



The Berbers

Linguistic and genetic diversity

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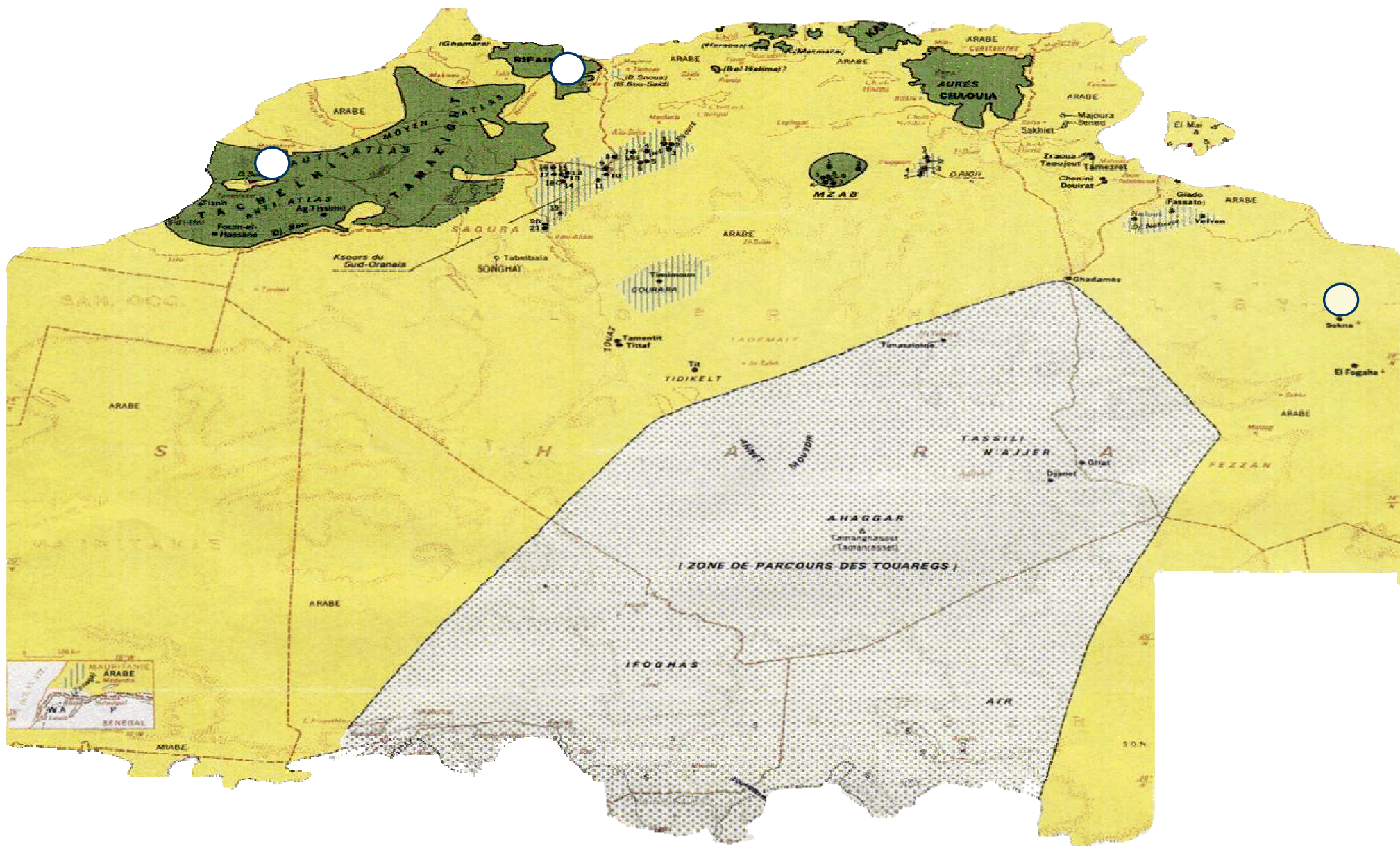
UMR 8555 CNRS Toulouse

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The Berber 'world'



Linguistic approach

- ◆ The Berber language and its place in Afro-Asiatic
- ◆ Sub-Classification
- ◆ Characteristics of Siwi
- ◆ The case of Tuareg
- ◆ Berber and Afro-Asiatic

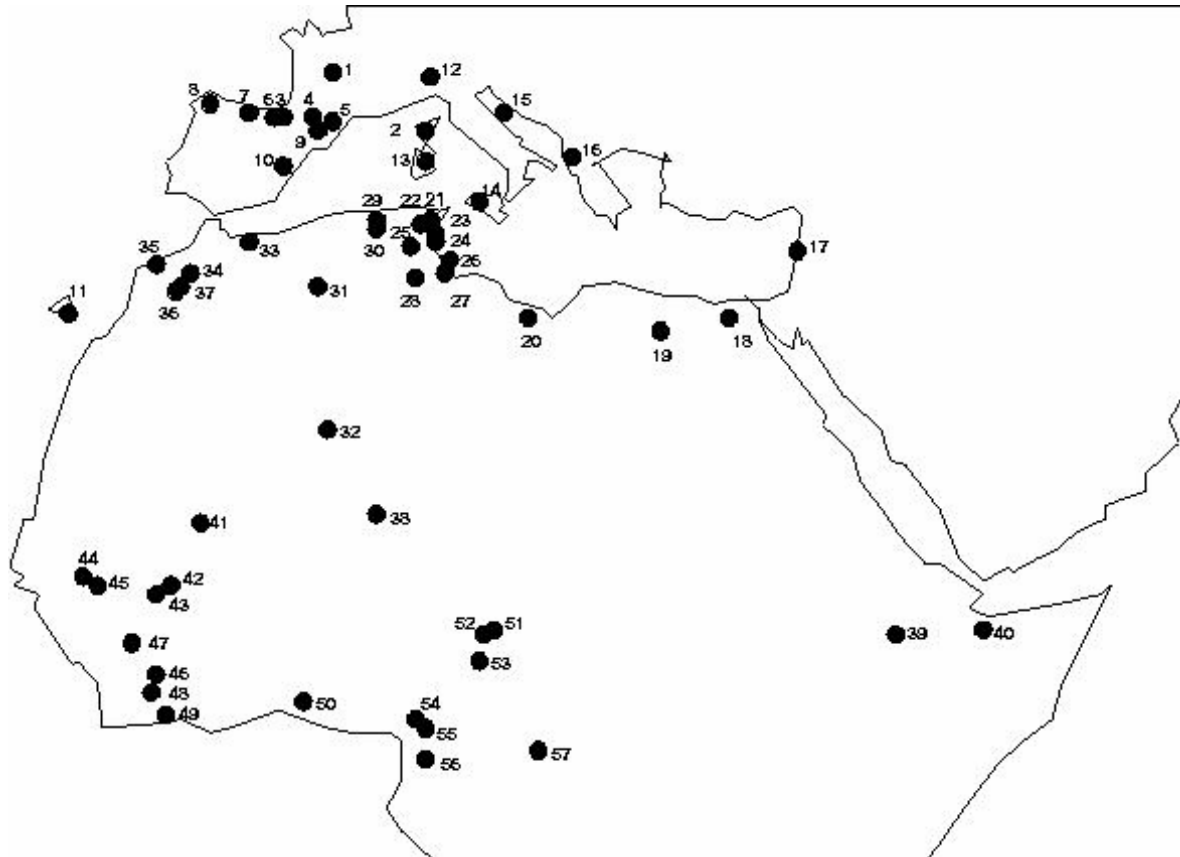
The genetic markers

- ◆ Gm and Km immunoglobulin allotypes
- ◆ Mitochondrial DNA (mtDNA): haplogroups and sub-haplogroups
- ◆ Y chromosome haplotypes

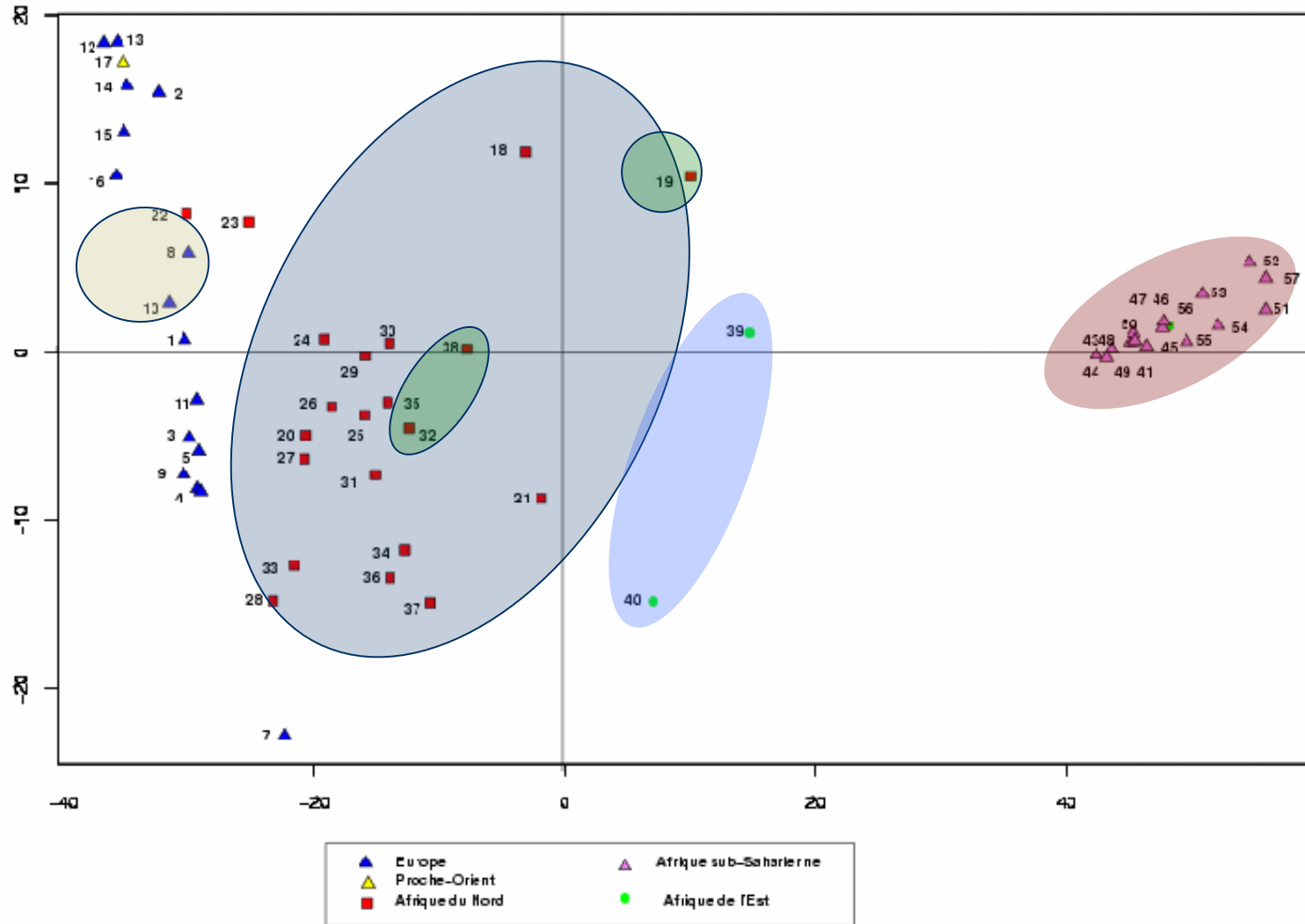


Gm and Km immunoglobulin allotypes

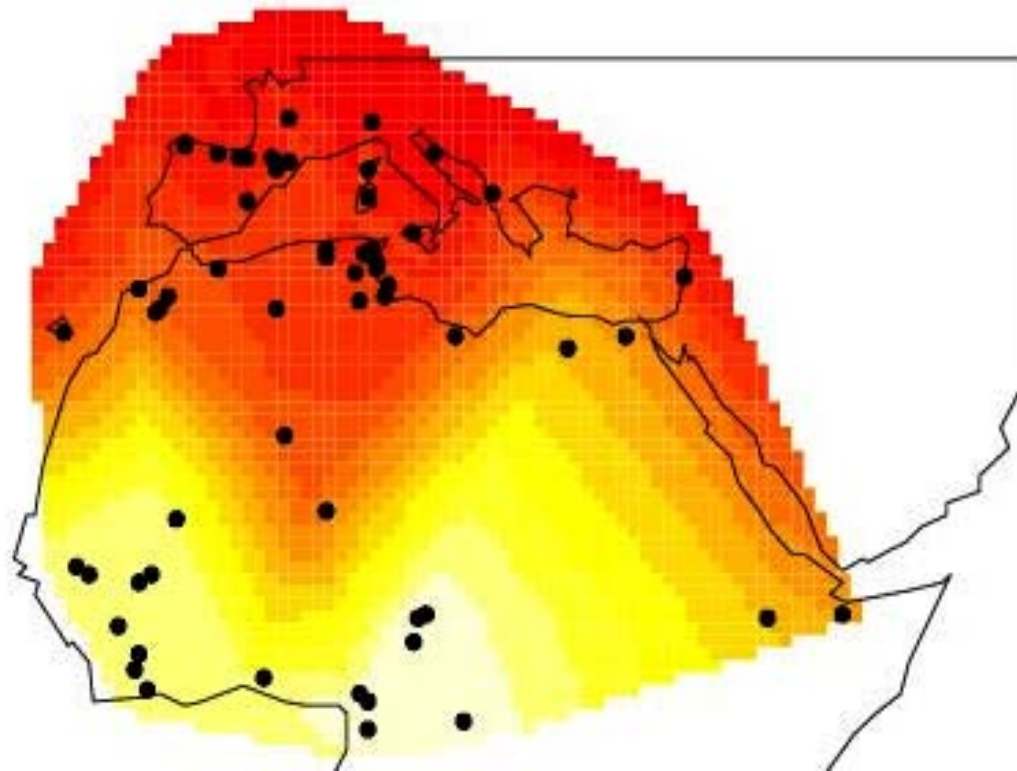
The populations



Multidimensional Scaling



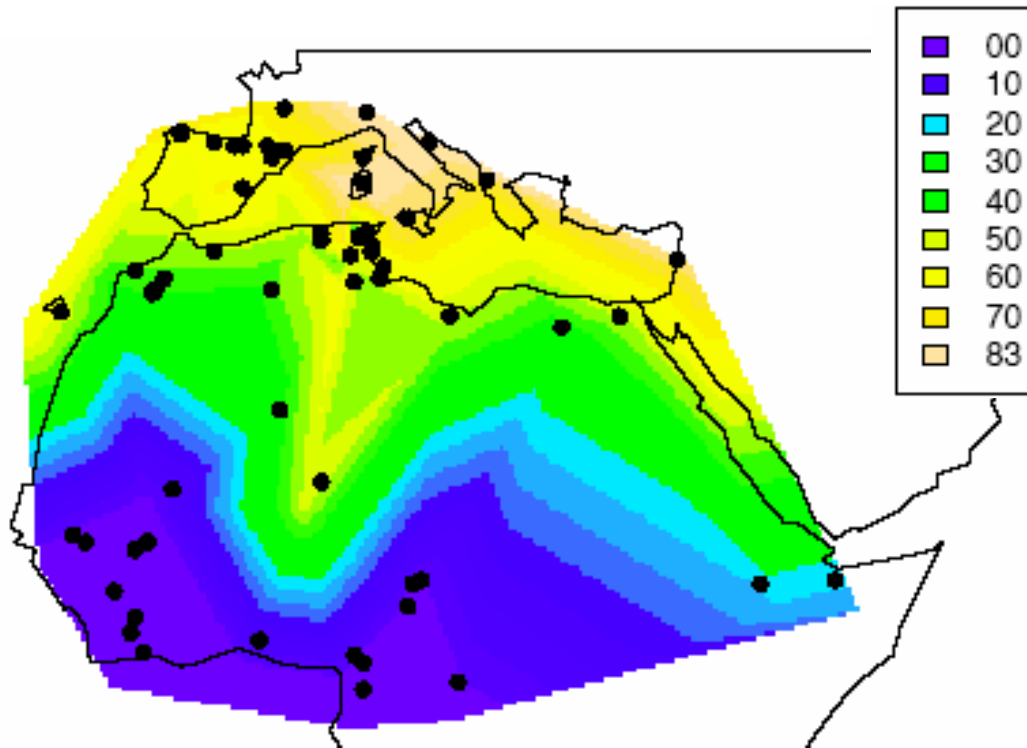
Principal Component Analysis: 1st axis (85%)



Gradient of Gm haploptypic frequencies

Gm*3;23;5*

Gm*3;...;5*



Gradient of Gm haploptypic frequencies

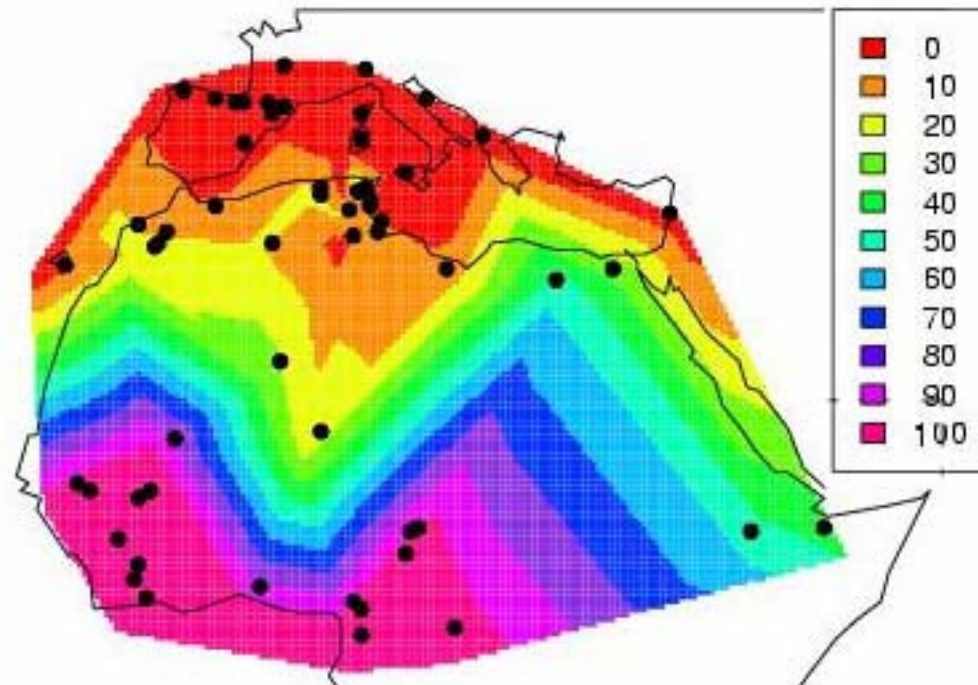
Gm*1,17;...;5*

Gm*1,17;...;5*,28

Gm*1,17;...;10,11,13,15,±28

Gm*1,17;...;5,6,10,11,14,±28

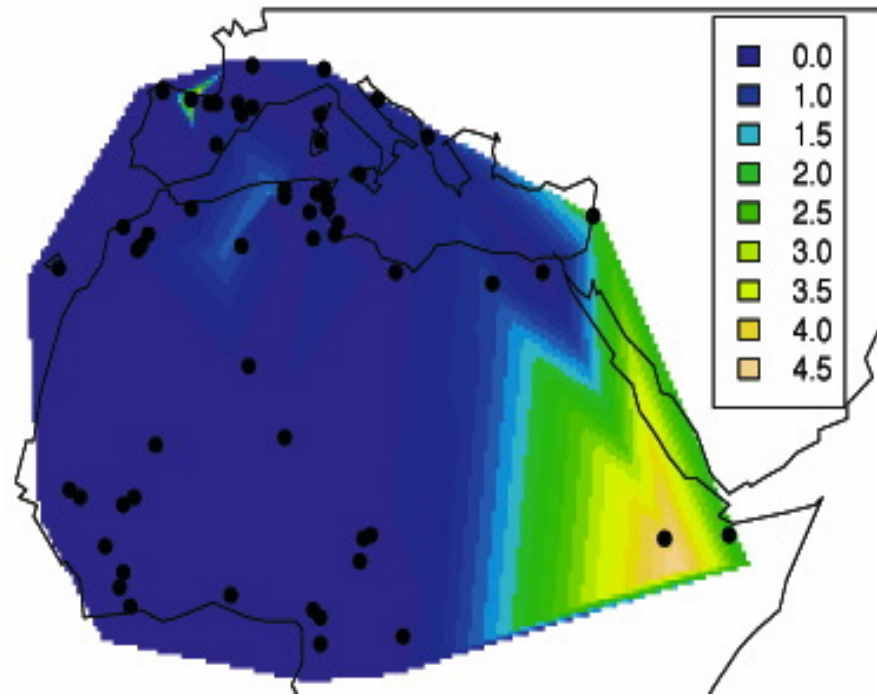
Gm*1,17;...;5,6,24,±28



Gradient of Gm haploptypic frequencies

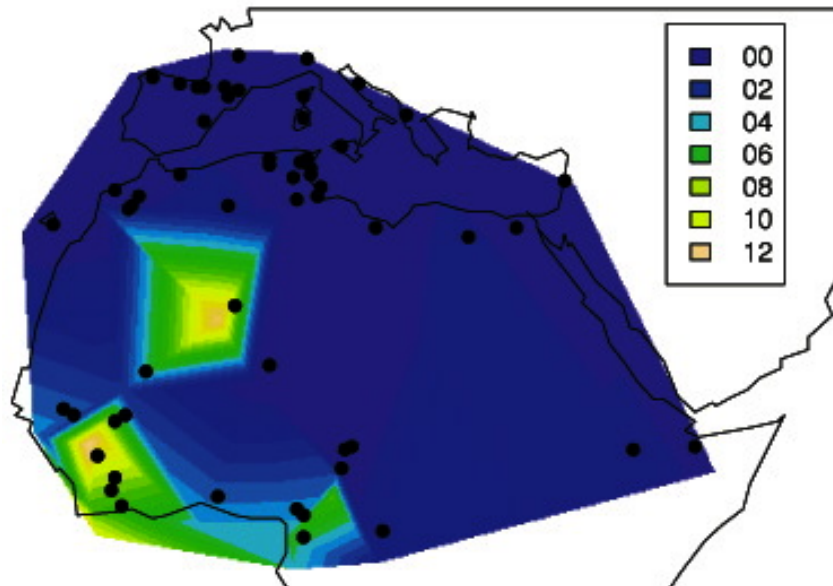
Gm*1,17;...;10,11,13,15,16

Gm*1,3;±23;5*

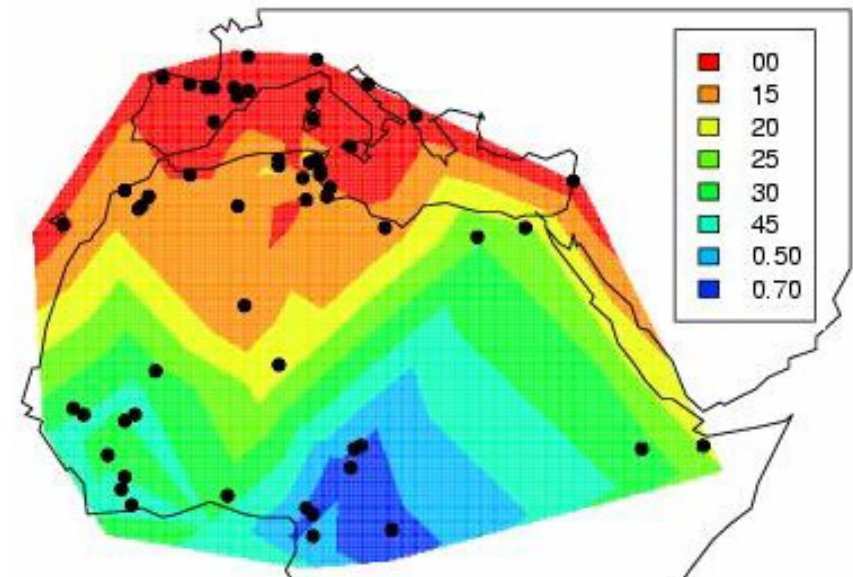


Gradient of Gm haplotypic frequencies

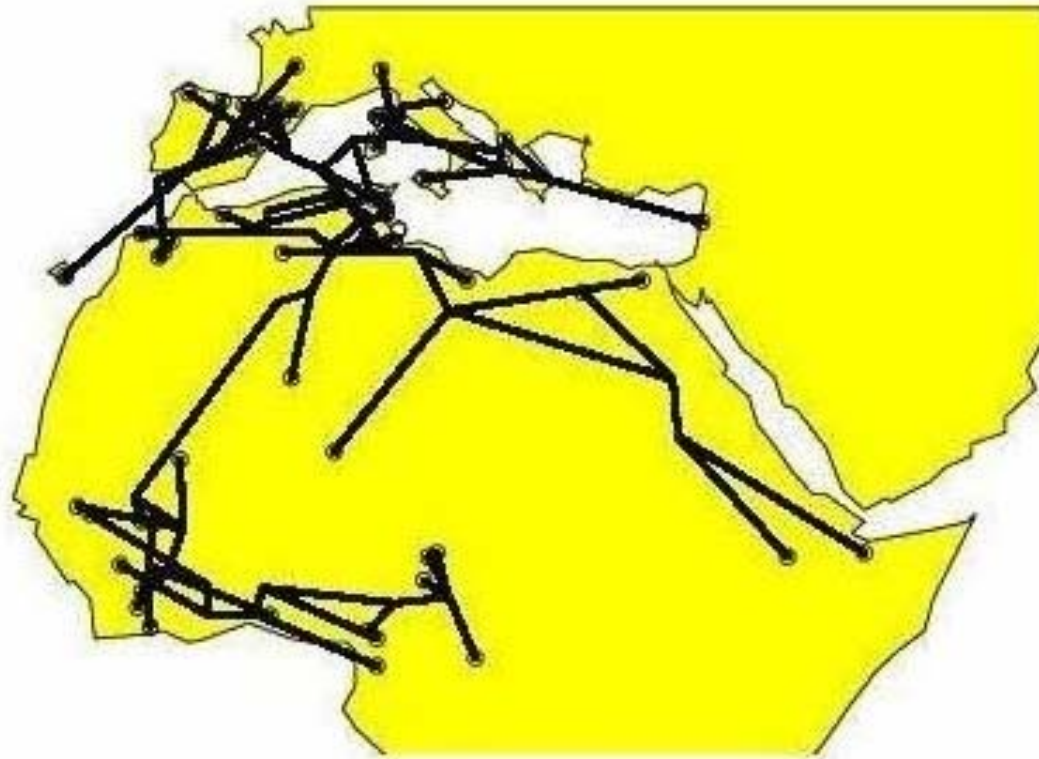
Gm*1,17;...;10,11,13,15,+28



Gm*1,17;...;5*



Minimal Spanning tree: genetic distances (12 Gm haplotypes)



Gm allotypes

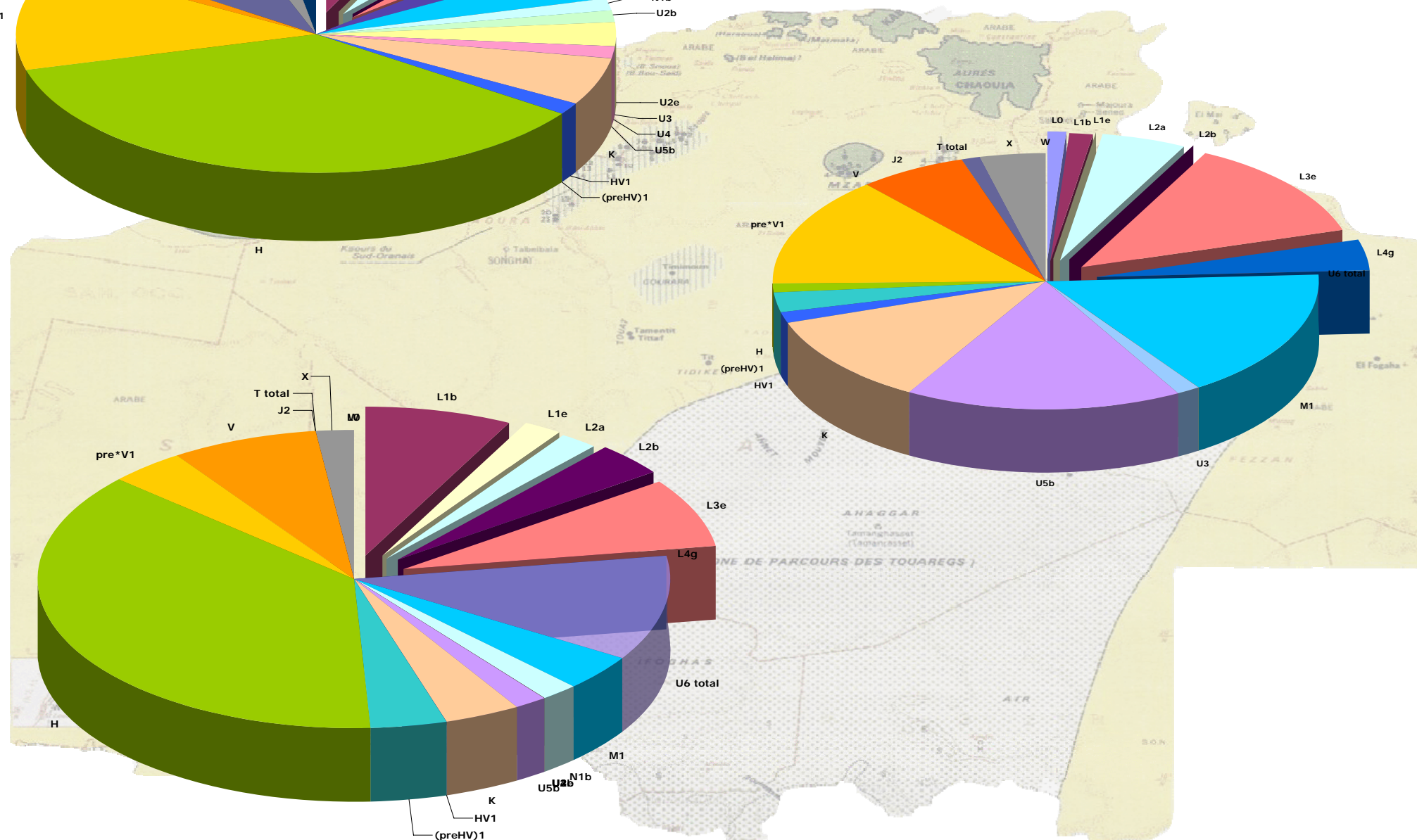
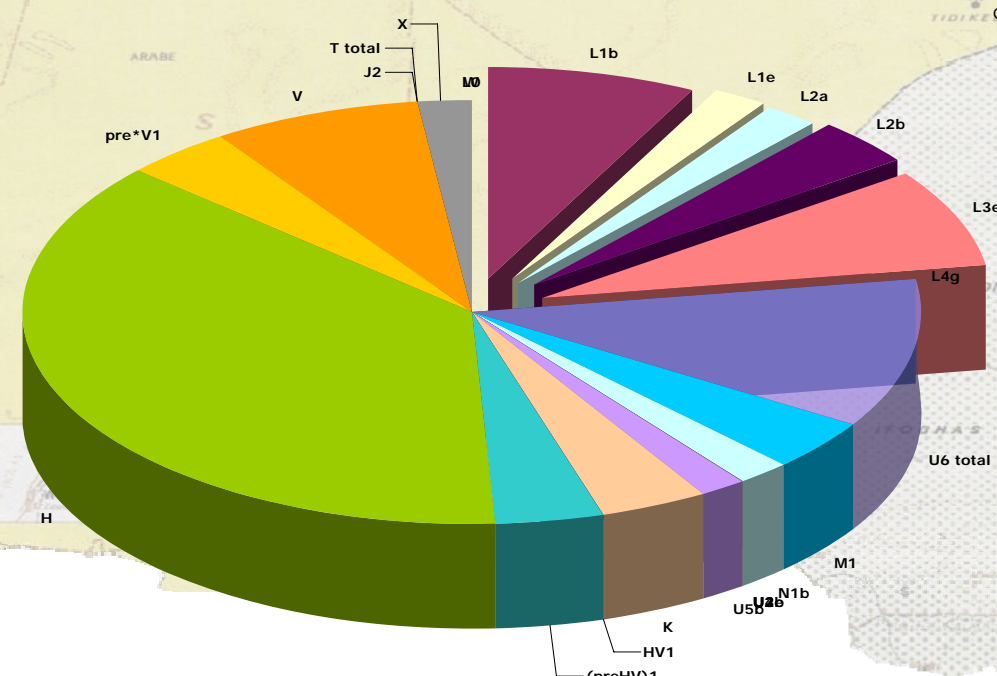
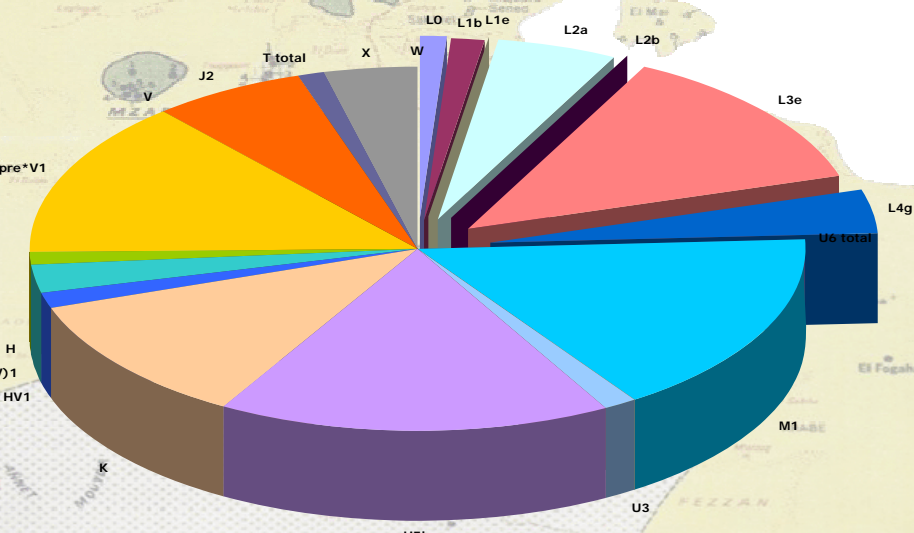
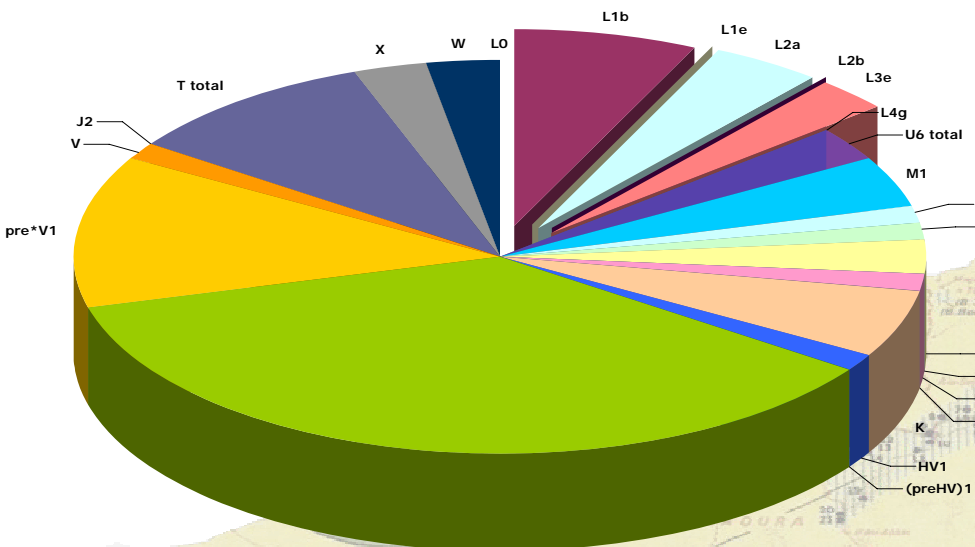
- ◆ Homogeneity of the Northern African Berber (and Arab) populations :
 - ~ 20 % of the sub-Saharan haplotypes in all the populations
 - 80 % of the Gm haplotypes frequency in common with Europeans and West Eurasians
- ◆ Isseqquamaren Tuaregs (Algeria) are different from Kel Nam Tuaregs (Niger)
- ◆ Siwan, with more than 50 % of sub-Saharan haplotypes are related to Semitic and Couchitic populations (owing to the caravans, as well as the slave market ?)

Gm allotypes

- ◆ Clear differentiation of Northern and Eastern Berbers
- ◆ If the South-North genetic gradient is marked on both sides from Sahara, the same is not true for East-West gradient



Mitochondrial DNA (mtDNA):

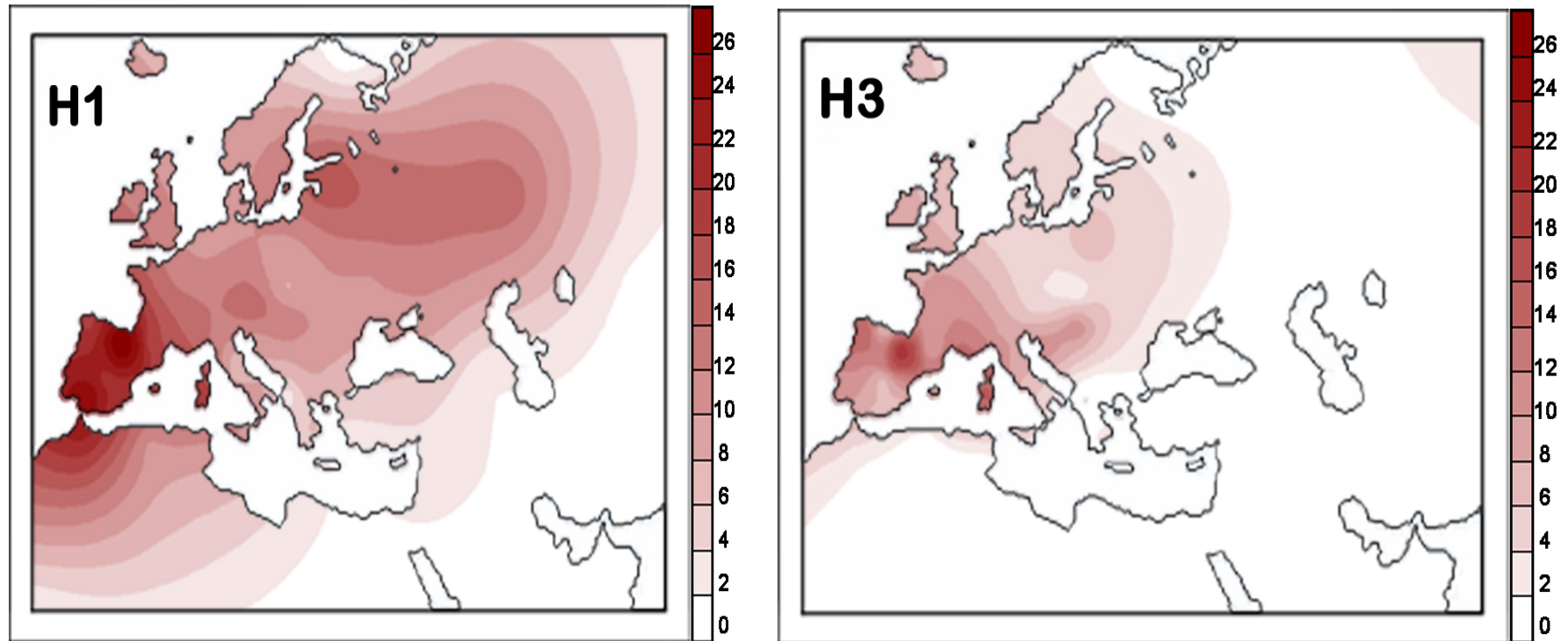




Mitochondrial DNA

	sub-Saharan	North African	European and West Eurasian
Moroccan Berbers			
Asni (Rhiraya)	22,6	11,3	66,1
Bouhria (Beni Snassen)	13,9	2,8	83,3
Algerian Berbers			
Ghardaia (Mozabite)	14	28,2	57,8
Egyptian Berbers			
Siwa	24	0	76

Distribution of the H1 and H3 sub-haplogroups frequencies





Mitochondrial DNA

- ◆ H1 and H3 subhaplogroups (coalescence ages ~ 11,000) are the markers of late-glacial expansions of hunter-gatherers from the Franco-Cantabrian refuge, after the « Last Glacial Maximum », about 20,000 years ago
- ◆ H1 displays a high frequency among North African populations (10 to 20 %), with a maximum in Berber populations
- ◆ Only 1 % frequency in Siwa

Mitochondrial DNA

L haplogroups:

- ◆ Genetic flow for L3e (13% in Siwan and 3% in Beni Snassen) : migration waves from the Horn of Africa ?
- ◆ L1, marker of West and Central Africa, is more frequent in Northern African Berber populations (7-9%) than in Siwa (1%)
- ◆ L4g, marker of East Africans, is only found in Siwa (4 %)

Mitochondrial DNA

M1 haplogroup

- ◆ 17% at Siwa and 4% at Bouhria (Beni Snassen) and Asni (Rhiraya)
- ➔ M1 distribution correlates with the spread of Afro-Asiatic languages (?)



Y chromosome haplotypes

Y chromosome haplotypes

- ◆ Sample tested:
Beni Snassen (67), Rhiraya (54) and Siwi (93)

- ◆ Markers:
 - > 70 biallelic markers (including some new unpublished)
 - 11 microsatellites

- ➔ 20 distinct binary haplogroups

Y chromosome haplotypes

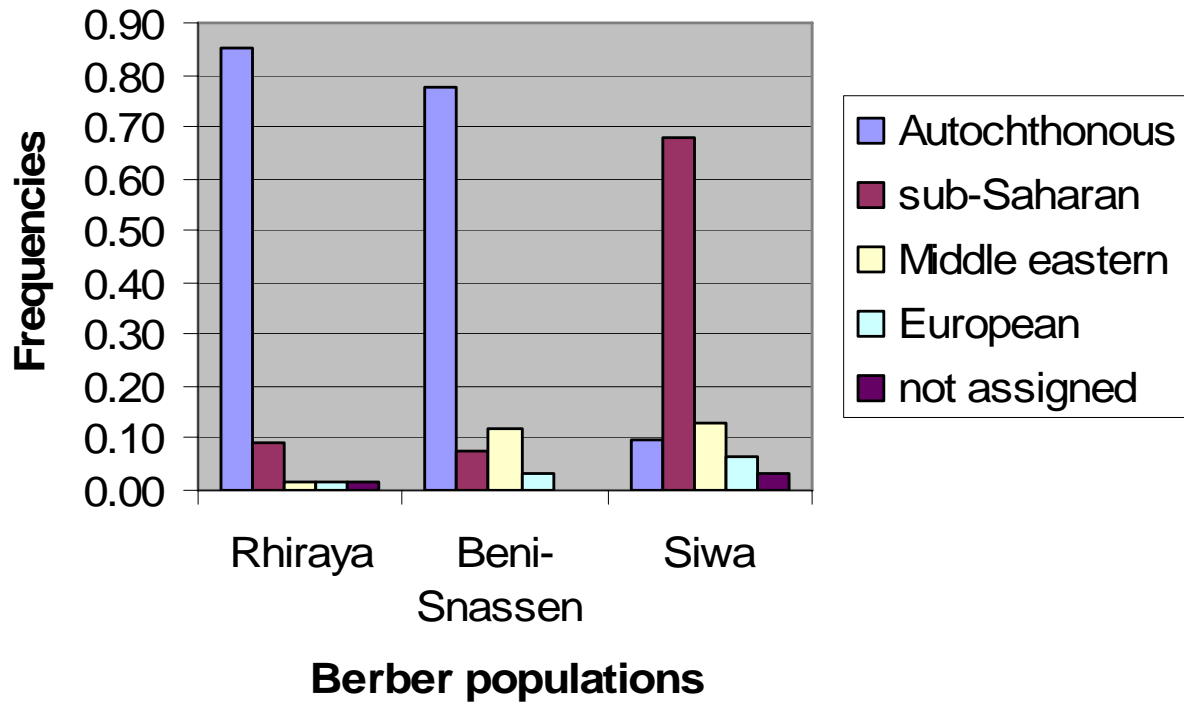
- ◆ Close relationship between the two Moroccan Berber populations (78-80% E-M81)
- ◆ E-M81 was found in only one Siwi (1%)
- ◆ Very low frequency (2-6%) of haplogroups of European descent (such as R-M269, J-M12 and E-M78 cluster α) in all the berber populations
- ◆ Relatively low frequency (2-14%) of haplogroups commonly found in the Middle East (J-M267 and G-M201)

Y chromosome haplotypes

- ◆ Beni Snassen and Rhiraya Berbers from Morocco show relatively low amount of sub-Saharan Y chromosomes, almost exclusively E-DYS271 (7%)
- ◆ Siwa Berbers have a similar frequency (6%) of this haplogroup, but other sub-Saharan haplogroups (e.g. B-M109 and E-V6) have been observed at high frequencies: about 60% on the whole (these haplogroups are very rare north of the Sahara)



Y chromosome haplogroups



Berbers from the North West and North East are genetically quite distinct

Y chromosome haplotypes

- ◆ Relative high microsatellite diversity in Siwa Berbers suggests that their presence cannot be ascribed to recent bottleneck or recent founder effect
- ◆ Sub-Saharan gene flow(s) reflect(s) ancient interactions, before Sahara became dry ?

Y chromosome haplotypes

- ◆ Y haplogroup sharing between Berbers and Middle East - Eastern Africa is very limited
- ◆ East-African or Middle Eastern origin of the berber ? Y data doesn't permit to answer these questions

Pastoralism and lactase genetics

- ◆ In Europe, the putatively causal allele (-13910T) for lactase tolerance has a frequency of ~ 85 %
- ◆ In sub-Saharan Africa, this frequency is 0 %
- ◆ In Berbers from North West : 25 %
- ◆ The distribution of the other haplotypes P, X and Y shows that migrations from the Sahara were limited

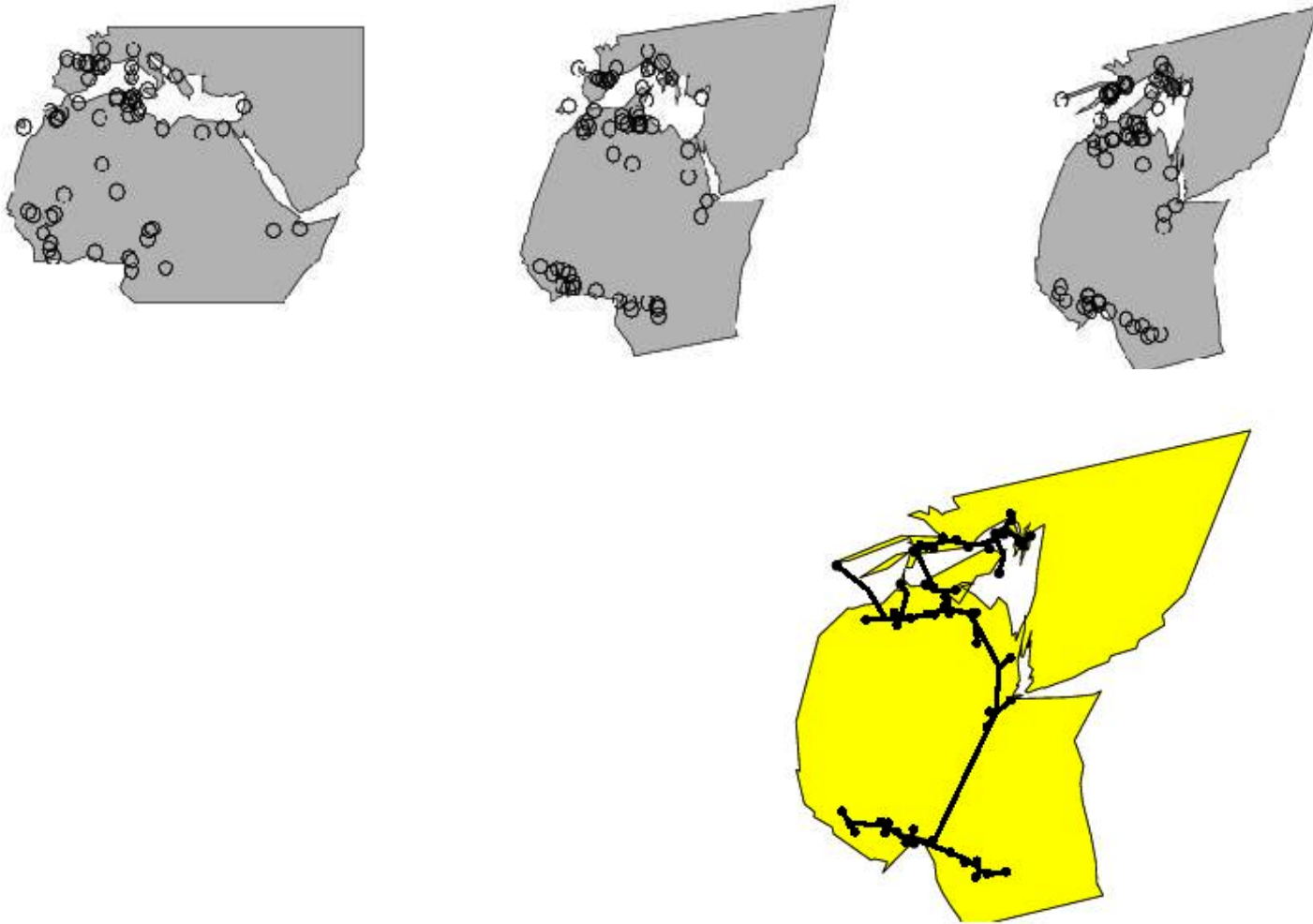
Pastoralism and lactase genetics

The positive selection pressure on lactase suggests that contemporary Berber populations possess the genetic signature of past migration of pastoralists from the Middle East (Neolithic transition)

Perspectives

- ◆ Mali (area of Tombouctou): linguistic and genetic investigation in progress on Tuareg
- ◆ Siwa (hypothesis of a « Zenati » peopling)
 - Investigation in Figuig oasis (Morocco-Algeria border)
 - Other Libyan Desert oasis: Augila ?
- ◆ Afro-Asiatic and Berber origins: M1 mtDNA haplotype evolution

Cartes de similarité génétique





Financements

CNRS: Programme OHLL et OMLL (EUROCORES - ESF)

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