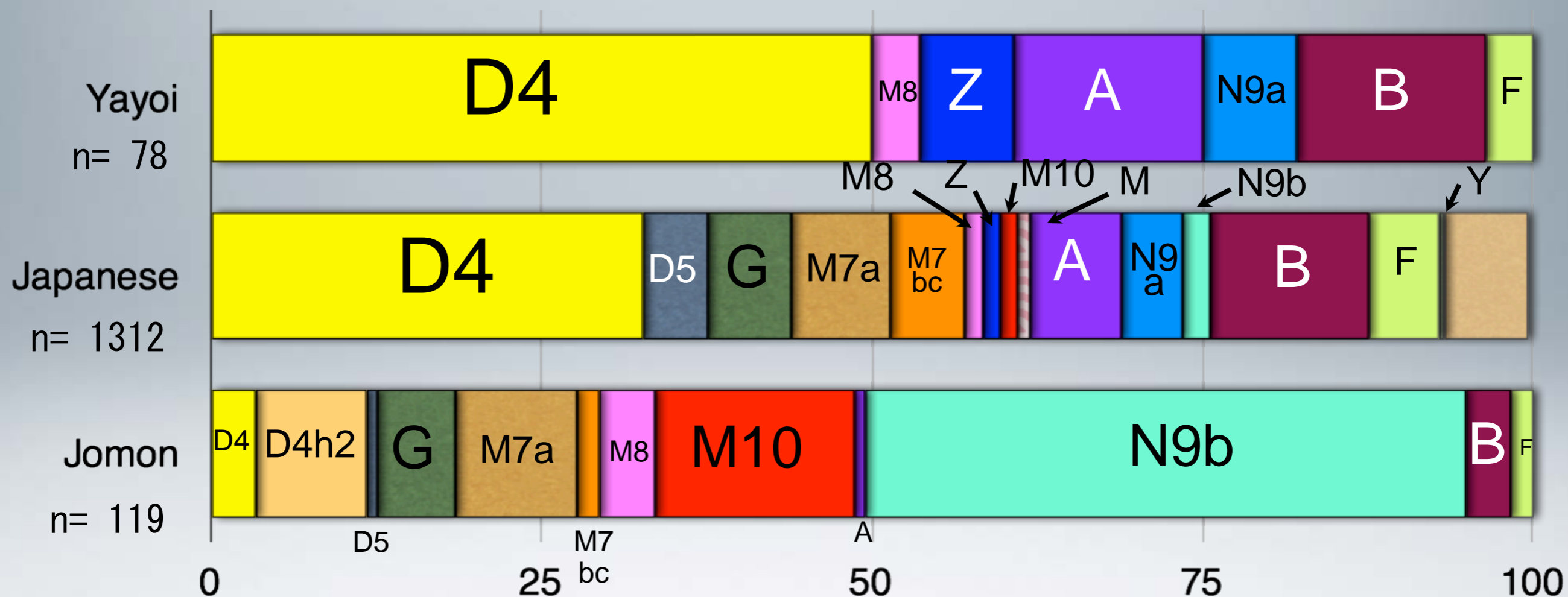


Yayoi  
3,000-1,700 BP.



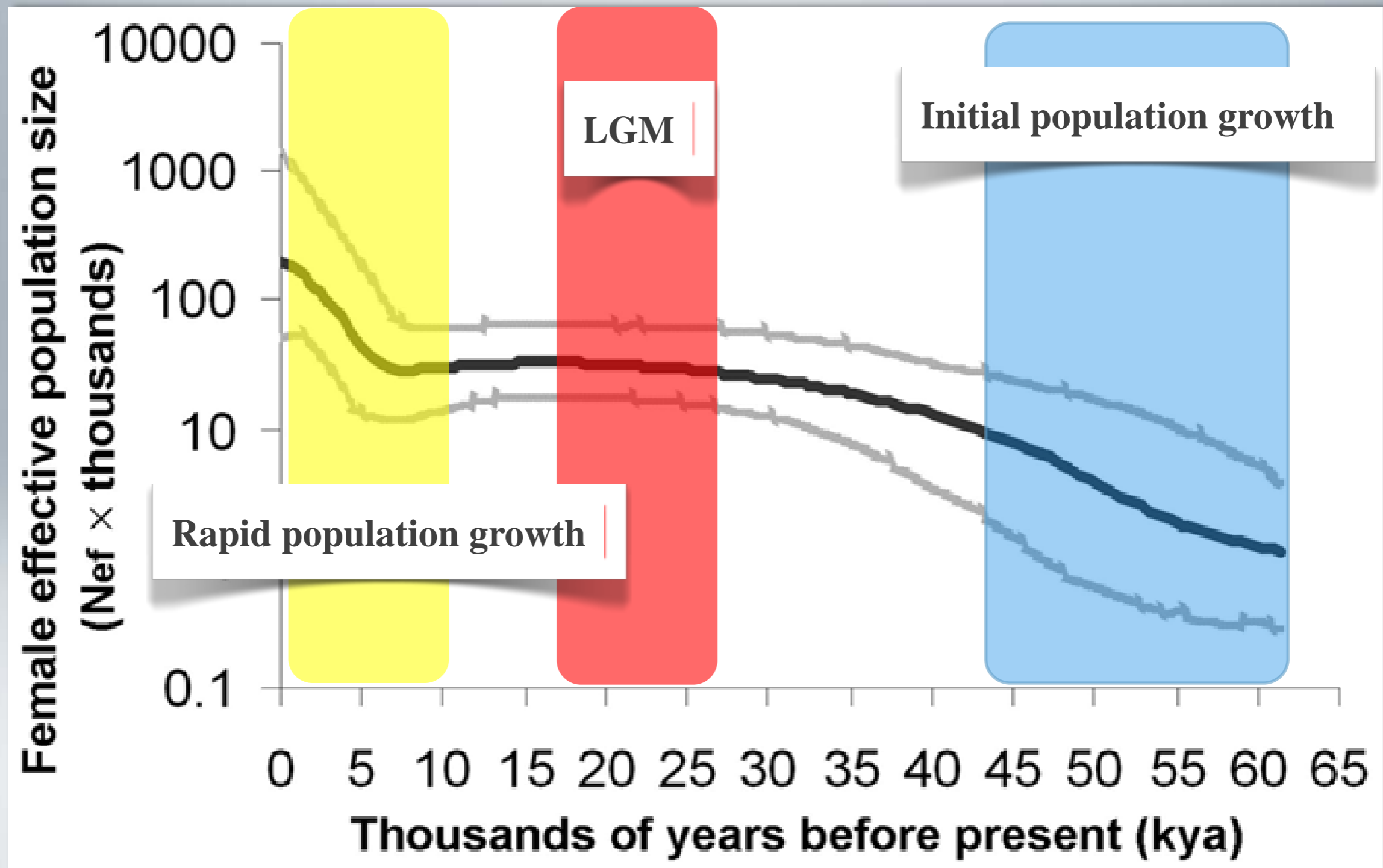
Historical  
1,700 BP. -

# Comparison of haplogroup frequencies between the Jomon, Yayoi, and modern Japanese populations.



**D4 is most common in the Japanese and Yayoi populations.**

# BSP of female effective population size ( $N_{ef}$ ) through time for Japanese mtDNA lineages.



# Population estimates by Koyama (1984)

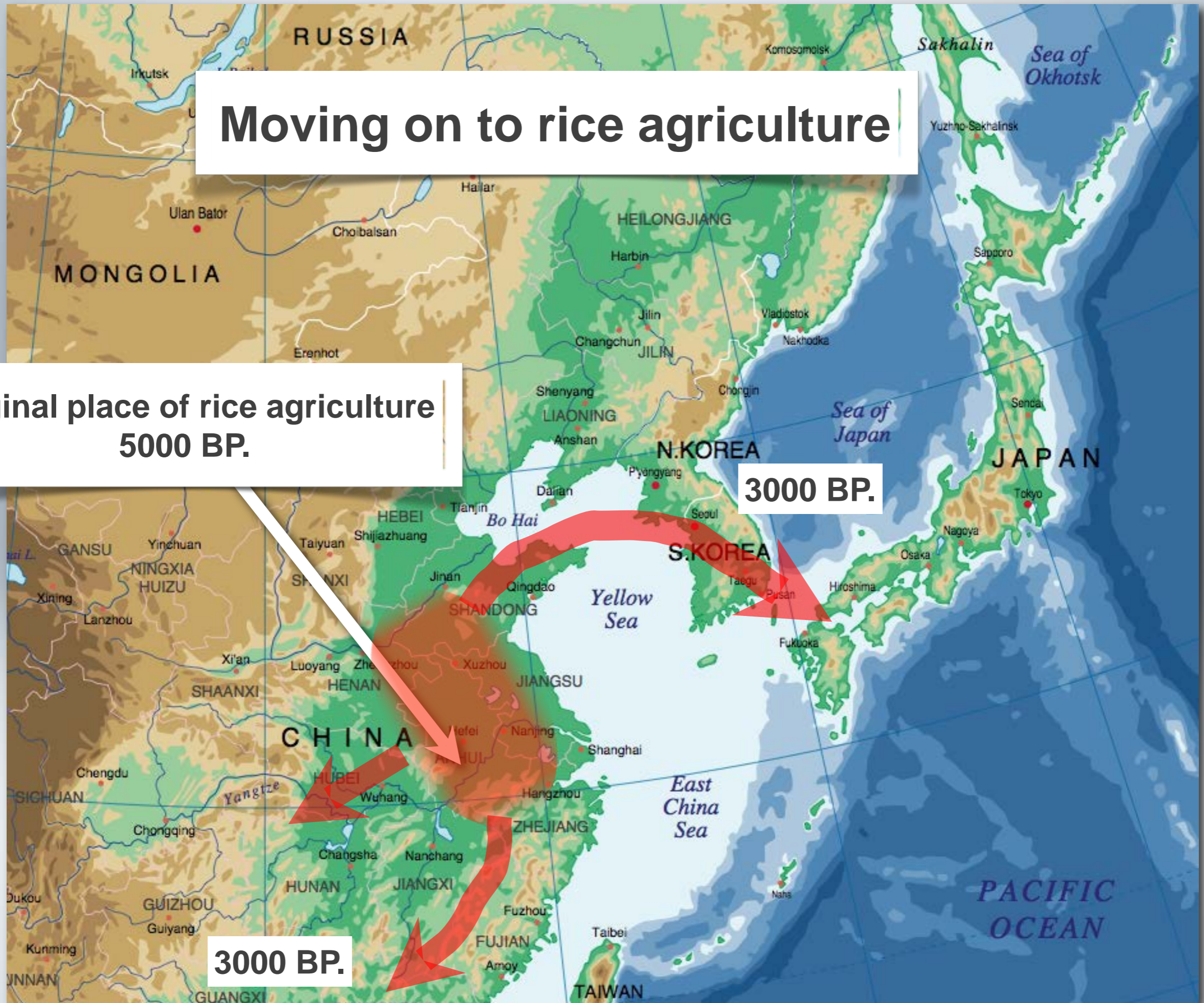


# Moving on to rice agriculture

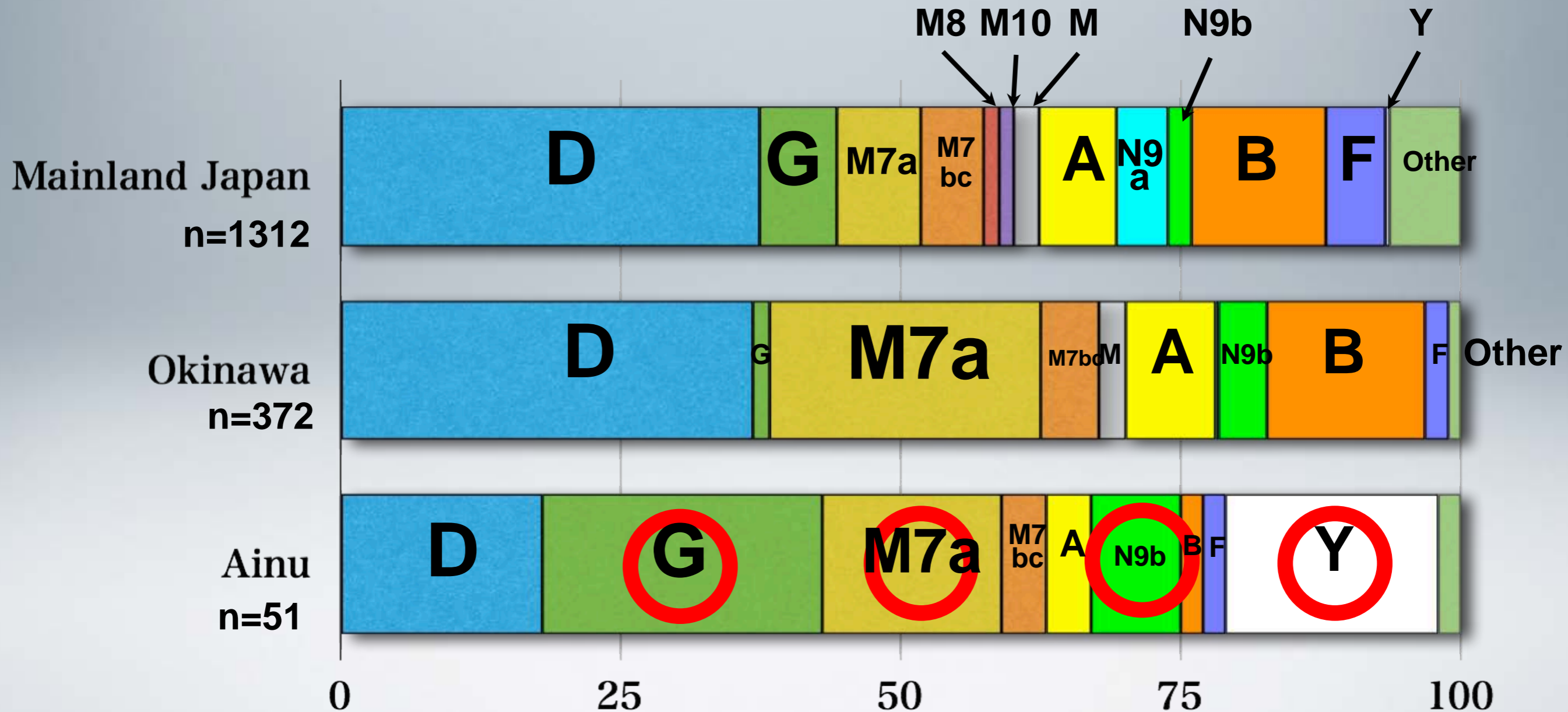
Original place of rice agriculture  
5000 BP.

3000 BP.

3000 BP.



# Comparison of haplogroup frequencies between Okinawa, Ainu, and modern Japanese populations.

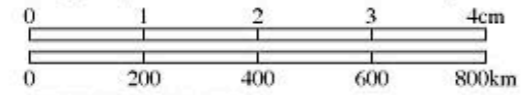




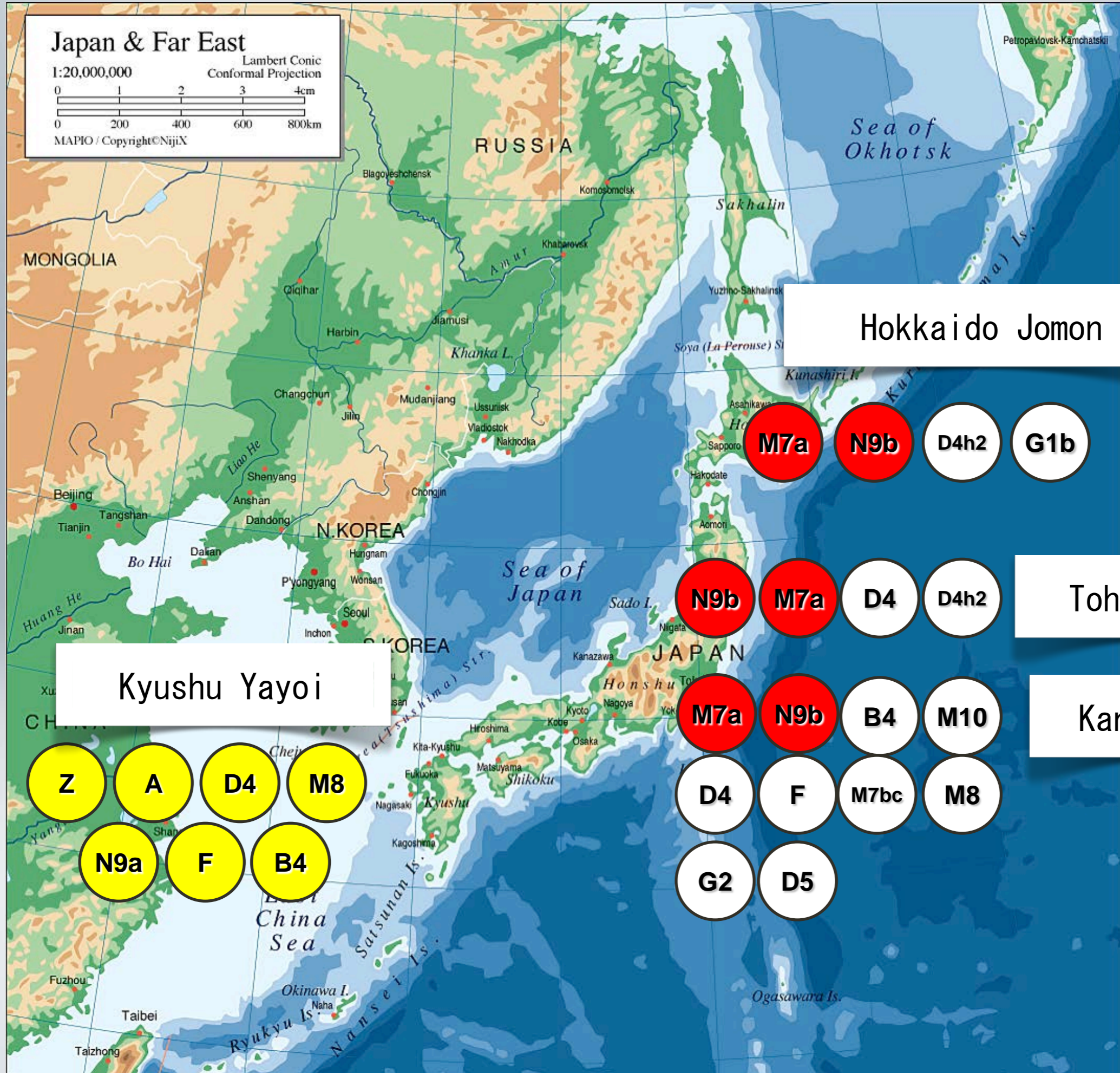
# Japan & Far East

1:20,000,000

Lambert Conic Conformal Projection



MAPIO / Copyright©NijiX



Hokkaido Jomon

M7a

N9b

D4h2

G1b

Tohoku Jomon

N9b

M7a

D4

D4h2

Kyushu Yayoi

Kanto Jomon

M7a

N9b

B4

M10

Z

A

D4

M8

D4

F

M7bc

M8

N9a

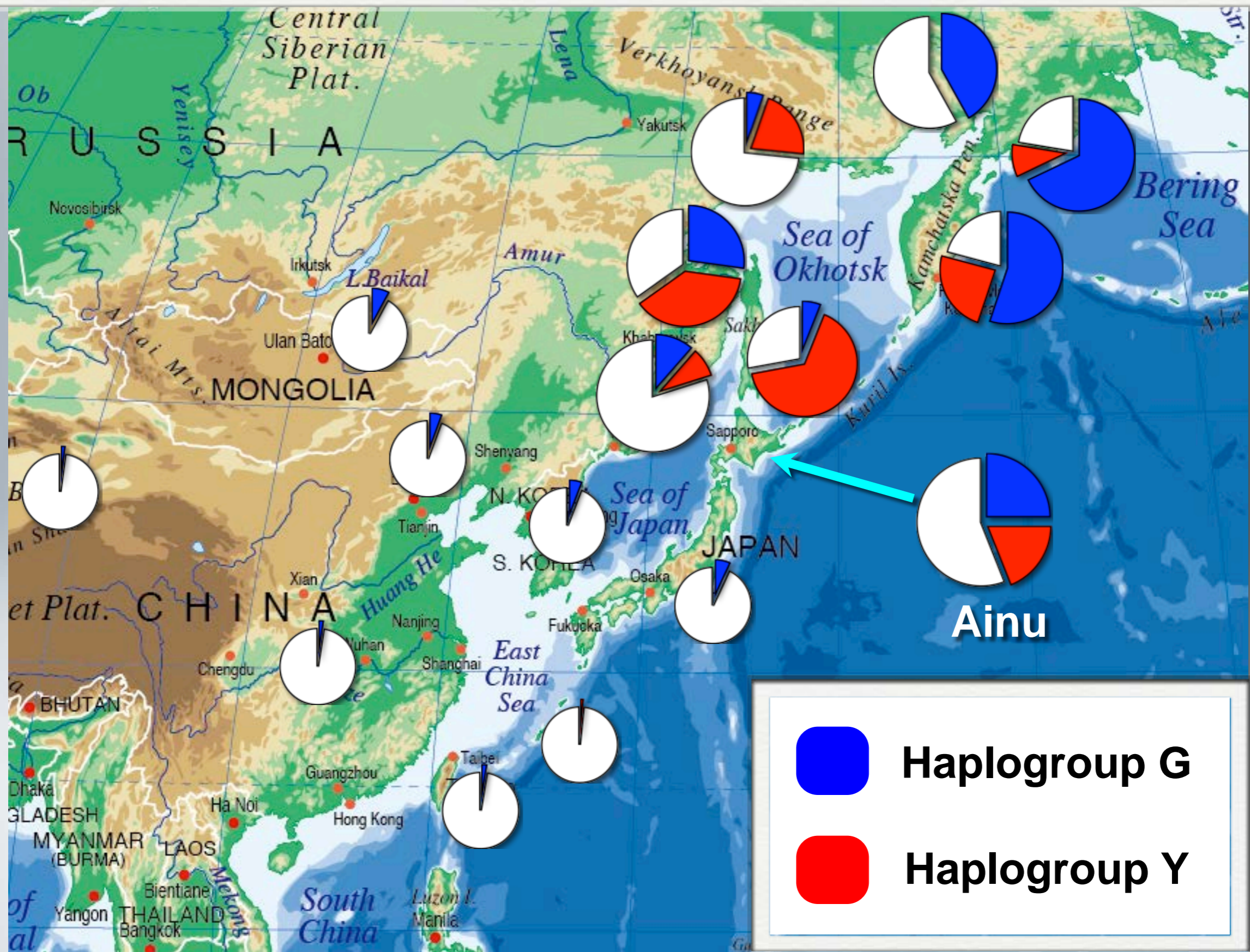
F

B4

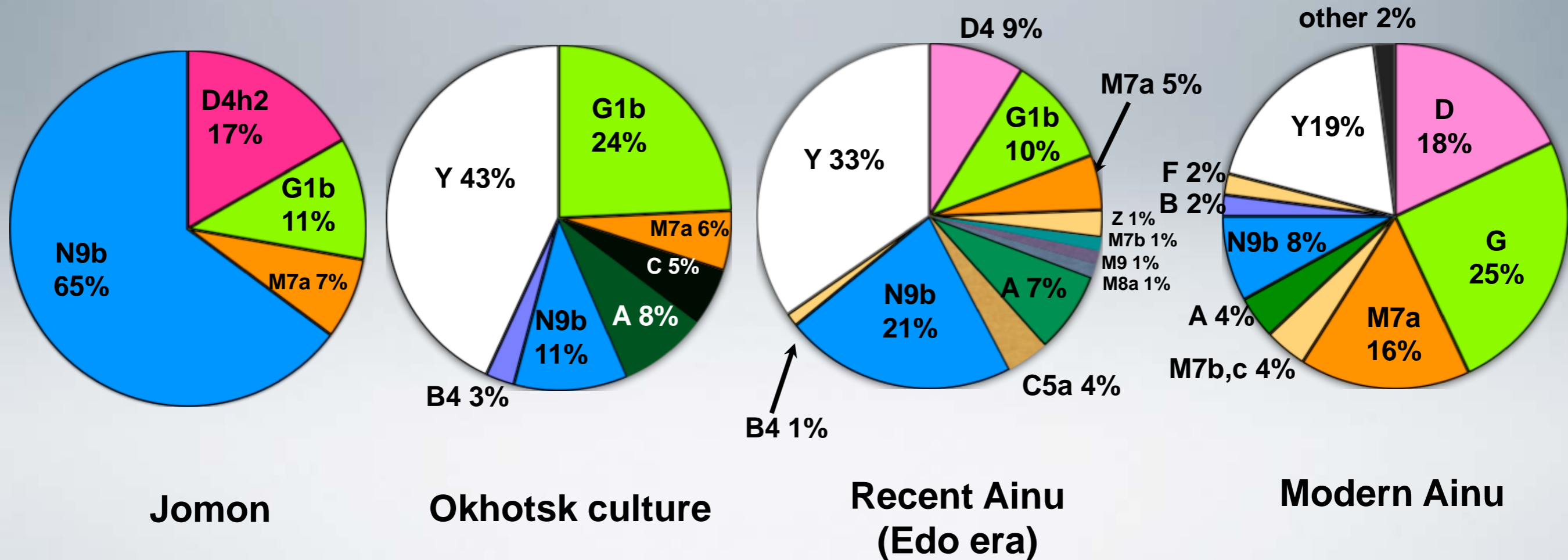
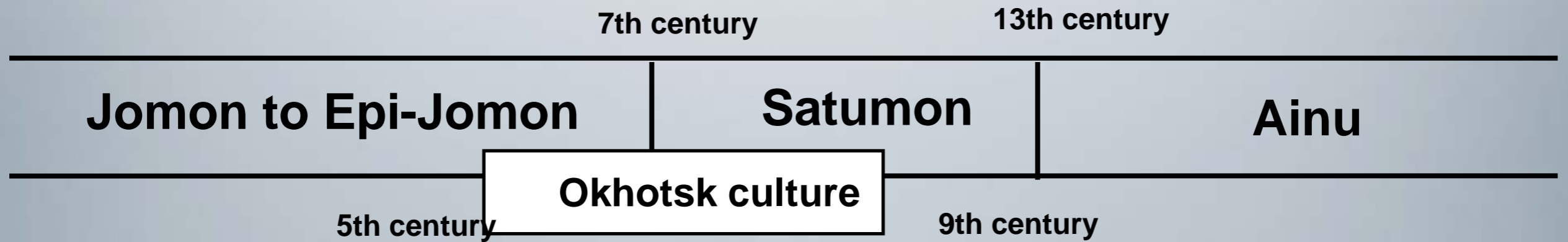
G2

D5

# Distributions of haplogroups G and Y of each population



# Population History of Hokkaido



**Thank you**

