

25 years of Genetic Studies on Jews and the wider Middle East

Their effect on our understanding of Jewish
and Middle Eastern History, Israel Advocacy,
and the conversation surrounding the
Israeli-Palestinian Conflict

Why Genetics?

- ***DNA as a window into history***
 - Quick layman's intro to DNA: it's our biological archive, passed down generation to generation, ***the central Dogma***, *DNA, RNA, Proteins*.
 - **Technologies**: sequencing DNA → identifying markers → comparing populations.
 - PCR → RFLP (Restriction Fragment Length Polymorphism) → Sanger Sequencing → NGS (Next Generation Sequencing)
 - Mention the main tools:
 - **Y-DNA** (father-to-son line),
 - **mtDNA** (mother-to-child line),
 - **Autosomal DNA** (the rest, a mix from all ancestors).
 - ***Ancient DNA (aDNA) Genetic samples recovered from archeological sites***
 - Explain that uniparental markers are simple but limited; autosomal gives the fuller story.

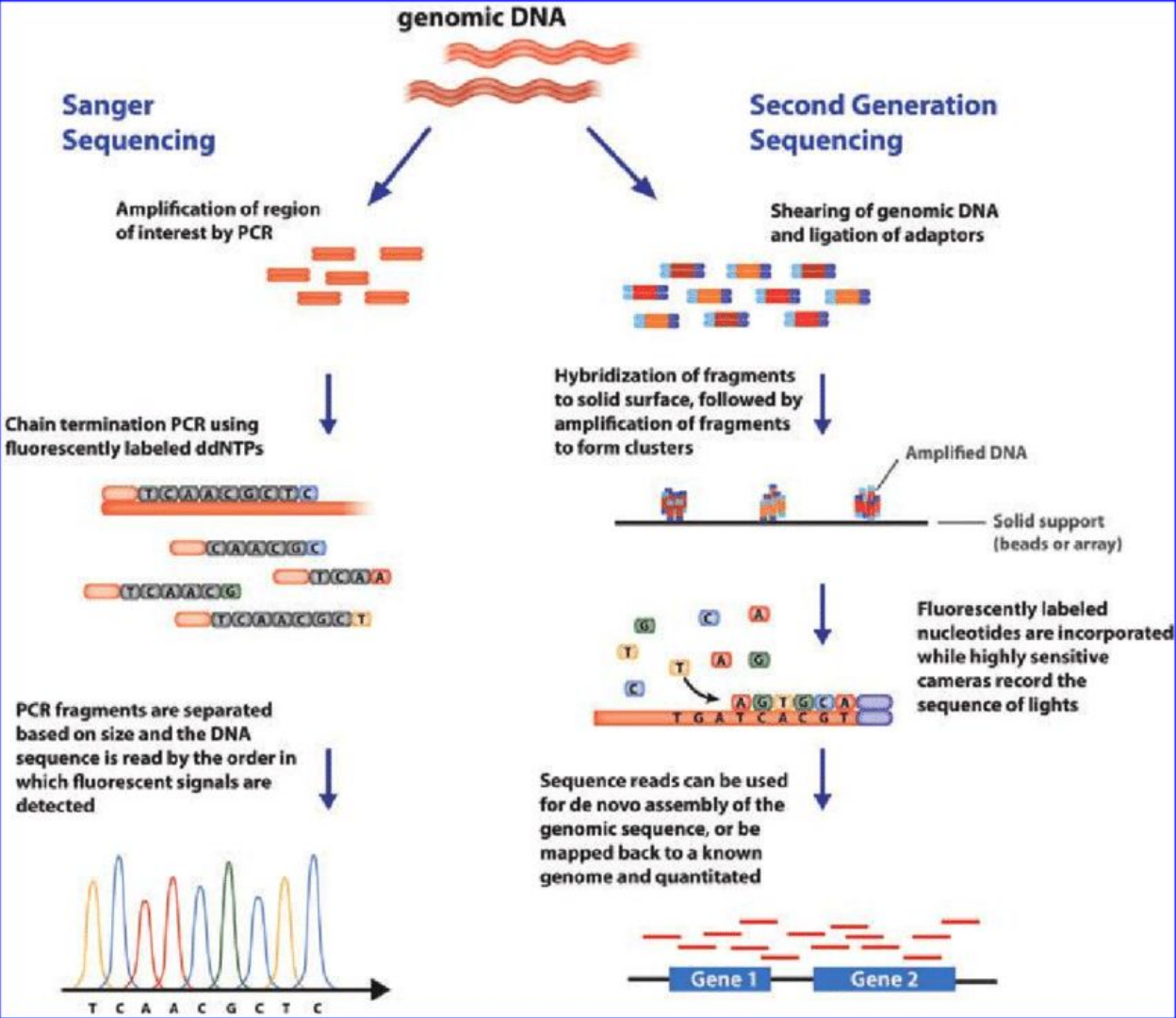
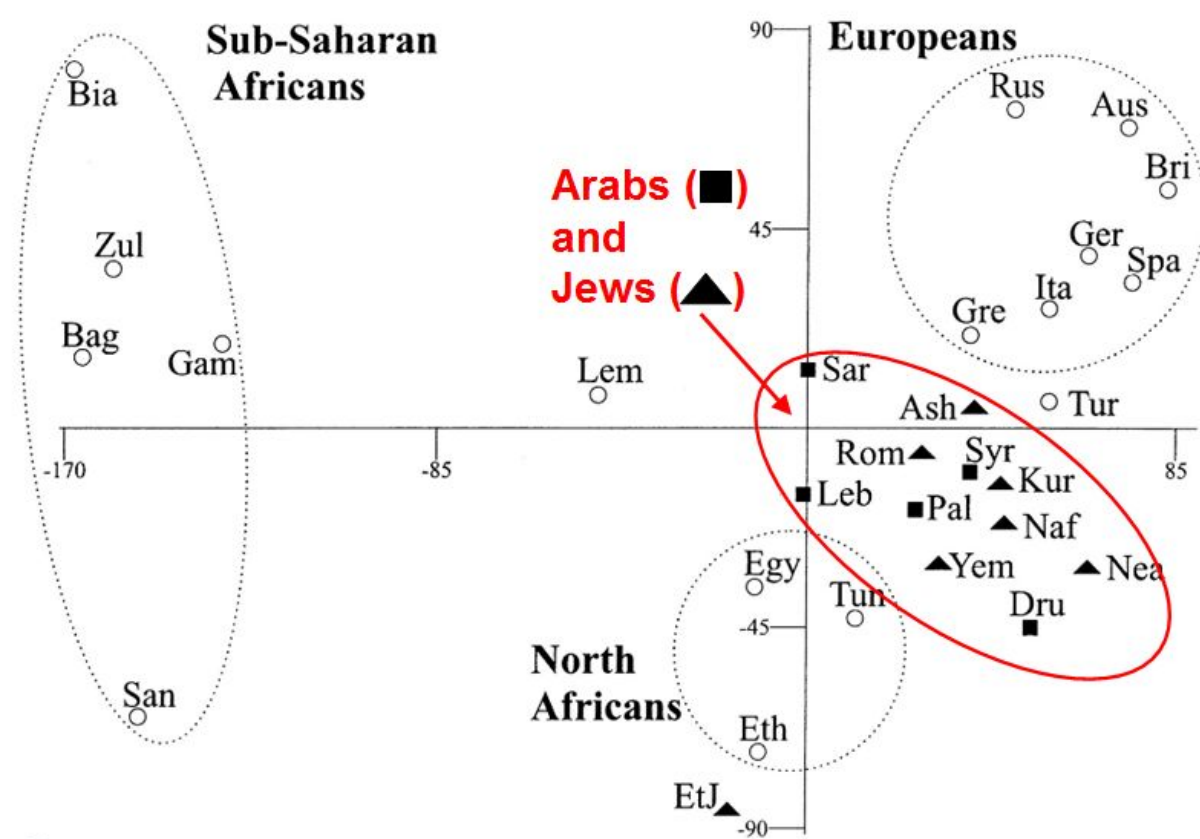


Figure 1. Comparison between Sanger sequencing and next-generation sequencing (NGS) technologies. Sanger sequencing is limited to determining the order of one fragment of DNA per reaction, up to a maximum length of *700 bases. NGS platforms can sequence millions of DNA fragments in parallel in one reaction, yielding enormous amounts of data. To see this illustration in color, the reader is referred to the web version of this article at www.liebertpub.com/wound

Early Studies: paternal Ancestry Y-DNA, (early 2000s)

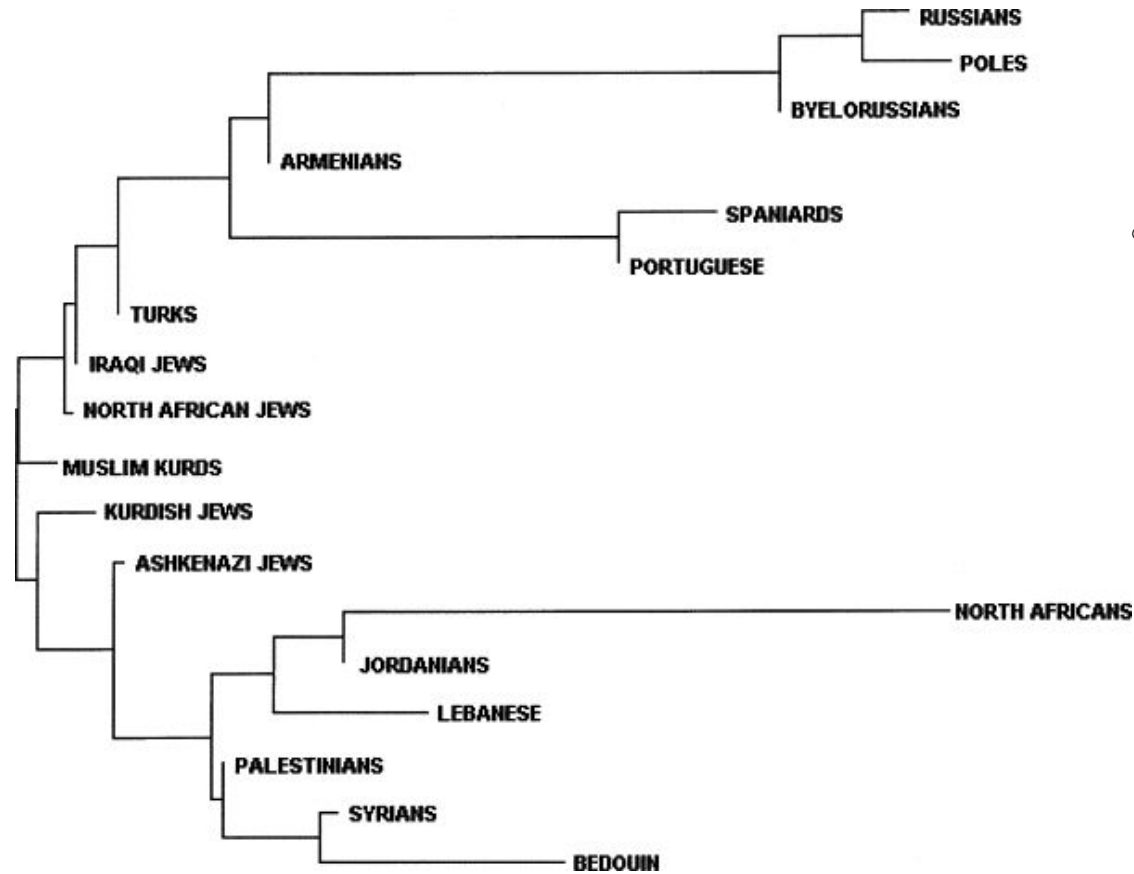
- *Uniparental Y-DNA: Oppenheim, Nebel, Hammer*
 - Ariella Oppenheim: Hebrew University first Y-DNA surveys of Jewish and Middle Eastern groups. Both Nebel and Hammer
 - **Nebel et al. (2001, AJHG): The Y Chromosome Pool of Jews as Part of the Genetic Landscape of the Middle East, showed Jews and Palestinians share many Y haplogroups, especially J1 and J2.13 binary Y chromosome polymorphisms**
 - Hammer et al. (2000, PNAS): identified “Cohen Modal Haplotype” — a shared priestly lineage.
(2001, PNAS): Jewish and Middle Eastern non-Jewish populations share a common pool of Y-chromosome biallelic haplotypes, 18 biallelic polymorphisms
 - These early studies showed **connections between Jews and Levantine Arabs**, but with low resolution.
 - Incorrectly presumed closer connection between Jews and Kurds than with Levantine Arabs
 - All of these used PCR and Restriction Enzymes: RFLP (**Restriction Fragment Length Polymorphism**), Pre Sequencing



Hammer et al. (2001, PNAS): Jewish and Middle Eastern non-Jewish populations share a common pool of Y-chromosome biallelic haplotypes

Early Studies: paternal Ancestry Y-DNA, (early 2000s)

- *Uniparental Y-DNA: Oppenheim, Nebel, Hammer*
 - Ariella Oppenheim: Hebrew University first Y-DNA surveys of Jewish and Middle Eastern groups. Both Nebel and Hammer
 - Nebel et al. (2001, AJHG): The Y Chromosome Pool of Jews as Part of the Genetic Landscape of the Middle East, showed Jews and Palestinians share many Y haplogroups, especially J1 and J2.13 binary Y chromosome polymorphisms
 - **Hammer et al. (2000, PNAS): identified “Cohen Modal Haplotype” — a shared priestly lineage. (2001, PNAS): Jewish and Middle Eastern non-Jewish populations share a common pool of Y-chromosome biallelic haplotypes, 18 biallelic polymorphisms**
 - These early studies showed **connections between Jews and Levantine Arabs**, but with low resolution.
 - **Incorrectly presumed closer connection between Jews and Kurds than with Levantine Arabs**
 - All of these used PCR and Restriction Enzymes: RFLP (**Restriction Fragment Length Polymorphism**), Pre Sequencing



- Nebel et al. (2001, AJHG): The Y Chromosome Pool of Jews as Part of the Genetic Landscape of the Middle East

Figure 2 Unrooted NJ tree depicting relationships among the six Middle Eastern populations, based on DA distances. The distance matrix is calculated using frequencies of haplogroups defined by 13 binary Y chromosome polymorphisms.

The Rise of High-Resolution Uniparental Markers Late: 2000's (2005–2010)

From Sanger Panels to High-Resolution Haplogroups: The Skorecki Era & Improved Uniparentals

- Emergence of extended Y-SNP & mtDNA panels
- **Karl Skorecki** & the refinement of Jewish Y-chromosome studies: Extended Y chromosome haplotypes resolve multiple and unique lineages of the Jewish priesthood, Human Genetics 2009
- **Doron Behar**: Counting the Founders: The Matrilineal Genetic Ancestry of the Jewish Diaspora, Behar 2008
- Y-chromosome phylogenetic tree expands dramatically
- Transition stage before genome-wide autosomal data

Y-Chromosome & mtDNA Insights in Jewish Populations

Paternal Lineages (Y-DNA)

- **Priestly Line (Cohanim):**

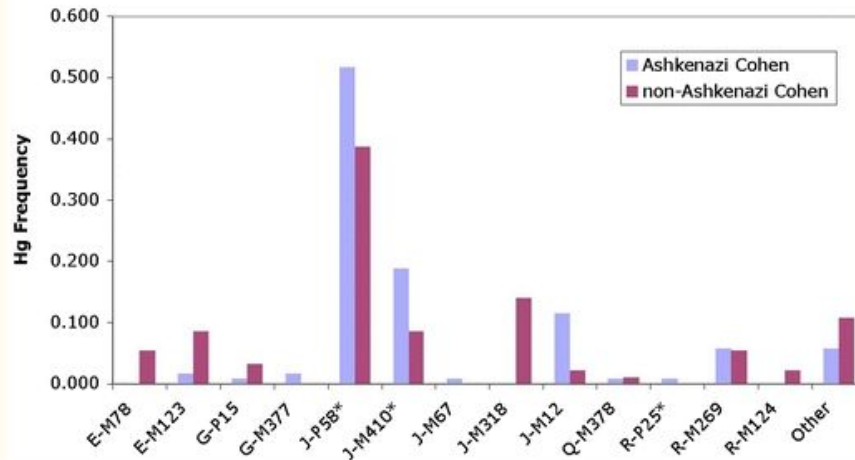
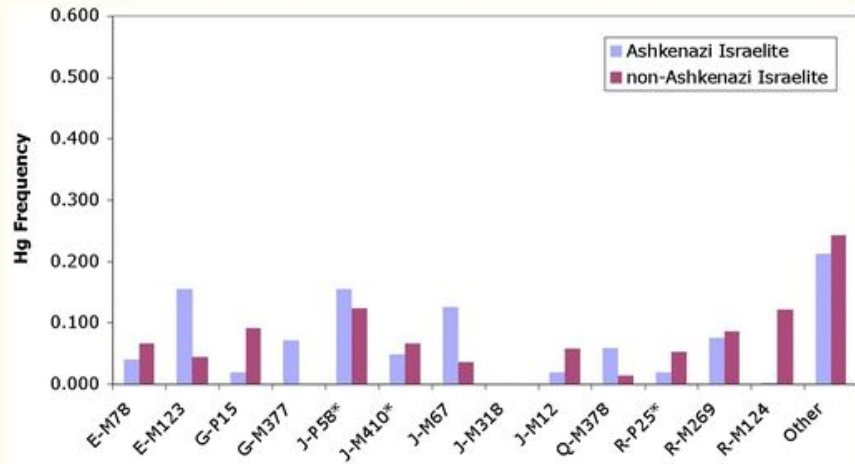
Skorecki et al. (1997) identified a characteristic Y-chromosome signature shared by Cohanim across Jewish communities, linked to haplogroup **J1-P58**.

- **High-Resolution Refinement:**

Using >600 Y-SNPs and expanded Y-STR panels (Karafet et al. 2008), researchers found **37 Y-haplogroups** among Jews — but Cohanim overwhelmingly cluster in **one dominant sub-clade**.

- **Key Findings:**

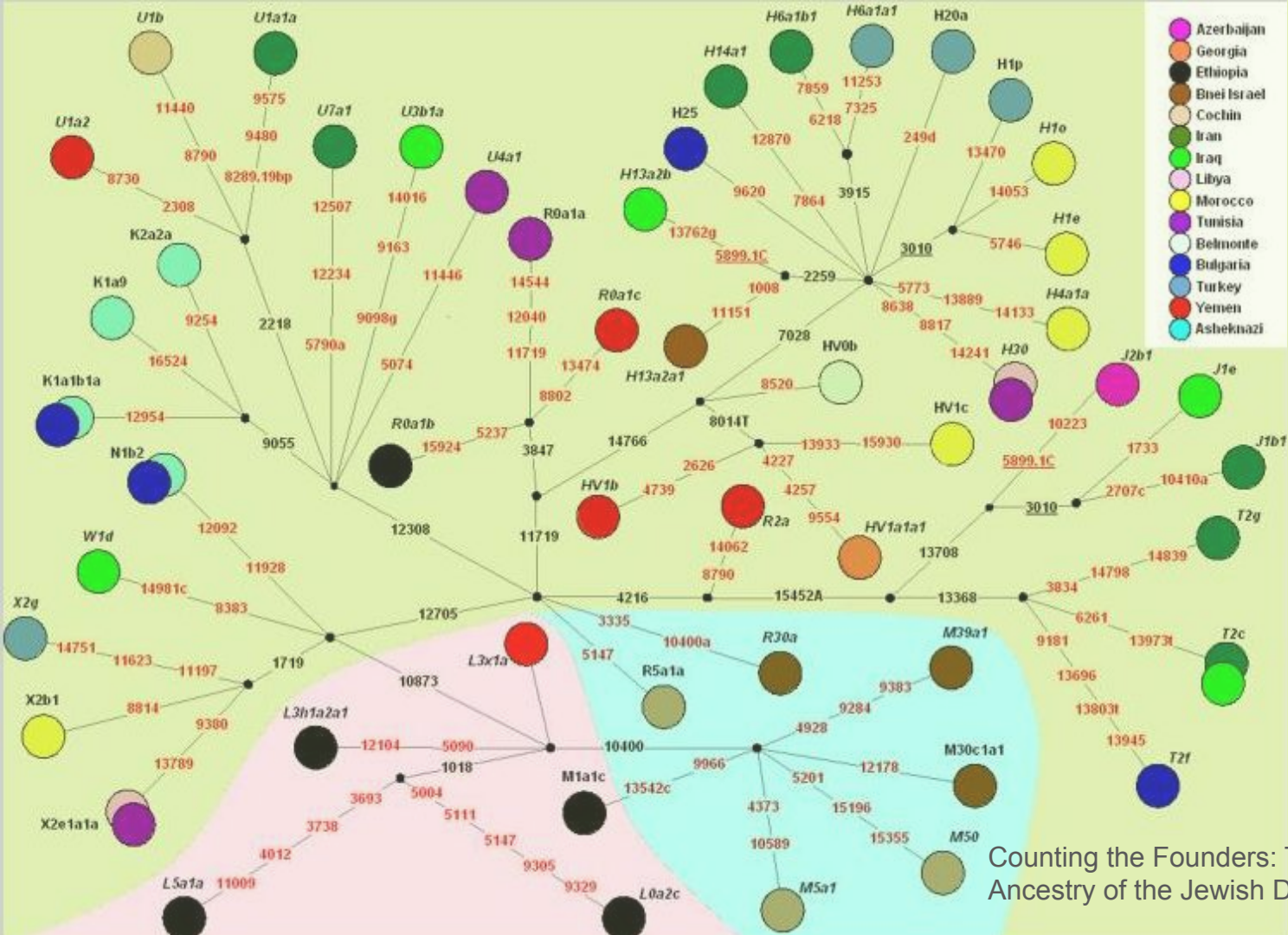
- Cohanim carry **21** Y-haplogroups, but most are rare.
- **J1-P58** dominates: **~52% of Ashkenazi** and **~39% of non-Ashkenazi** Cohanim.
- Israelites (non-Cohanim) show **no dominant lineage** (none >14%).
- The “extended CMH” cluster makes up **~65% of J-P58 Cohanim** and **~30% of all Cohanim Y-chromosomes** → strong evidence for a **shared ancient paternal origin**.
- **Rafi’s insight**, reminds me of ‘13 tribes of Israel’, fictive kinship, not the descendants of 12 brothers, but a group non-related regional tribes that united around a common narrative and tradition of kinship



Skorecki et al. Extended Y chromosome haplotypes resolve multiple and unique lineages of the Jewish priesthood,
Human Genetics 2009

Jewish Maternal Lineages (mtDNA)

- Maternal ancestry shows **more local admixture** than paternal lines: most Jewish groups acquired mtDNA from **regional populations** where they lived.
- Yet each community still has a **small number of strong founding maternal lineages**, many showing **Levantine origins**.
- **Ashkenazi Jews:**
4 founding mtDNA lineages $\approx$ 50% of all maternal ancestry.
- **Non-Ashkenazi Jews:**
A survey identified **49 putative founding lineages**, each contributing $\geq 5\%$ of their community, collectively explaining $\geq 40\%$ of maternal ancestry.



Counting the Founders: The Matrilineal Genetic Ancestry of the Jewish Diaspora, Behar 2008

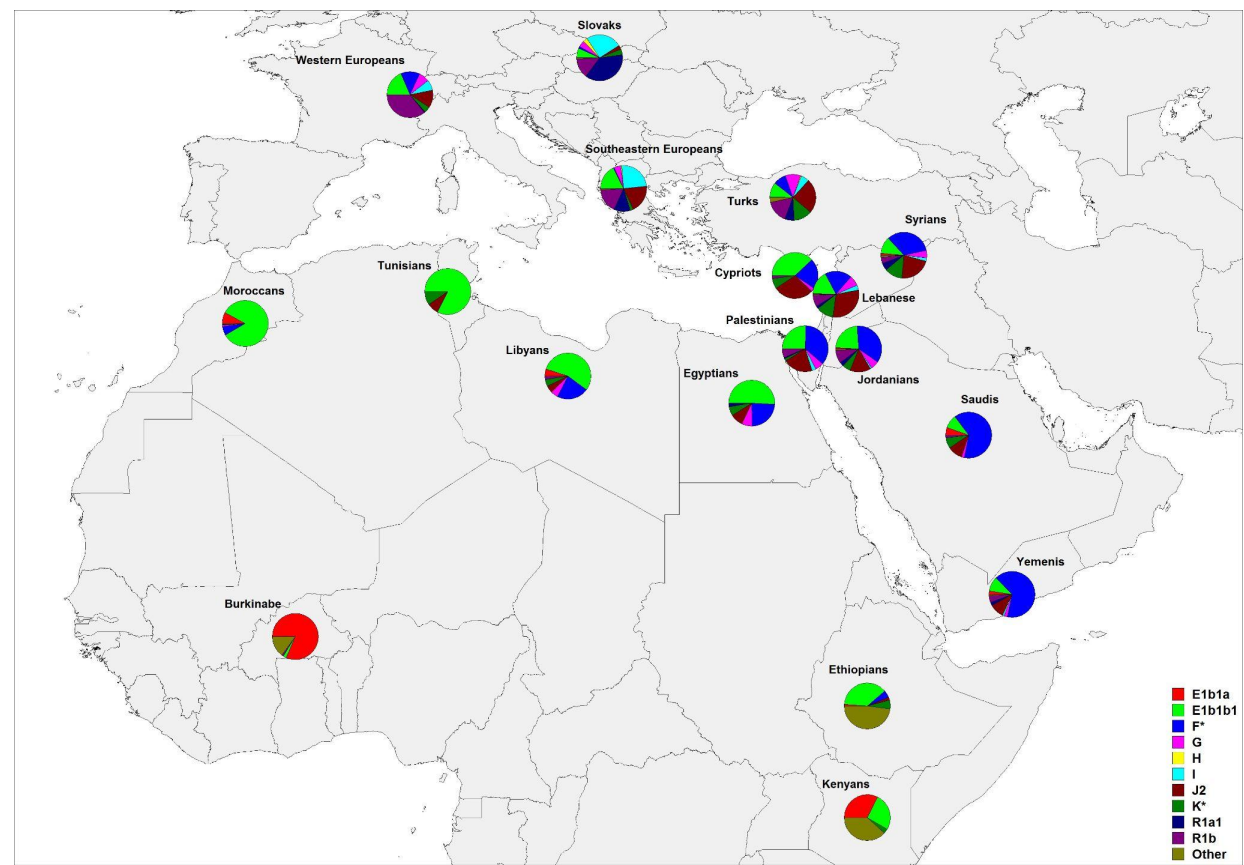
Y-Chromosome and mtDNA Genetics Reveal Significant Contrasts in Affinities of Modern Middle Eastern Populations with European and African Populations, Danielle A. Badro, 2013

- This study compared **maternal (mtDNA)** and **paternal (Y-chromosome)** ancestry patterns across many Middle Eastern and nearby populations to see how their genetic histories differ.

What they did

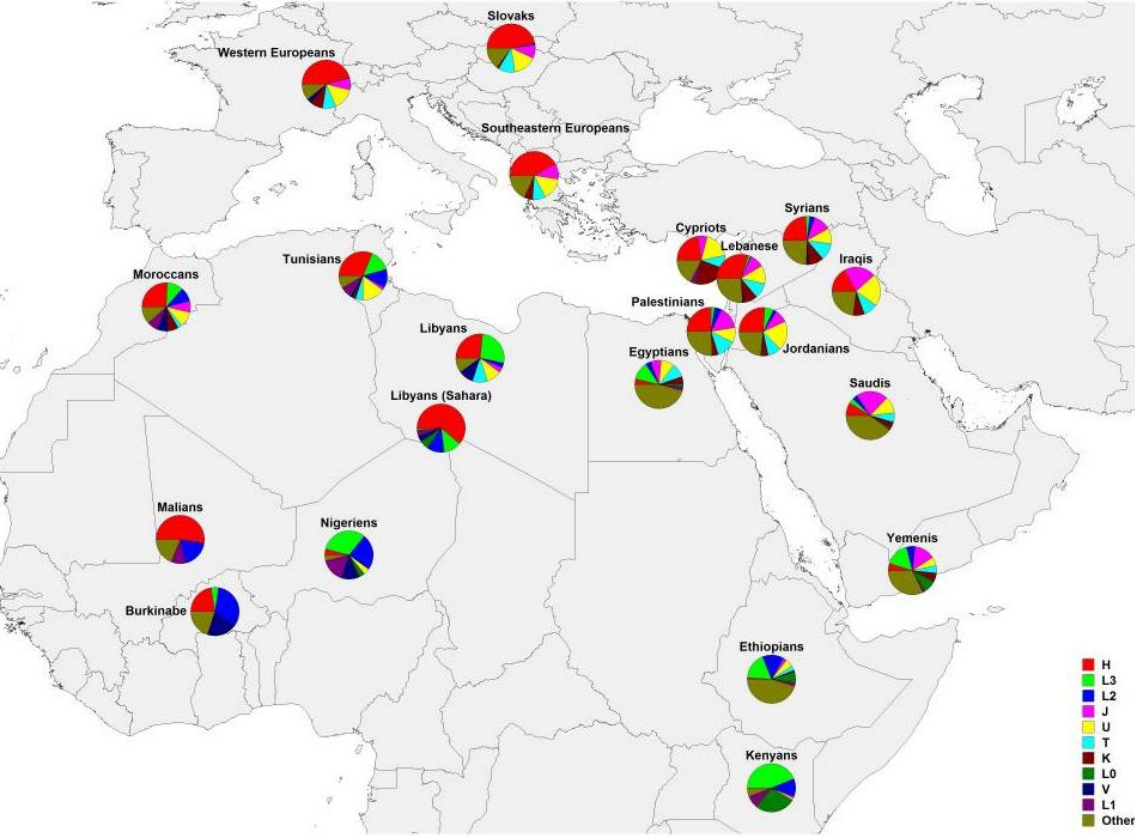
- Studied >5,000 mtDNA and >4,600 Y-chromosome samples across Middle East, Africa, Europe.
- mtDNA: Northern Levant → closer to Europe; Arabian Peninsula → closer to Africa.
- Y-chromosome: Distinct local patterns (J1/J2) and North African signal.
- **Maternal vs paternal patterns differ**, indicating complex sex-biased history.
- Many groups show deep settlement with **limited large-scale replacement**.

Geographic distribution of Y-DNA haplogroup



Y-Chromosome and mtDNA Genetics Reveal Significant Contrasts in Affinities of Modern Middle Eastern Populations with European and African Populations, Danielle A. Badro, 2013

Geographic distribution of mtDNA haplogroup



Y-Chromosome and mtDNA Genetics Reveal Significant Contrasts in Affinities of Modern Middle Eastern Populations with European and African Populations, Danielle A. Badro, 2013

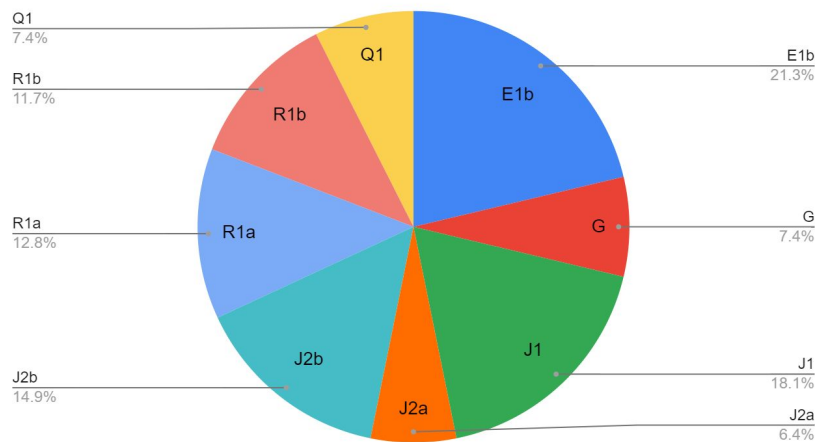
My Research Uniparental Research

YFull results

- **Speaker notes:**
 - Using the Y-Full DNA online database we looked at 105 listed Palestinian samples and compared to closest known Jewish sample as well as overall Haplogroups
 - When compared to Ashkenazi Jews over 90% of both Palestinians and Ashkenazi Jews fall into the same major haplogroups

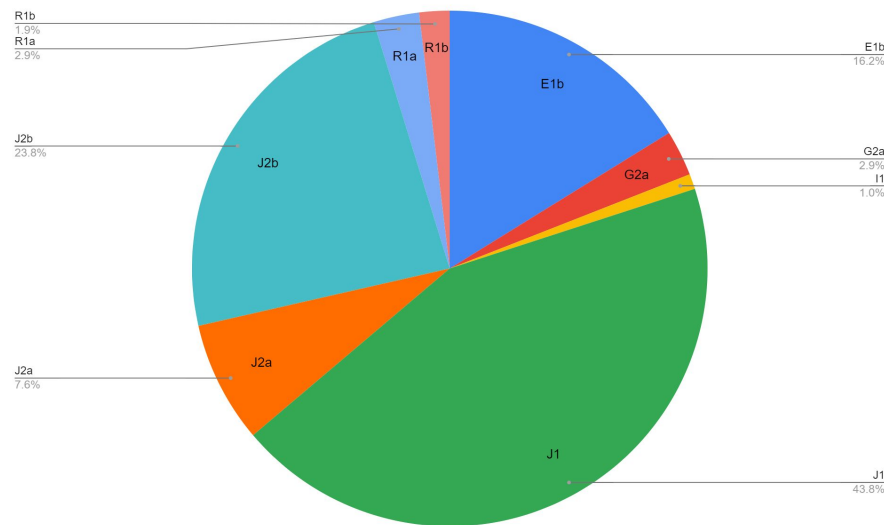
Ashkenazi Y- Haplogroups

Ashkenazi Paternal Ancestry



Extended Y chromosome haplotypes resolve multiple and unique lineages of the Jewish priesthood,
Human Genetics 2009

Palestinian Y- Haplogroups



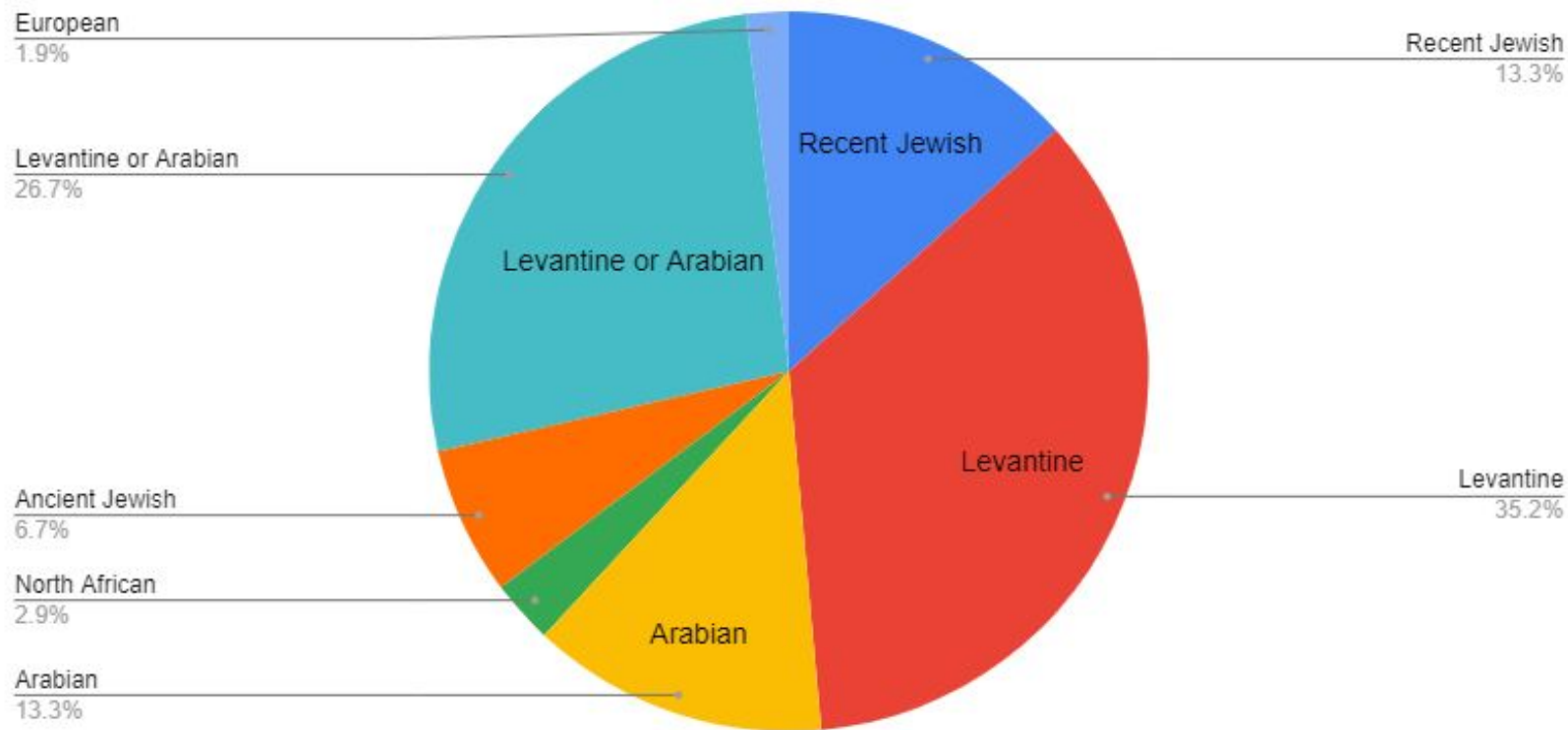
Y-Tree DNA, 2021

My Research - Uniparental Research

YFull results

- **Speaker notes:**
 - YFull: showed shared Y lineages between Jewish and Palestinian men, coalescing 5–7 kya.
 - “Recent Jewish” indicates a common ancestor with known Jewish sample within the last 4000 years for (also includes Samaritans)
 - “Ancient Jewish” indicates a common ancestor with known Jewish sample 4000-7000 years ago (also includes Samaritans)
 - This suggests about 20% crossover in common paternal lineage ancestry between Jews and Palestinians from Copper and Bronze ages and onwards

Palestinian Paternal Ancestry Origin



Y-Full DNA, 2021

My Research Uniparental Research

Maternal Haplogroups - based on "Counting the Founders: The Matrilineal Genetic Ancestry of the Jewish Diaspora, Behar 2008"

- **Speaker notes:**
 - Study included 110 Palestinian samples as Middle Eastern reference controls
 - These samples fell into 41 distinct mtDNA haplotypes
 - Only 6 haplotypes exceeded 5% frequency
 - All 6 were also present in Jewish samples
 - 5 of these were classified as major "founding Jewish maternal lineages"
 - Across all Palestinian samples, **~88% fall within haplogroups also found in Jewish populations**

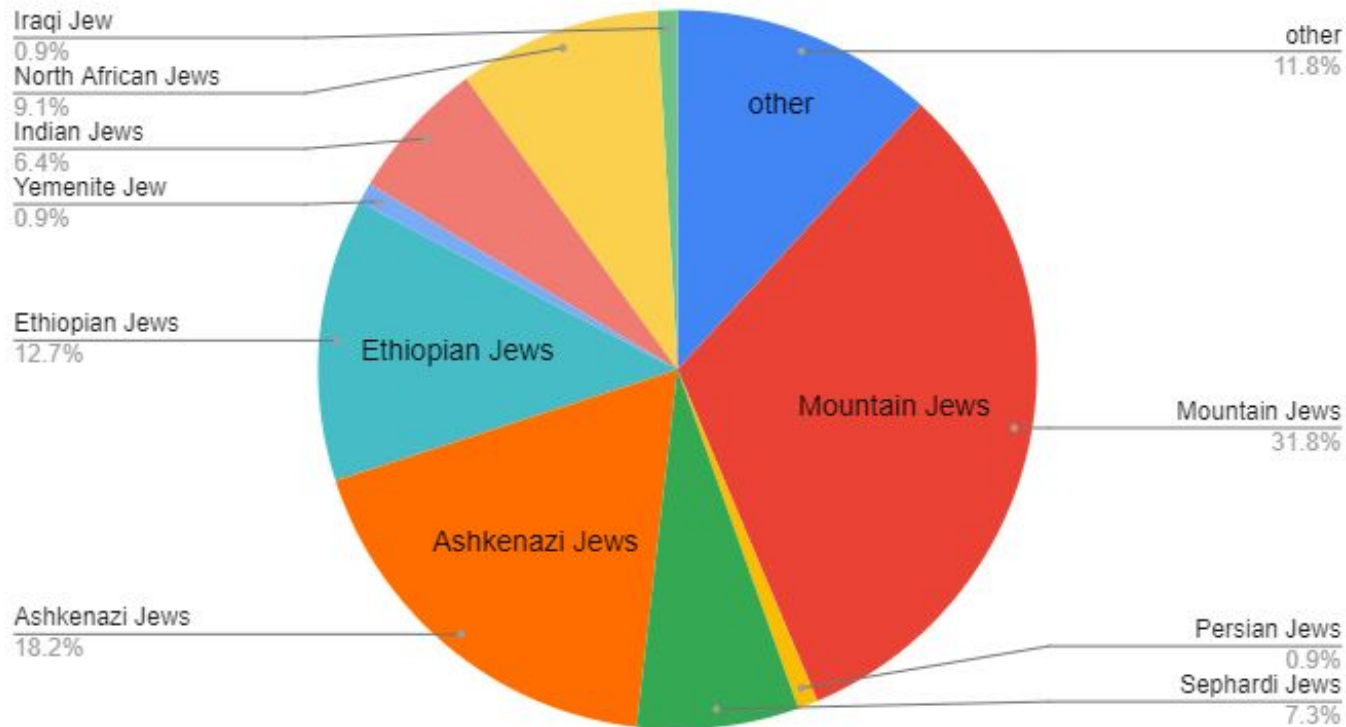
Caveat:

- Jewish samples analyzed at higher resolution than Palestinian controls
- Precise timing of shared maternal ancestry remains unresolved

Interpretive note:

- Given evidence for male-biased Jewish migration, shared maternal ancestry in Palestinians is plausible, but requires further high-resolution study

Palestinian Maternal Haplogroups found in Jewish populations

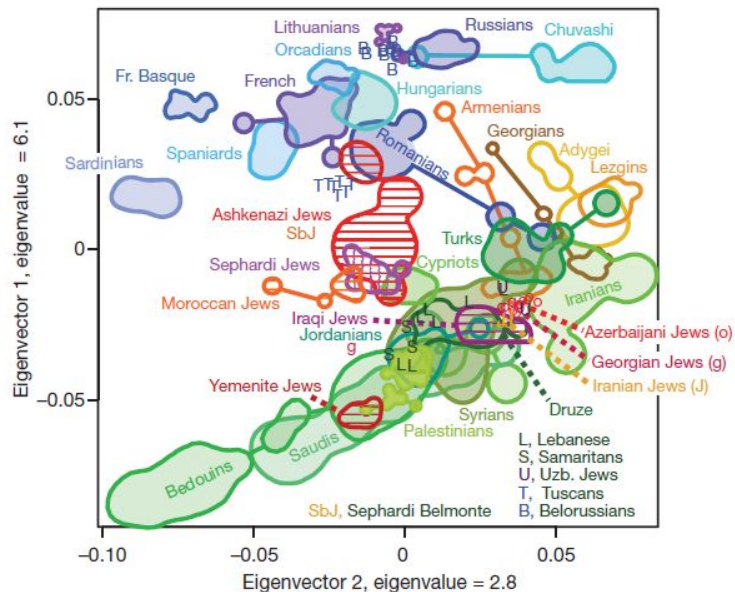


Based on: Counting the Founders: The Matrilineal Genetic Ancestry of the Jewish Diaspora, Behar 2008

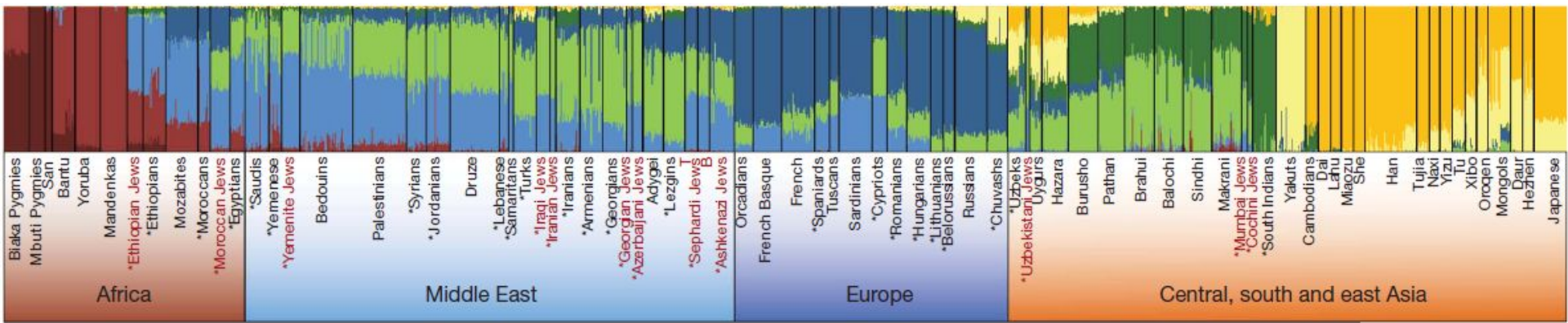
Early Genome-wide Era (2009-2014):

Autosomal SNP studies: Kopelman, Behar, Atzmon, Ostrer, Carmi

- **Kopelman et al. (2009 BMC) Genomic microsatellites identify shared Jewish ancestry intermediate between Middle Eastern and European populations**, a genome-wide population-genetic study of Jewish populations, analyzing 678 autosomal microsatellite loci in 78 individuals from four Jewish groups together with similar data on 321 individuals from 12 non-Jewish Middle Eastern and European populations. found that Jewish populations worldwide share significant genetic similarity, clustering together but positioned genetically between non-Jewish Middle Eastern and European populations, it used microsatellite genotyping (STRs).
- **Behar et al. (2010, Nature): The genome-wide structure of the Jewish people**, large-scale autosomal SNP analysis → Jews cluster together, with Levantine + diaspora admixture. Illumina 610K or 660K bead arrays were used to genotype 121 samples from 14 Jewish communities. The results were compared with 1,166 individuals from 69 non-Jewish populations, microarray
- **Atzmon & Ostrer (2010, AJHG): Abraham's children in the genome era**: major Jewish diaspora populations comprise distinct genetic clusters with shared Middle Eastern Ancestry, confirmed shared Middle Eastern roots among Jewish groups. a “genome-wide analysis”, but in the sense of dense autosomal SNP array data, not full sequencing..
- Carmi et al. (2014, Nat. Comm.): studied Ashkenazi bottleneck, showing a mix of Levantine and Southern European ancestry.
- These studies gave much sharper resolution — but still relied only on modern DNA.



Behar et al. (2010, Nature): The genome-wide structure of the Jewish people



later Genome-wide Era (2014-2017): Hello NGS (Next Generation Sequencing)

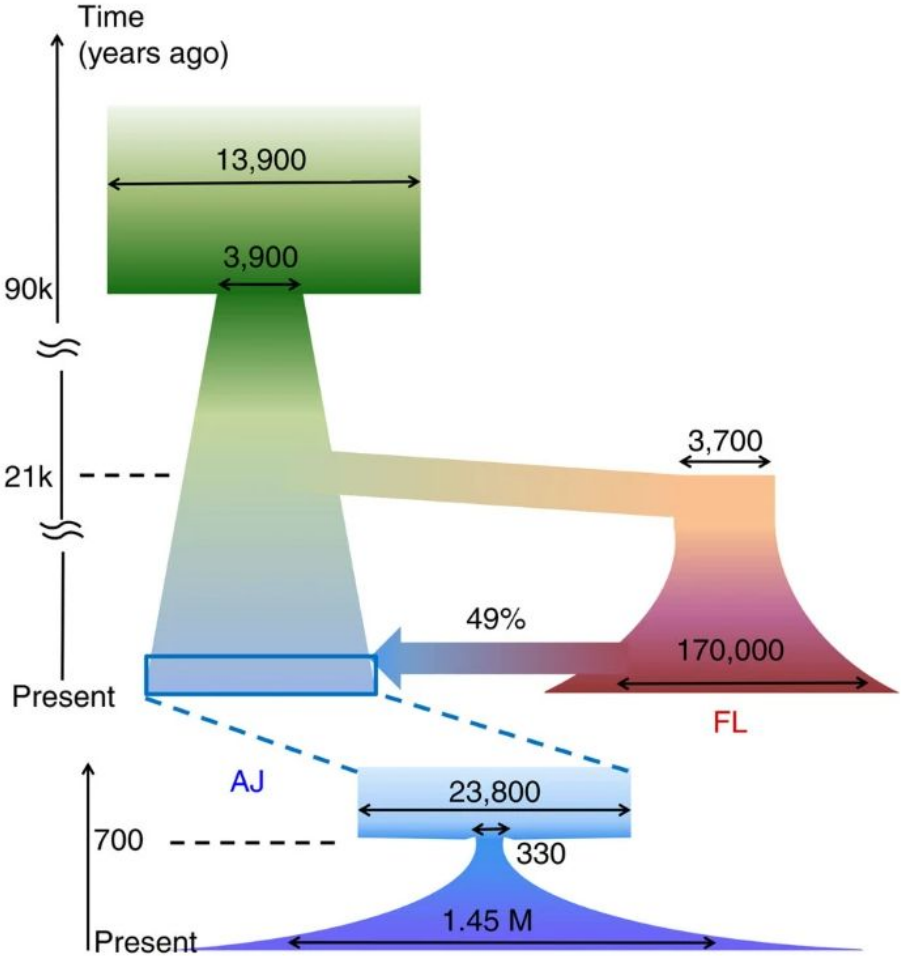
Autosomal SNP studies: Kopelman, Behar, Atzmon, Ostrer, Carmi

- Kopelman et al. (2009 BMC) Genomic microsatellites identify shared Jewish ancestry intermediate between Middle Eastern and European populations
- Behar et al. (2010, Nature): The genome-wide structure of the Jewish people,
- Atzmon & Ostrer (2010, AJHG): Abraham's children in the genome era: major Jewish diaspora populations comprise distinct genetic clusters with shared Middle Eastern Ancestry, confirmed shared Middle Eastern roots among Jewish groups. a “genome-wide analysis”, but in the sense of dense autosomal SNP array data, not full sequencing.
- **Carmi et al. (2014, Nat. Comm.): Sequencing an Ashkenazi reference panel supports population-targeted personal genomics and illuminates Jewish and European origins**, studied Ashkenazi bottleneck, showing a mix of Levantine and Southern European ancestry. **Finally some NGS**. Drew some actual detailed conclusions
- These studies gave much sharper resolution — but still relied only on modern DNA.

2014, Carmi et al. published by Nature Communications found that the Ashkenazi Jewish population originates from an even mixture between Middle Eastern and European peoples.

- The study found that all Ashkenazi Jews descend from around 350 individuals who were genetically about half Middle Eastern and half European.
- According to the authors, this genetic bottleneck likely occurred some 600–800 years in the past, followed by rapid growth and genetic isolation
- **This bottleneck correlates the massive genocide event in Ashkenazi Jewish history following the Black Plague in Europe, Germany (1348-1351)**
- Estimated an 'effective population' of 350 people who are ancestors of the modern Ashkenazi Jews suggest about 1000-2000 survivors of the genocide including elderly and children

Figure 4: A reconstruction of the AJ and FL demographic history.



Carmi et al. Sequencing an Ashkenazi reference panel supports population-targeted personal genomics and illuminates Jewish and European origins,
Nature Communications, September 2014

The Controversy - Ashkenazim from Khazaria?

- *Eran Elhaik and the Khazar hypothesis*
- **Speaker notes:**
 - Elhaik (2012, Genome Biology and Evolution): argued Ashkenazim descended from Khazars in the Caucasus.
 - Relied on proxies (modern Armenians, Georgians) — no Khazar aDNA existed.
 - This generated debate, because without ancient DNA, arguments about origins were speculative.
 - Refuting paper from Behar, No Evidence from Genome-Wide Data of a Khazar Origin for the Ashkenazi Jews, Doron M. Behar 2013
 - *“This was the peak of the pre-aDNA era — a time when models were based more on imagination than direct evidence.”*

The Controversy - Ashkenazim, from Khazaria?

Refuting paper from Behar, No Evidence from Genome-Wide Data of a Khazar Origin for the Ashkenazi Jews, Doron M. Behar 2013

- Elhaik (2012, Genome Biology and Evolution): **The Missing Link of Jewish European Ancestry: Contrasting the Rhineland and the Khazarian Hypotheses**, argued Ashkenazim descended from Khazars in the Caucasus.
- Relied on proxies (modern Armenians, Georgians) — no Khazar aDNA existed.
- This generated debate, because without ancient DNA, arguments about origins were speculative.
- *“This was the peak of the pre-aDNA era — a time when models were based more on imagination than direct evidence.”*

Elhaik Controversy: Claim vs. Refutation

Elhaik (2012) Claim

- Proposed Ashkenazim as mixed between **Caucasus groups** and Middle Easterners.
- Used **modern Armenians/Georgians** as “**Khazar proxies**” (no real Khazar DNA exists).

Methodological Issues

- Proxy populations **not genetically Turkic**.
- Reference panel selection strongly biased the results.
- Widely criticized for **overfitting** and **historical inaccuracy**.

Refutation (Behar 2013 & others)

- Much larger & geographically accurate dataset.
- **No Khazar genetic signal** in Ashkenazi Jews.
- Clear ancestry: **Levantine roots + European admixture**.

Significance

- Shows limitations of early genome-wide modeling.
- aDNA + qpAdm later resolved the question decisively.

Behar et al. 2013: No Khazar Origin for Ashkenazi Jews

Background

- Khazar-origin theory comes mainly from **the 12th-century Kuzari**, not historical evidence.
- Tested using the **largest dataset ever assembled** for this question.

Dataset

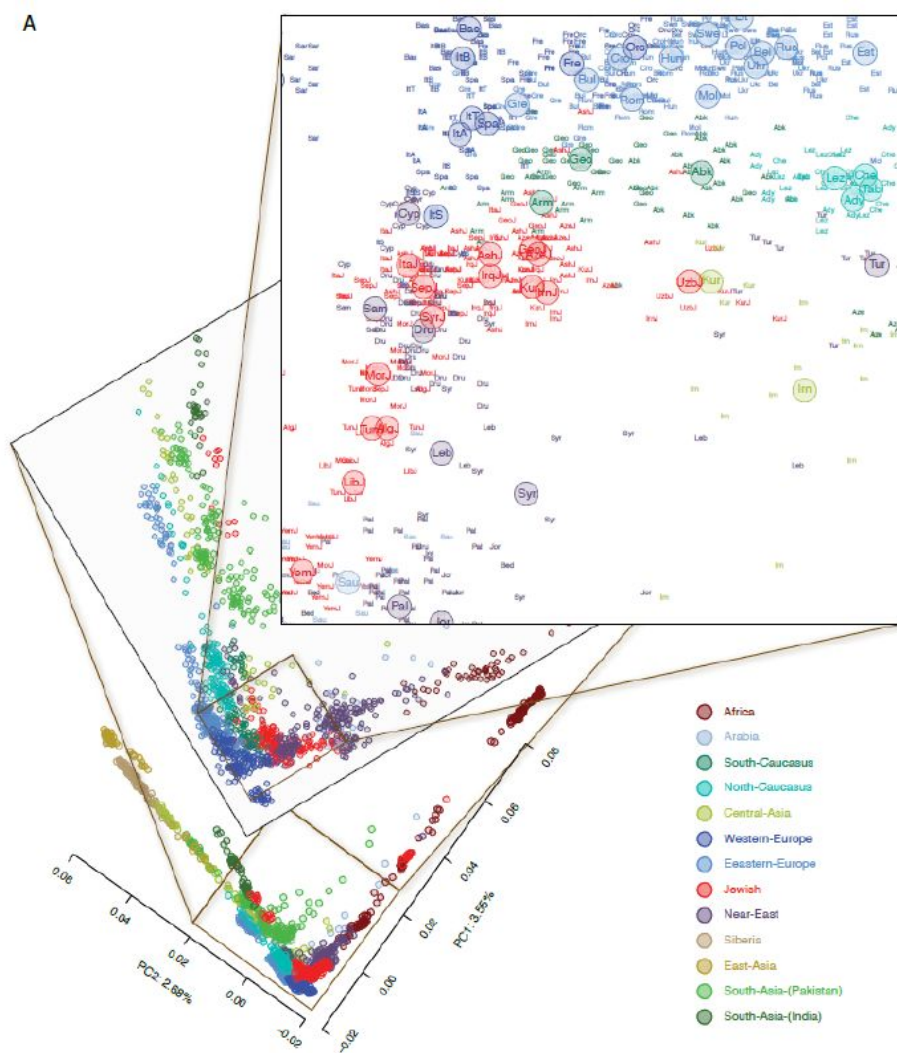
- **1,774 total samples** (352 new).
- **88 non-Jewish populations** across Europe, Middle East, Caucasus, Arabia, Africa, Asia.
- **222 Caucasus + Volga samples** (actual Khazar-realm coverage).
- **202 Jews** from **18 Jewish communities**.

Findings

- Ashkenazi, Sephardi & North African Jews share **strong Levantine ancestry + European admixture**.
- **No detectable Khazar/Turkic contribution**.
- Confirms earlier genome-wide studies (Atzmon 2010; Behar 2010; Kopelman 2009; Haber 2013).

Conclusion

- Ashkenazi Jews = Largely **Levantine-origin population**, not descended from Khazars.



No Evidence from Genome-Wide Data of a Khazar Origin for the Ashkenazi Jews, Doron M. Behar 2013

Das & Elhaik 2016, Localizing Ashkenazic Jews to Primeval Villages in the Ancient Iranian Lands of Ashkenaz, Genome Biology and Evolution, April 2016

Purpose:

- Proposed an alternative origin for Ashkenazi Jews (AJ), challenging Behar 2013's Levantine–European model.

Method:

- Used **GPS (Geographic Population Structure)** on modern genomes (393 AJ + Iranian, Mountain Jews + non-Jews).
- No ancient DNA; relies on similarity to present-day populations.

Claim:

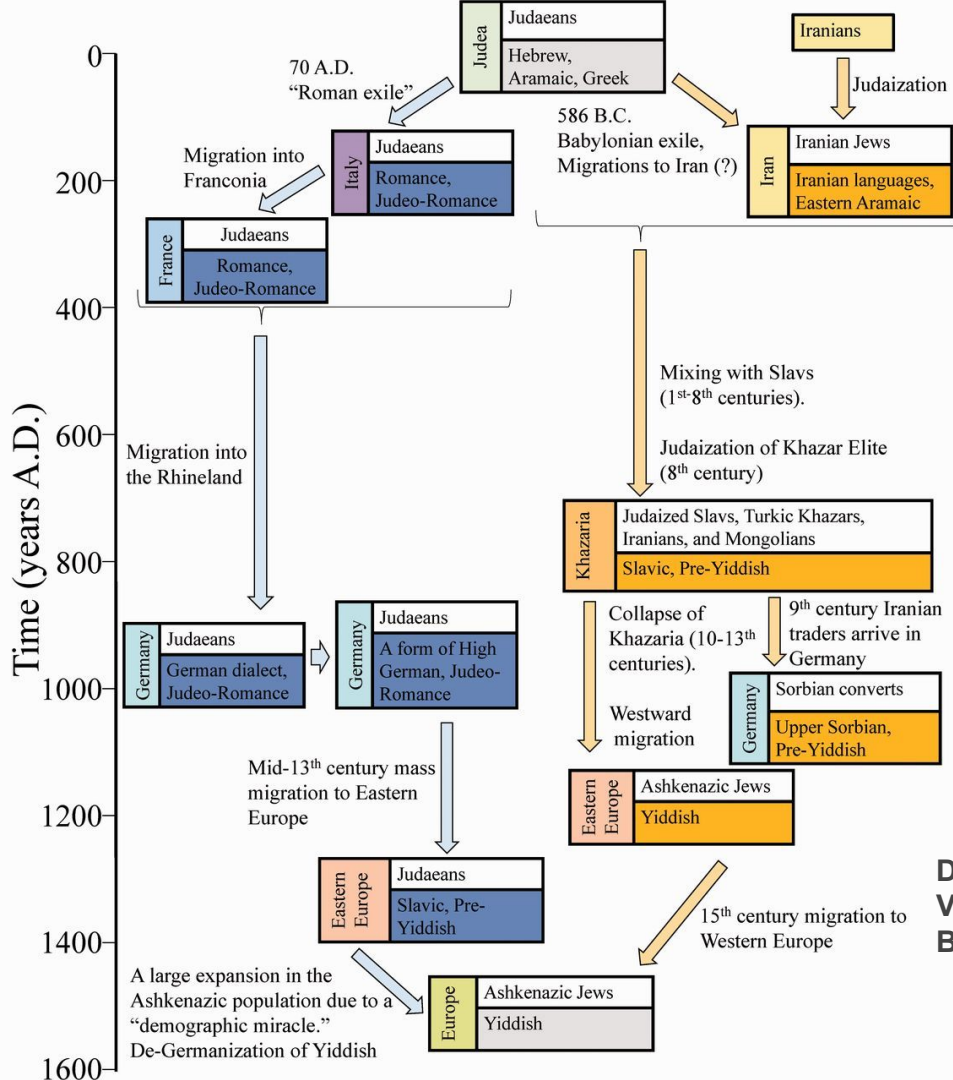
- AJ ancestry “localized” to **northeastern Turkish villages** along ancient trade routes.
- Suggested a mixed Iranian/Anatolian/Caucasus origin.

Criticisms:

- **GPS not reliable for admixed groups**; extremely sensitive to reference panels.
- Contradicted by numerous genome-wide studies showing **no Caucasus/Turkic component**.
- Seen as the **final major pre-aDNA attempt** to reinterpret Ashkenazi origins without Levantine anchors.

Takeaway:

- Useful as an example of *why ancient DNA was needed* to resolve long-standing debates.



Das & Elhaik, Localizing Ashkenazic Jews to Primeval Villages in the Ancient Iranian Lands of Ashkenaz, Genome Biology and Evolution, April 2016

Xue et al. 2017 – Refining Ashkenazi Origins (Pre-aDNA Era)

Study:

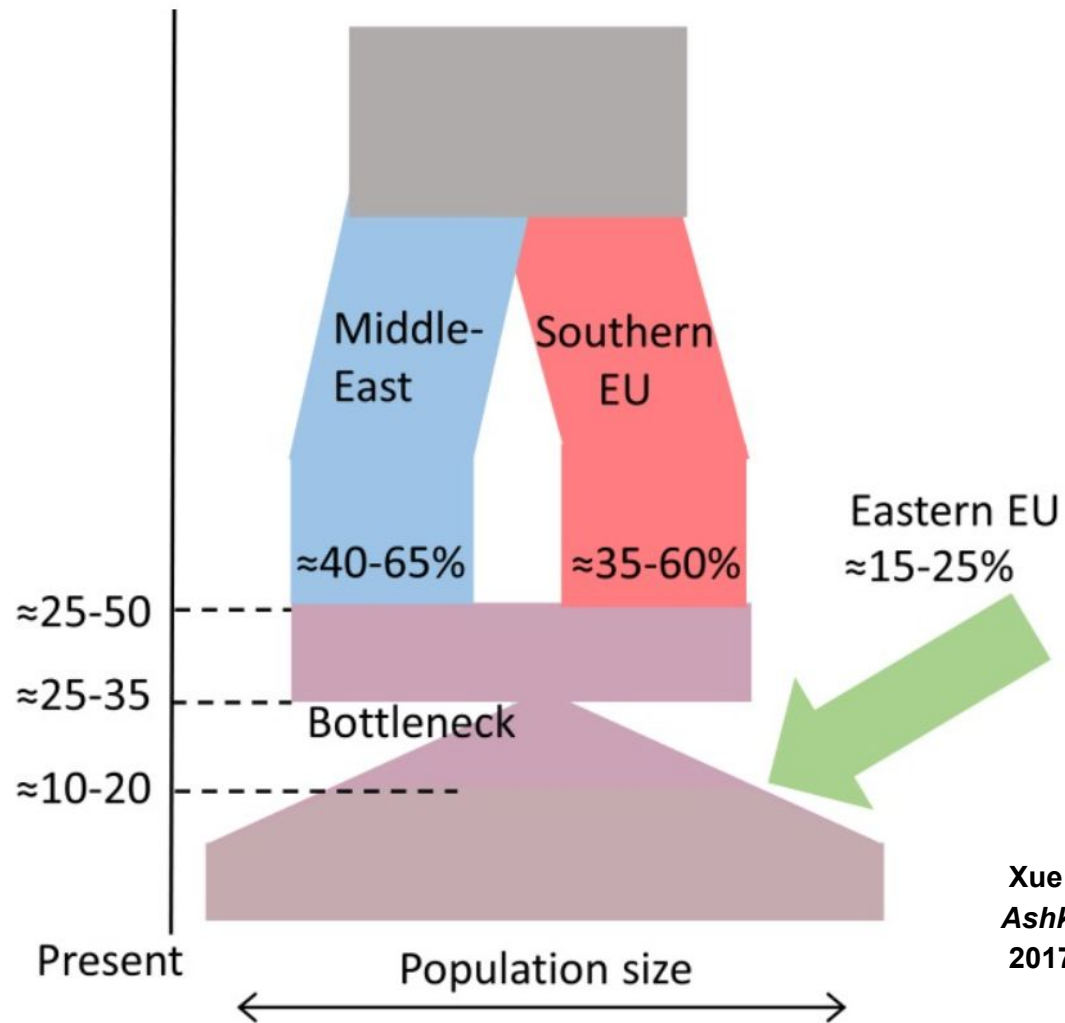
Xue et al., *The time and place of European admixture in Ashkenazi Jewish history*
2017

How this builds on Carmi (2014):

- Confirms **mixed Middle Eastern + European ancestry**
- Moves beyond global ancestry to **local ancestry inference**
- Identifies **Southern Europe (Italy/Greece)** as the dominant European source
- Supports **multiple admixture events**, not a single bottleneck episode

Relation to Elhaik / Khazar Hypothesis:

- Finds **no Central Asian / Khazar genetic signal**
- European ancestry clusters with **Mediterranean**, not Caucasus or Volga
- Reinforces earlier genome-wide studies refuting a Khazar origin



Xue et al., The time and place of European admixture in Ashkenazi Jewish history
2017

Xue et al. 2017 – Refining Ashkenazi Origins (Pre-aDNA Era)

Study:

Xue et al., *The time and place of European admixture in Ashkenazi Jewish history*
2017

Key Limitation (Pre-aDNA Era):

- Relies on **modern populations as proxies**
- Cannot directly compare to **Bronze/Iron Age Levantines**
- Timing estimates remain **averaged and model-dependent**

Why This Matters:

- Clarifies *where* European ancestry likely came from
- Narrows the debate significantly
- But shows that **only ancient DNA** can decisively resolve deep origins

Takeaway:

Xue et al. refined Carmi's findings, further weakened Elhaik's claims, but also highlighted the limits of pre-aDNA genetics — setting the stage for the ancient DNA revolution.

Ancient DNA Breakthroughs, the modern era, (2017 - today) Core Ancient DNA Studies Reshaping Levantine History

Foundational Levant aDNA

- **Haber, Marc et al. The American Journal of Human Genetics, 2017, Continuity and Admixture in the Last Five Millennia of Levantine History from Ancient Canaanite and Present-Day Lebanese Genome Sequences,** *showing modern Lebanese people descend largely from Bronze Age Canaanites, who themselves arose from local Neolithic groups mixing with Iranian migrants*
- **Science 2019 – Ancient DNA sheds light on the genetic origins of early Iron Age Philistines**
Early Iron Age Aegean gene flow → rapid Levantine assimilation
- **L. Agranat-Tamir, S. Waldman, S. Carmi, L. Carmel et al., 2020 (Cell) The Genomic History of the Bronze Age Southern Levant**
Bronze & Iron Age Levantines → continuity with modern Jews & Palestinians, increase in Chalcolithic Iranian component during Bronze Age

Jewish Diaspora Resolution

- **Waldman, Carmi, Reich et al., 2022 (Cell) Genome-wide data from medieval German Jews show that the Ashkenazi founder event pre-dated the 14th century**
Medieval Erfurt Jews → Ashkenazi bottleneck predates 14th c.; Levantine + European mix

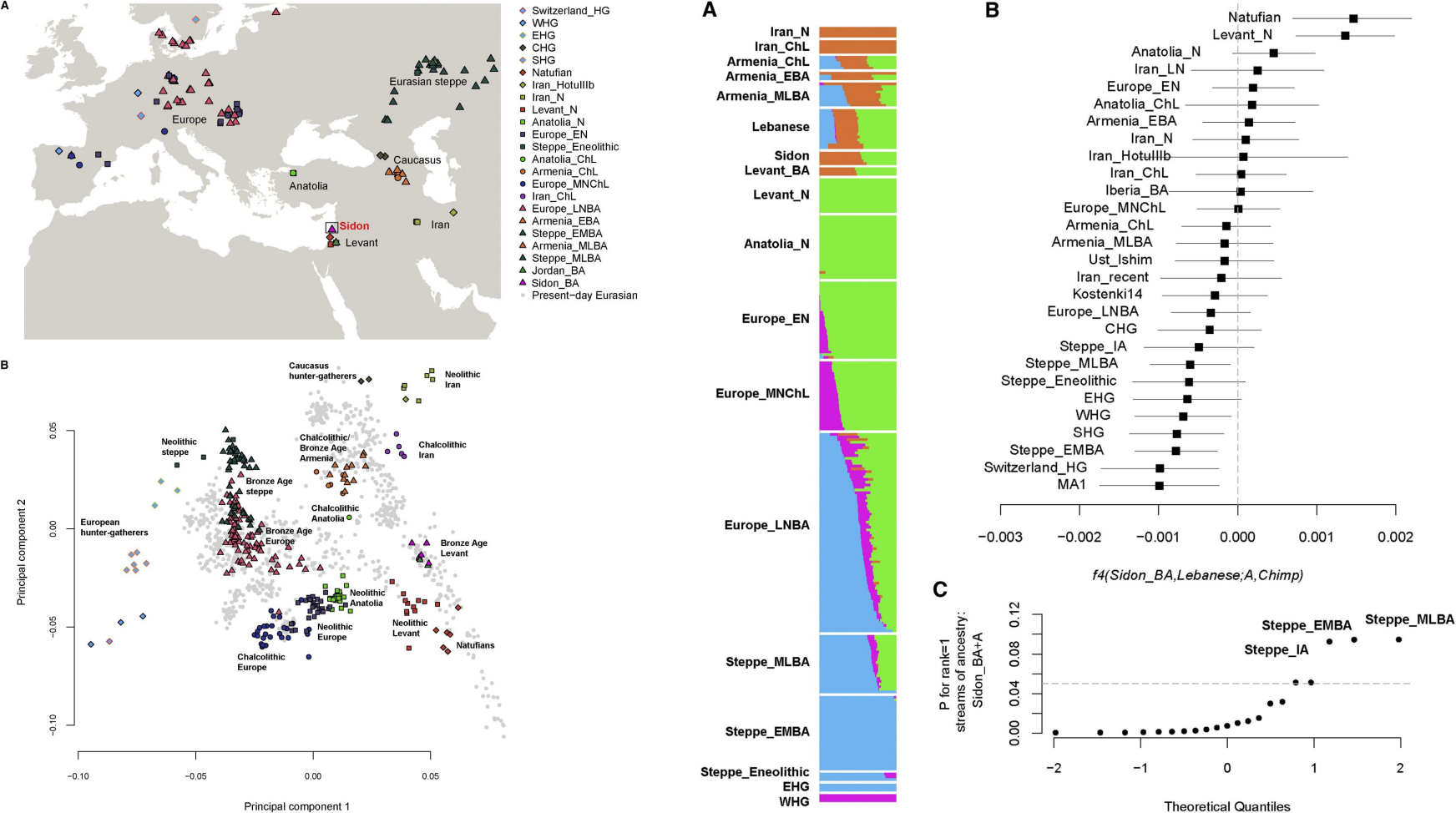
Bottom line (bold):

- Direct ancient DNA confirms **shared Levantine ancestry** across Jews and Palestinians
- Disproves Khazar-only, colonial, or purely exogenous origin myths

Ancient DNA Breakthroughs, the modern era, (2017 - today) Core Ancient DNA Studies Reshaping Levantine History

Foundational Levant aDNA

- **Haber, Marc et al. The American Journal of Human Genetics, 2017, Continuity and Admixture in the Last Five Millennia of Levantine History from Ancient Canaanite and Present-Day Lebanese Genome Sequences, *showing modern Lebanese people descend largely from Bronze Age Canaanites, who themselves arose from local Neolithic groups mixing with Iranian migrants***



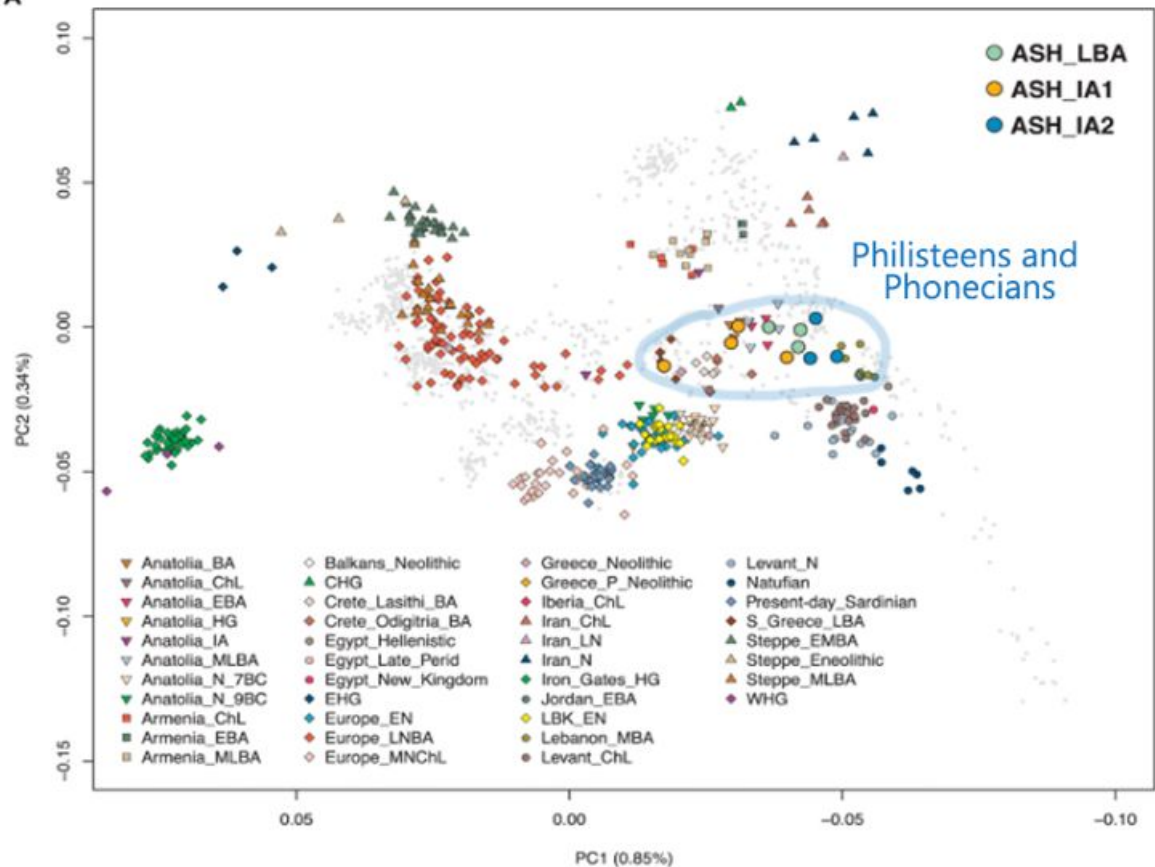
The American Journal of Human Genetics, 2017, Continuity and Admixture in the Last Five Millennia of Levantine History from Ancient Canaanite and Present-Day Lebanese Genome Sequences

Ancient DNA Breakthroughs, the modern era, (2017 - today) Core Ancient DNA Studies Reshaping Levantine History

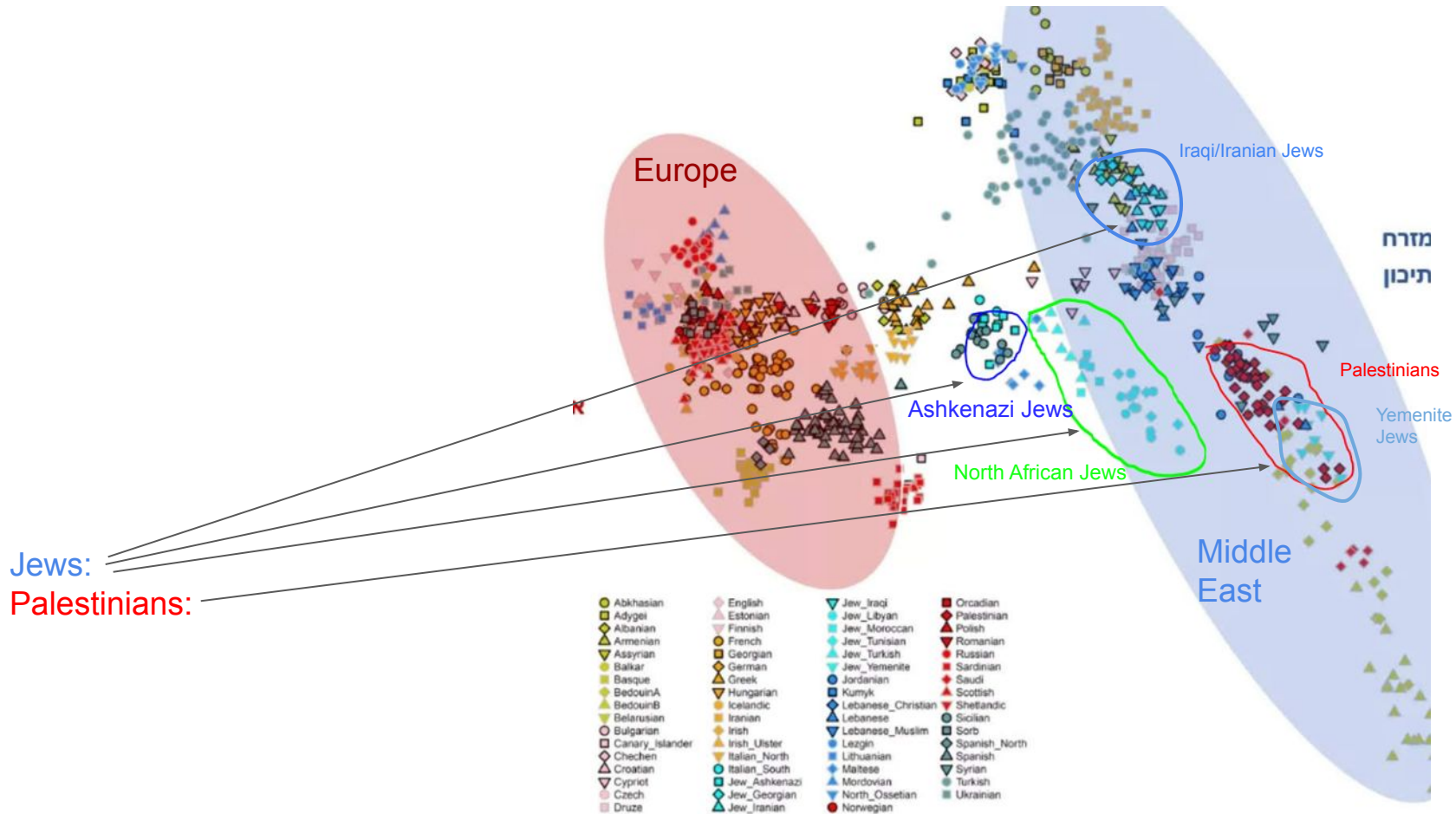
Foundational Levant aDNA

- **Science 2019 – Ancient DNA sheds light on the genetic origins of early Iron Age Philistines**
Early Iron Age Aegean gene flow → rapid Levantine assimilation

A

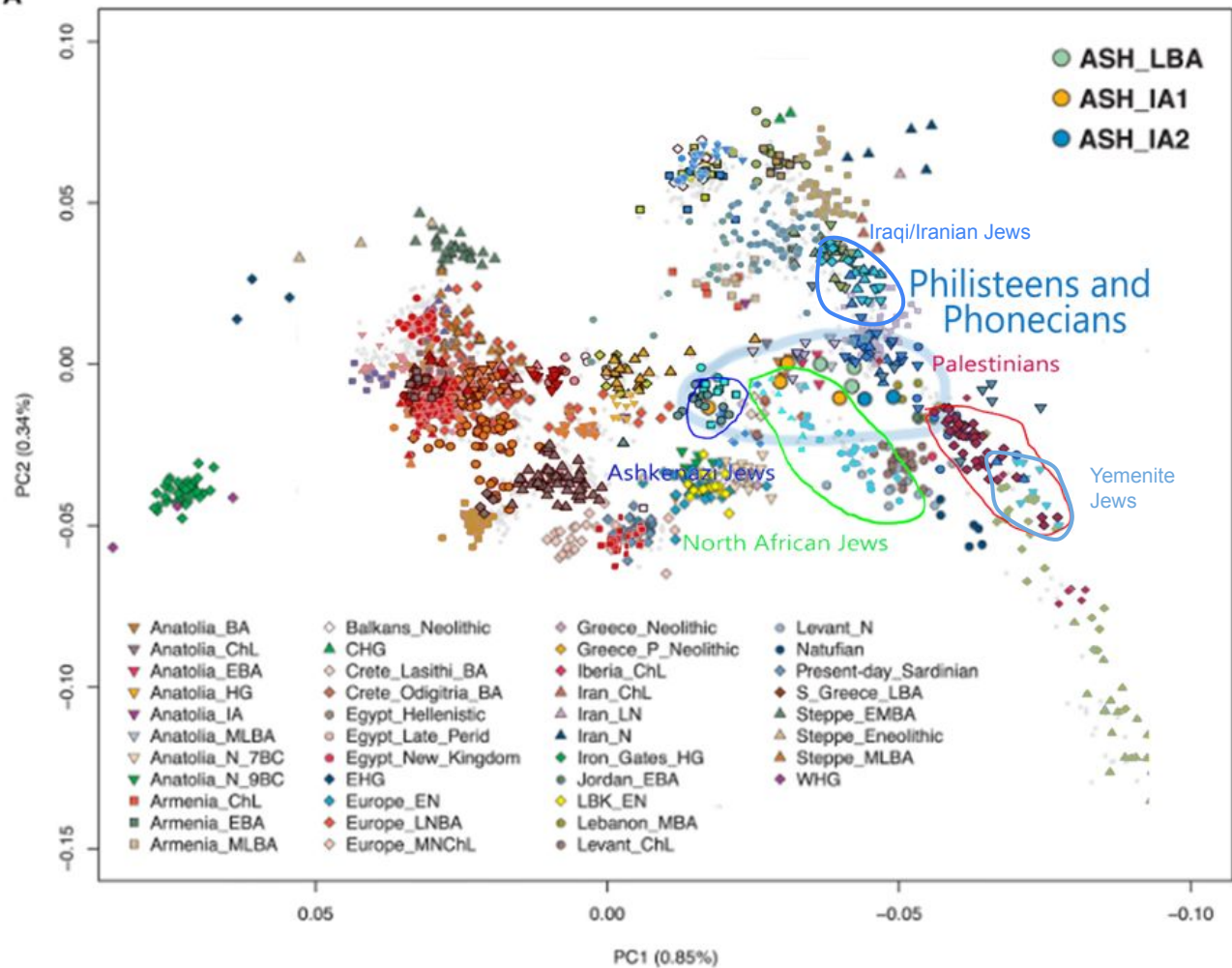


Ancient DNA sheds light on the genetic origins of early Iron Age Philistines, Science 2019



Jewish and Palestinian Populations compared with other modern population groups

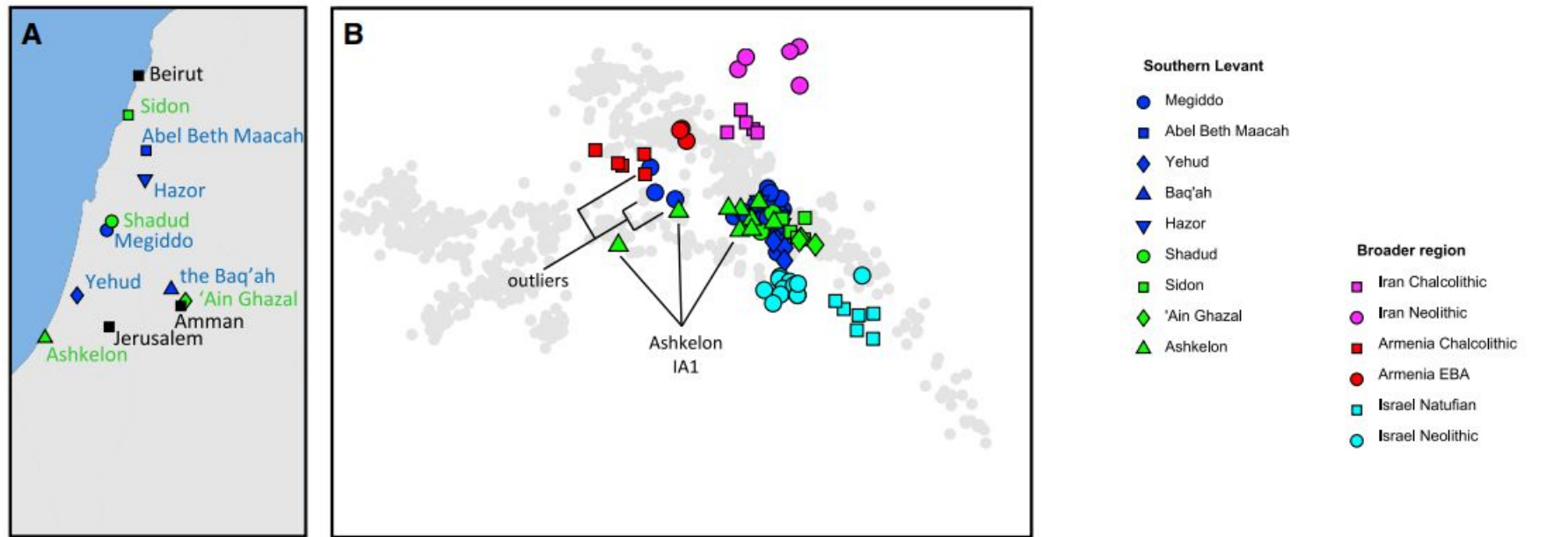
A



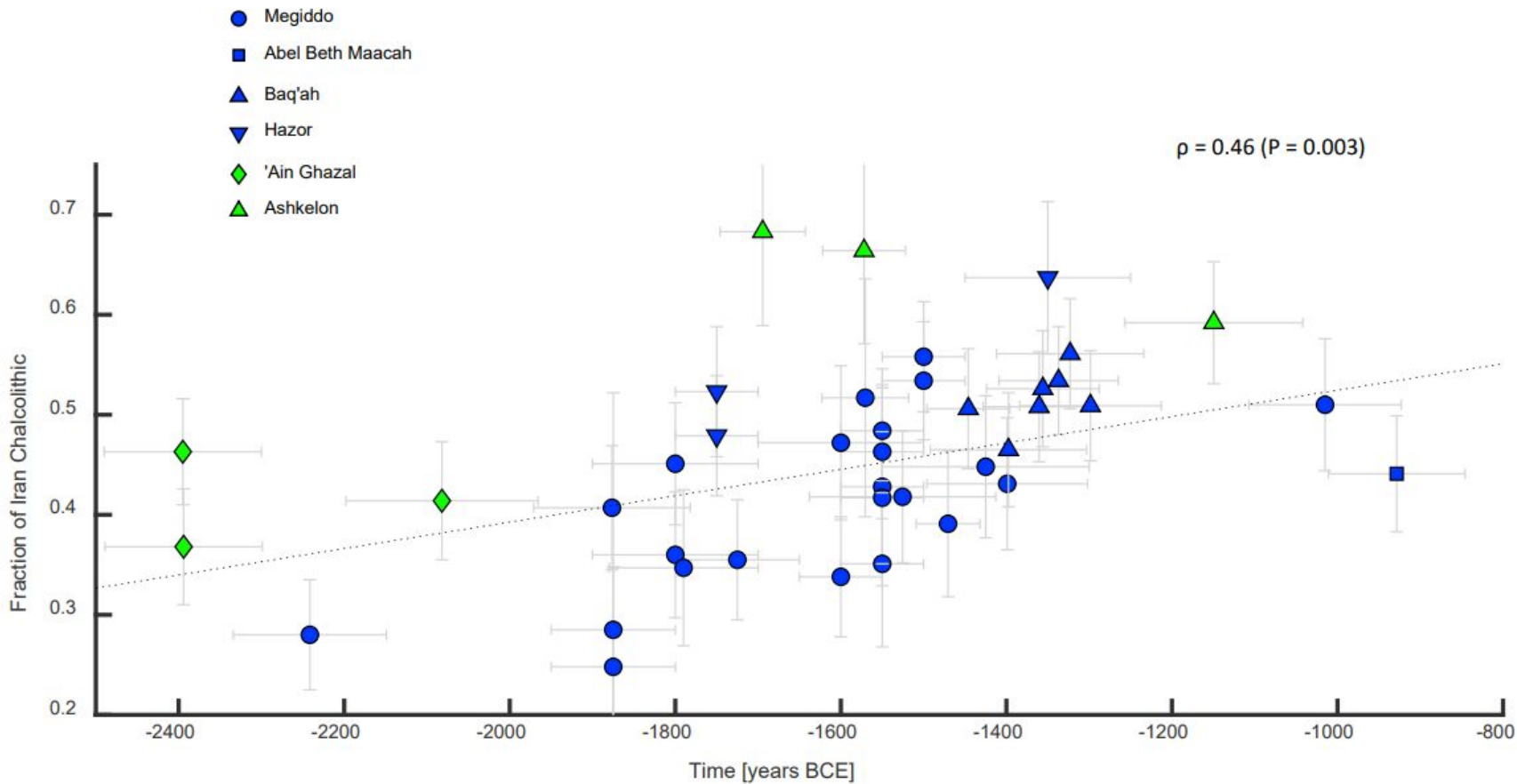
Ancient DNA Breakthroughs, the modern era, (2017 - today) Core Ancient DNA Studies Reshaping Levantine History

Foundational Levant aDNA

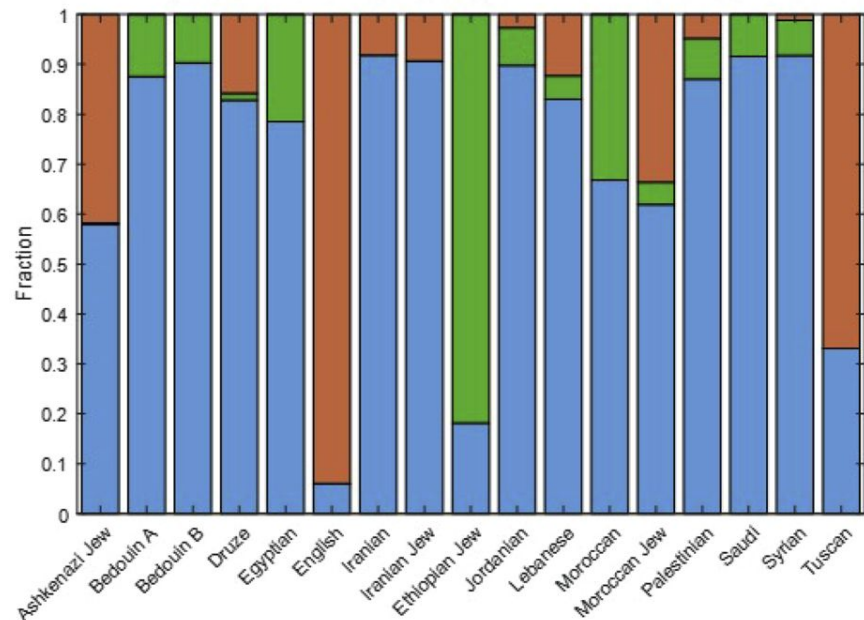
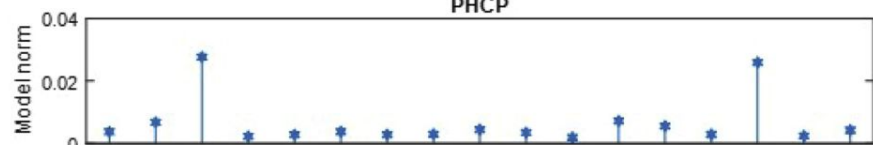
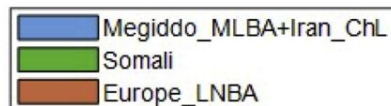
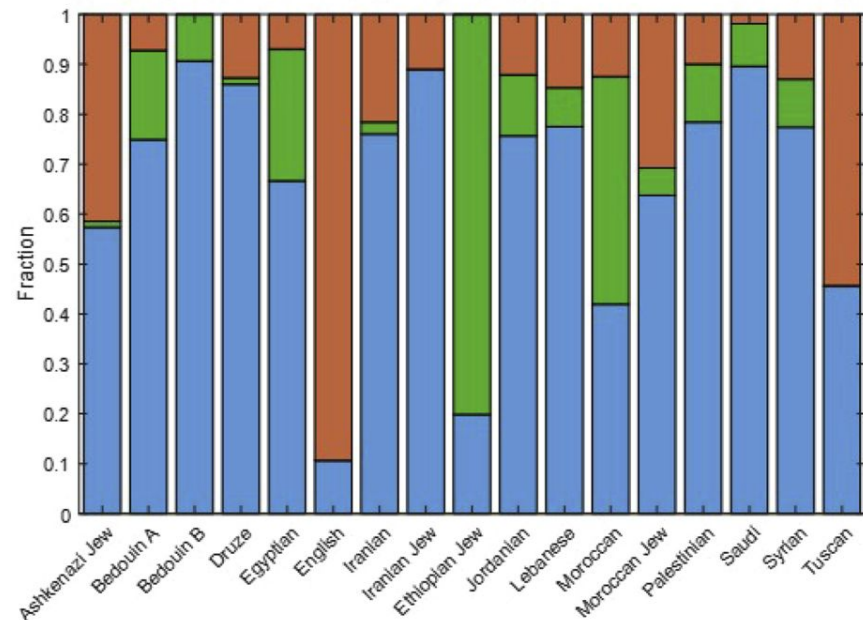
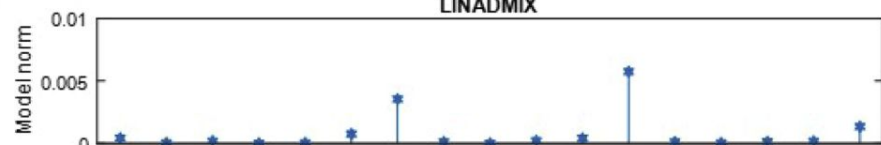
- **L. Agranat-Tamir, S. Waldman, S. Carmi, L. Carmel et al., 2020 (Cell) The Genomic History of the Bronze Age Southern Levant**
Bronze & Iron Age Levantines → continuity with modern Jews & Palestinians, increase in Chalcolithic Iranian component during Bronze Age



Ancient DNA Samples, Cell 2020
The Genomic History of the Bronze Age Southern Levant



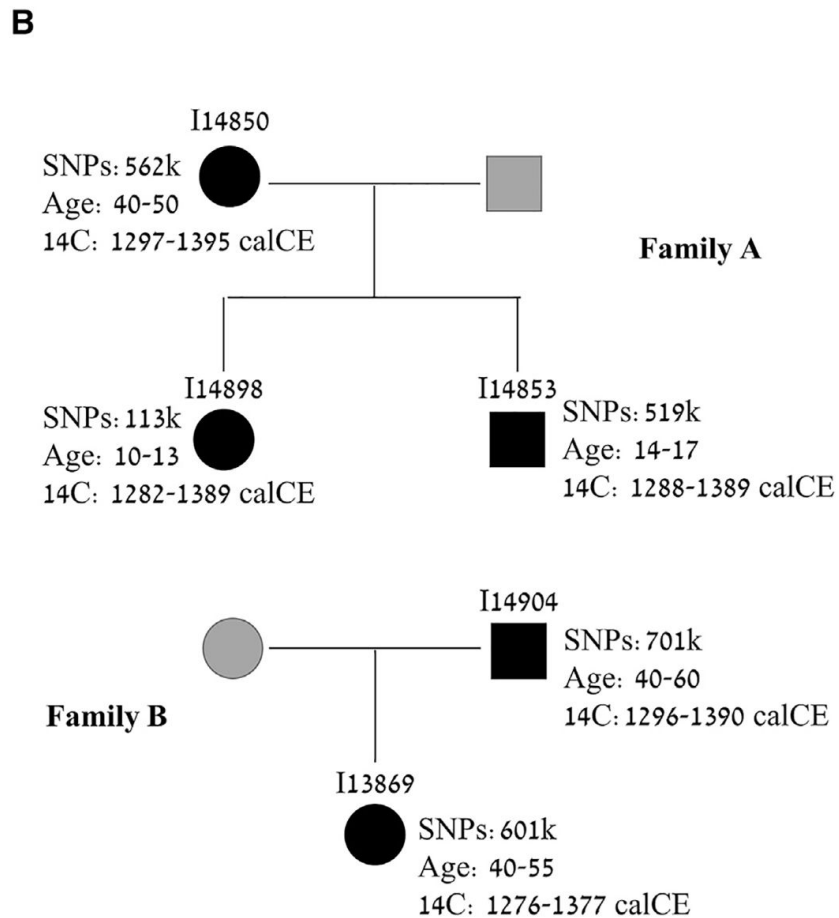
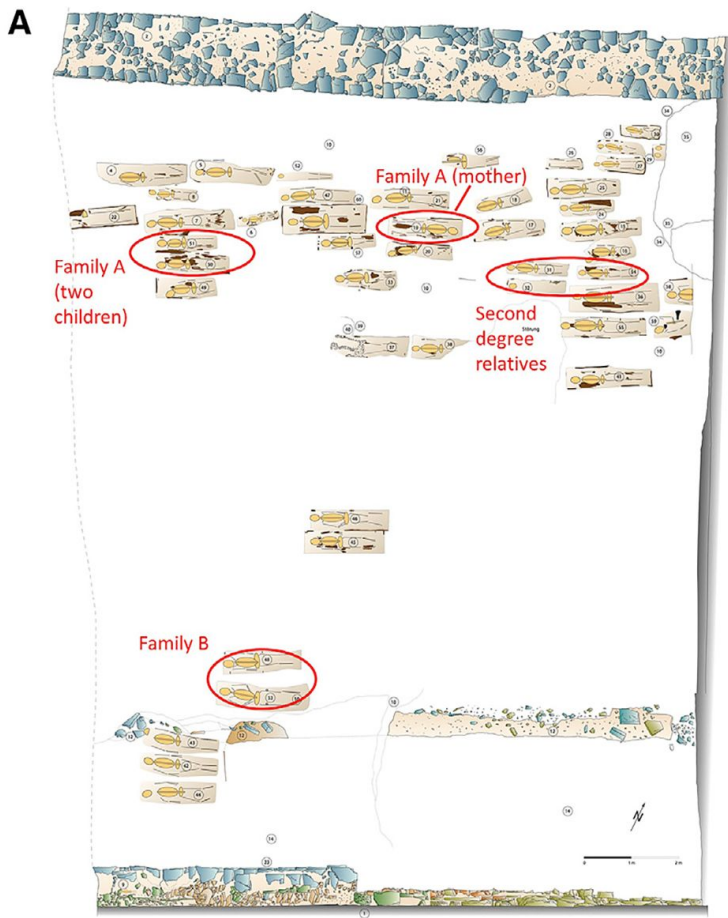
Ancient DNA Samples, Cell 2020
The Genomic History of the Bronze Age Southern Levant



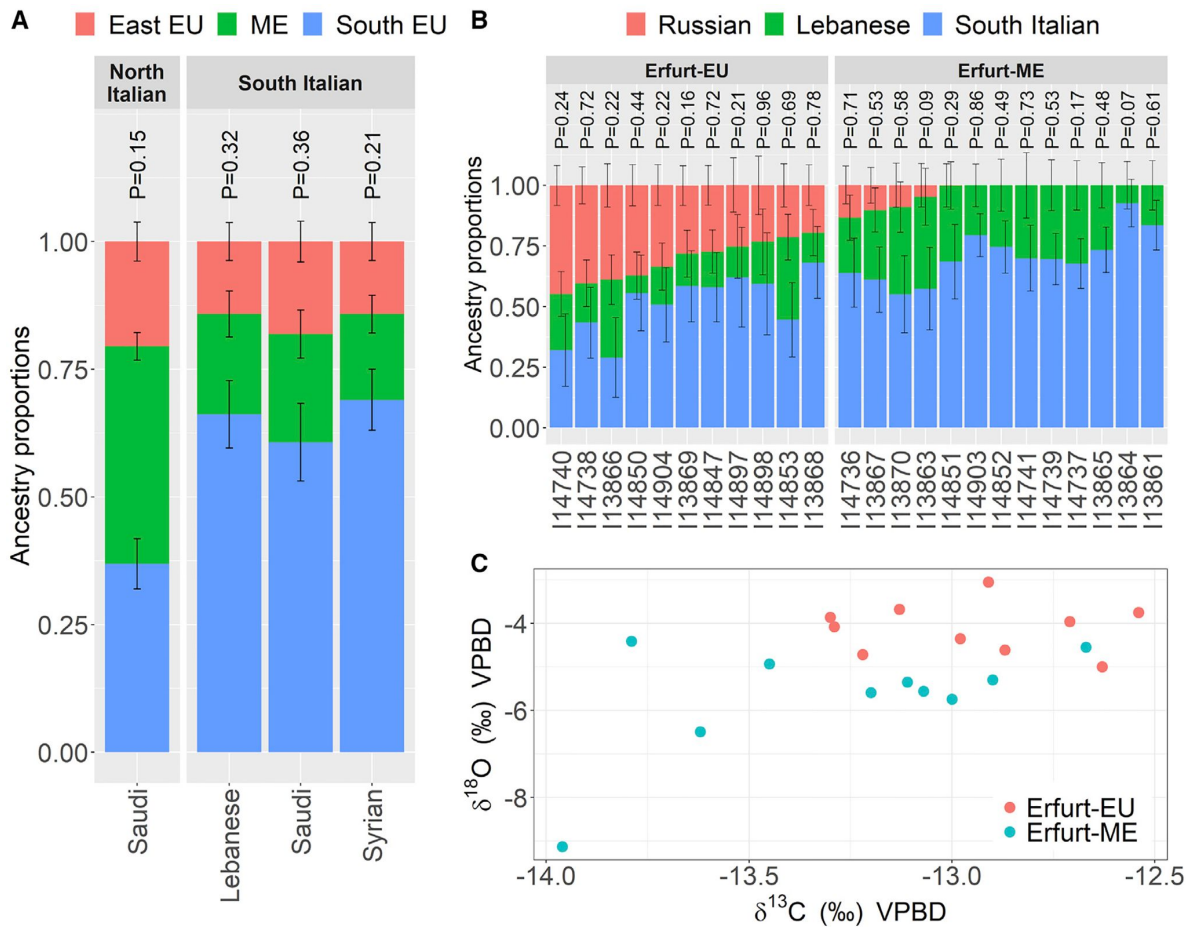
Ancient DNA Breakthroughs, the modern era, (2017 - today) Core Ancient DNA Studies Reshaping Levantine History

Jewish Diaspora Resolution

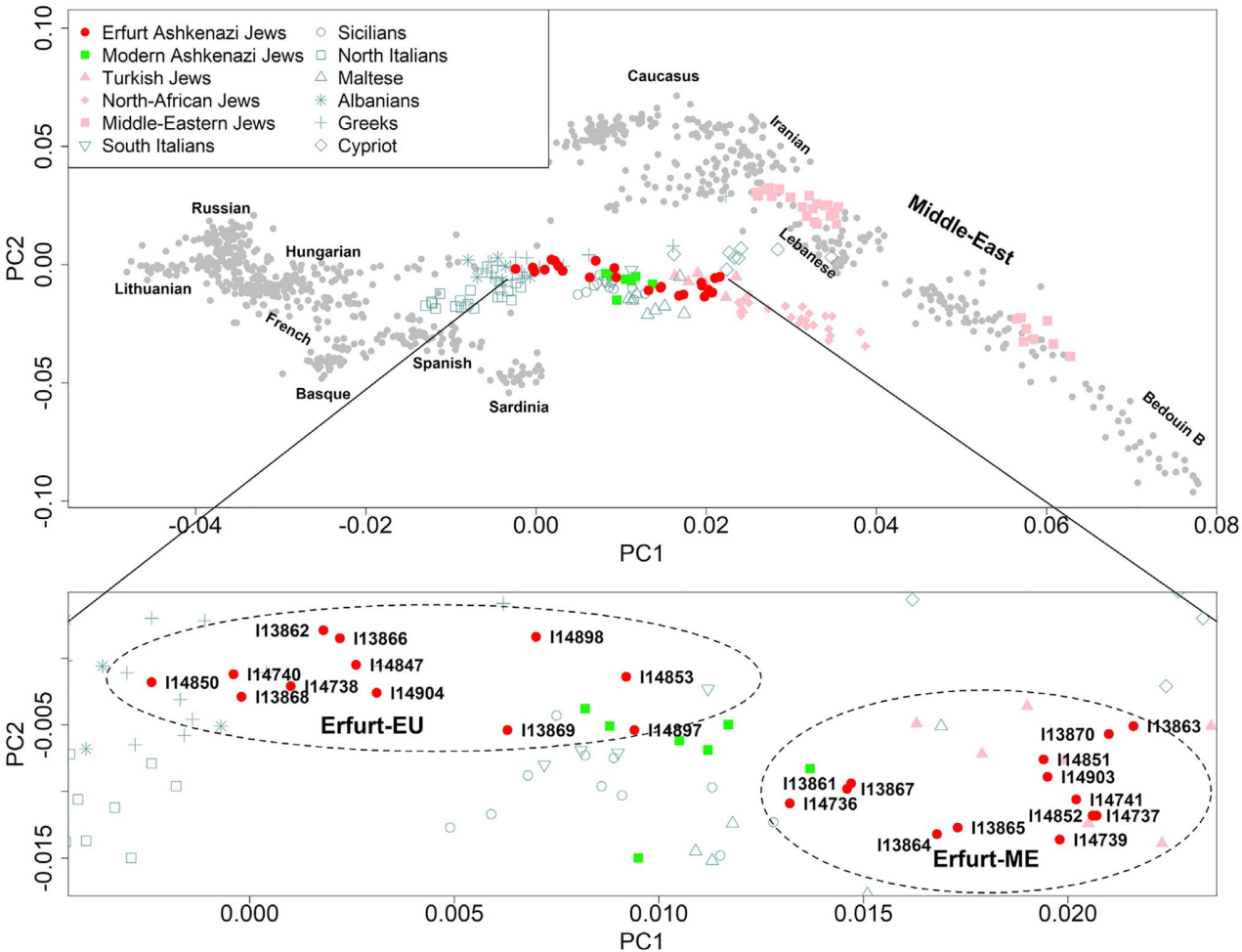
- **Waldman, Carmi, Reich et al., 2022 (Cell) Genome-wide data from medieval German Jews show that the Ashkenazi founder event pre-dated the 14th century**
Medieval Erfurt Jews → Ashkenazi bottleneck predates 14th c.; Levantine + European mix



Waldman, Carmi, Reich et al., 2022 (Cell) Genome-wide data from medieval German Jews show that the Ashkenazi founder event pre-dated the 14th century



Waldman, Carmi, Reich et al., 2022 (Cell) Genome-wide data from medieval German Jews show that the Ashkenazi founder event pre-dated the 14th century



Waldman, Carmi, Reich et al., 2022 (Cell) Genome-wide data from medieval German Jews show that the Ashkenazi founder event pre-dated the 14th century

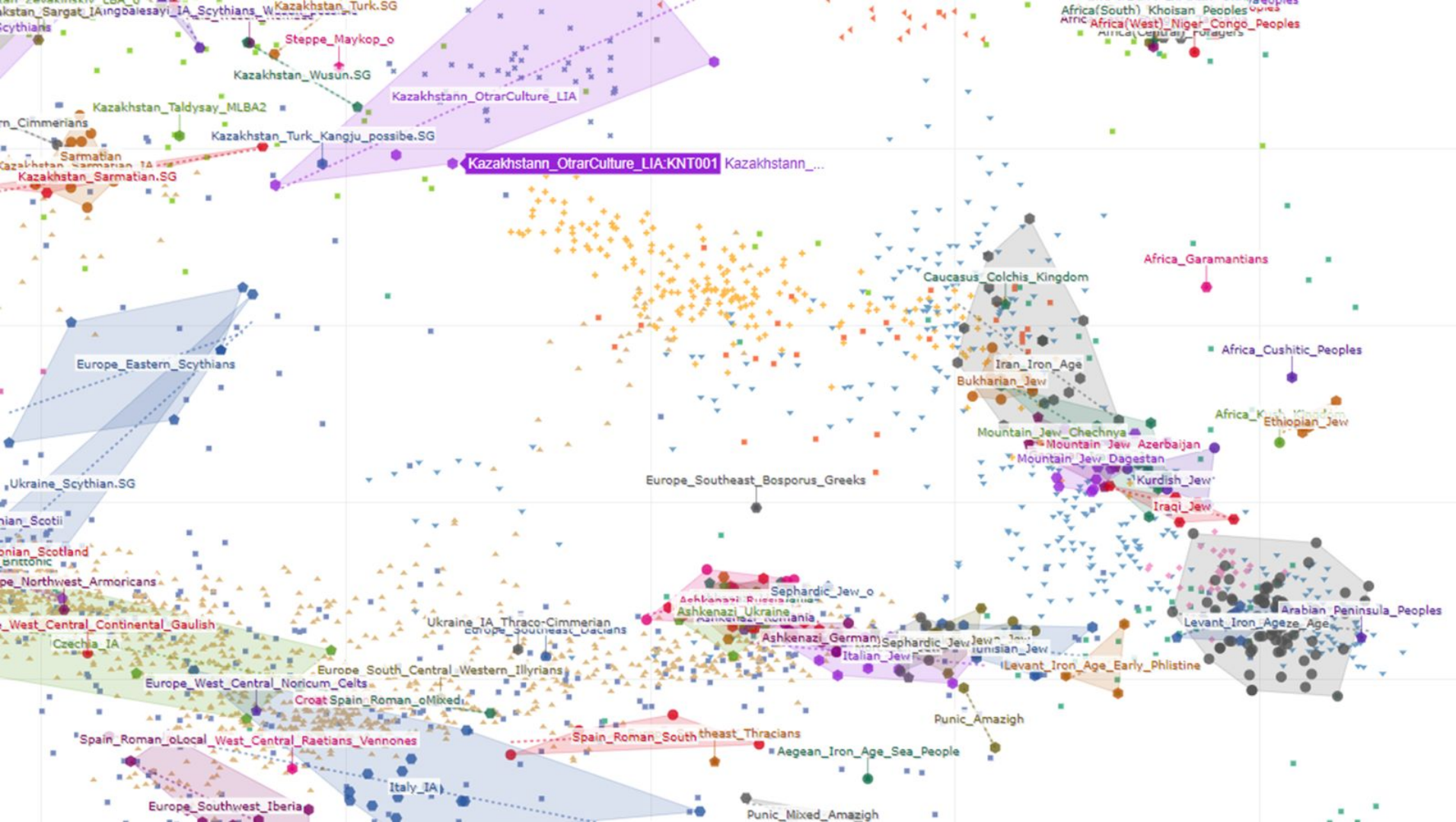
Methods Today

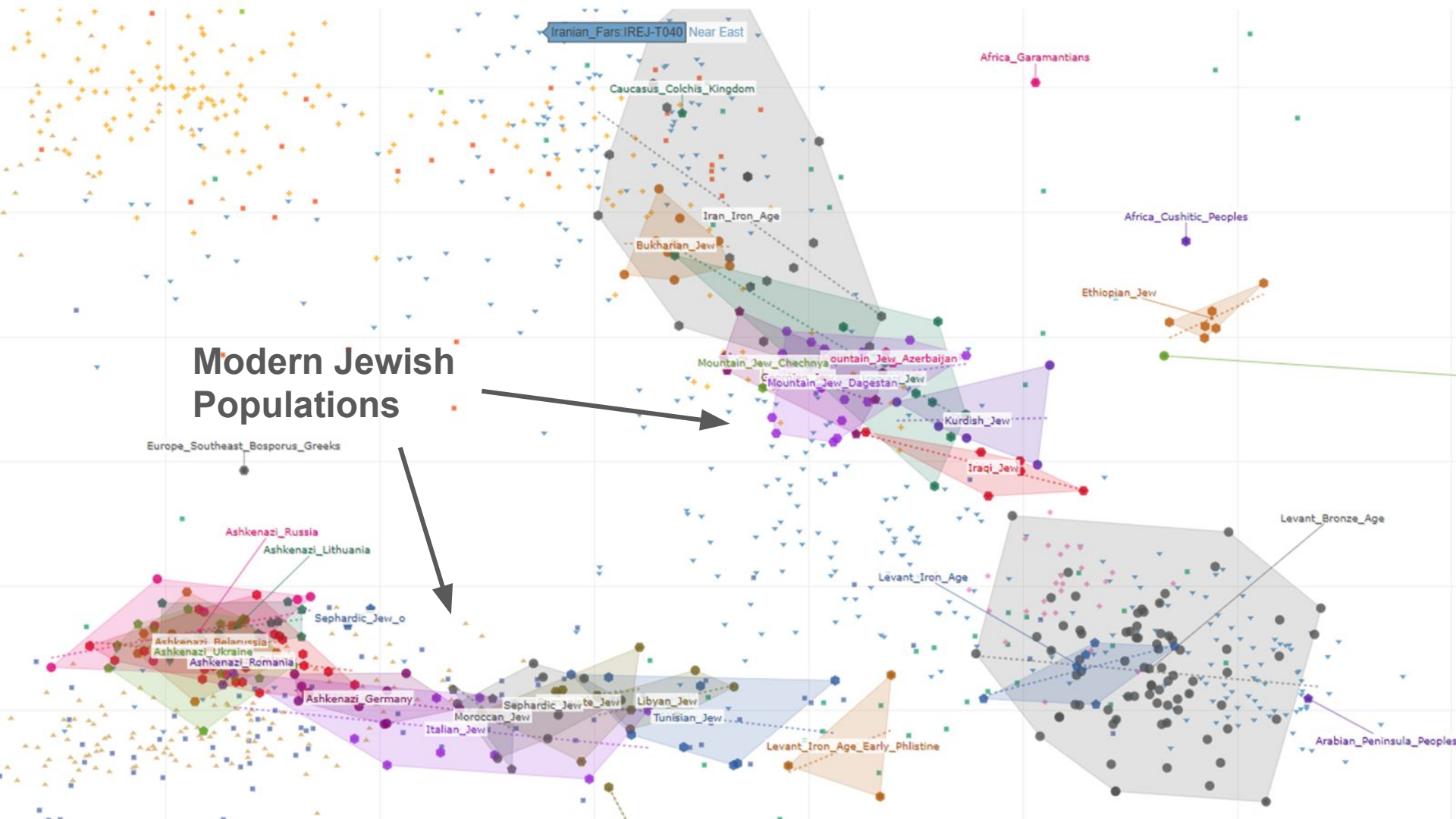
qpAdm vs G25

- **Speaker notes:**
 - **qpAdm:** statistical tool using f-stats, powerful for admixture modeling with ancient sources.
 - **G25 PCA:** reduces genomes into 25 coordinates, good for visualization and exploratory modeling.
 - **G25 Admixture:** Allows for a larger number of samples due to lower computation limitations, not as limited to a representative data set.
 - *“I like both: qpAdm for rigor, G25 for storytelling and experimentation.”*
 - *Gözde Atağ, Shamam Waldman, Shai Carmi et al. GENETICS, 2024, An explanation for the sister repulsion phenomenon in Patterson’s f-statistics*

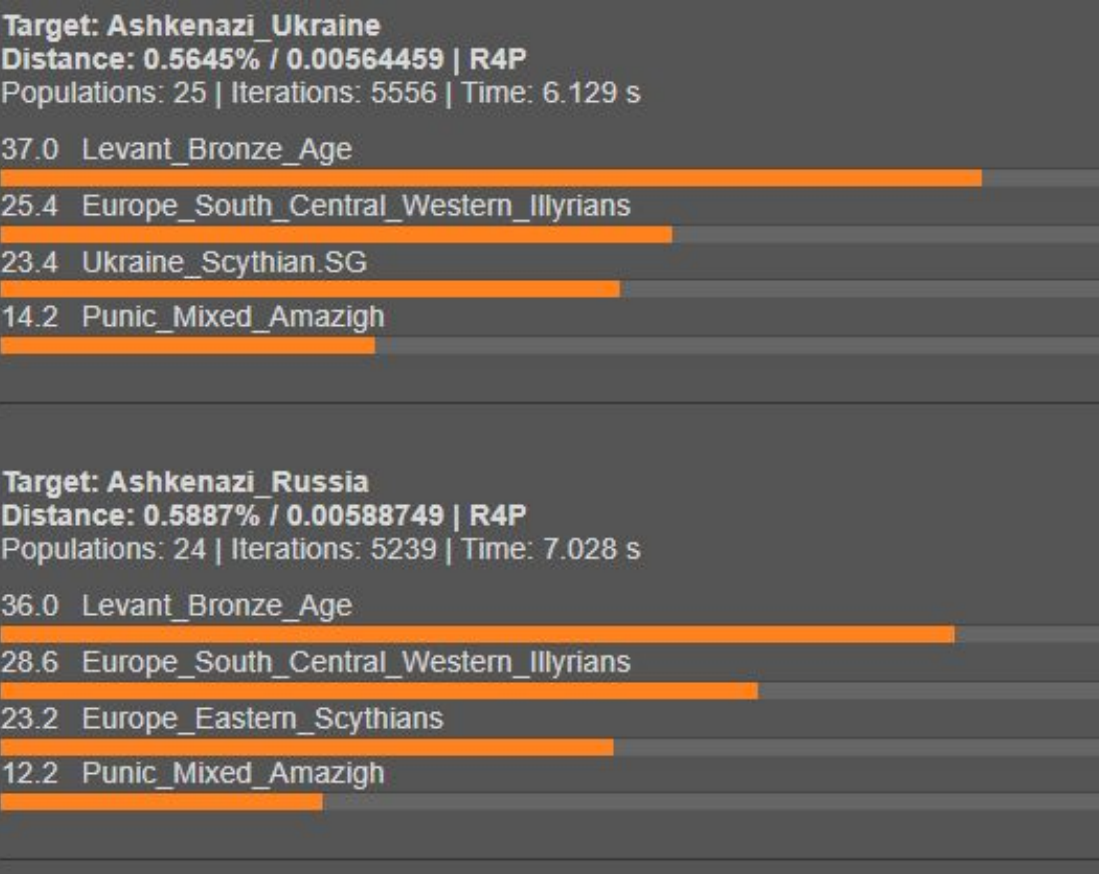
My Research with G25

- Loaded Bronze & Iron Age Levant samples into G25.
- Compared Jews, Palestinians, Arabs, and “lost tribes” candidates.
- Findings:
 - Both Jews and Palestinians show strong continuity with ancient Levant.
 - Jews pull toward Europe, Mesopotamia, North Africa depending on diaspora.
 - Palestinians pull toward Arabia and local continuity.





Ashkenazi Jews



Sephardi Jews



Target: Sephardic_Jew
Distance: 0.4890% / 0.00489001 | R4P
Populations: 20 | Iterations: 4051 | Time: 6.877 s

52.6 Levant_Bronze_Age

23.2 Albania_BA_IA

13.8 Italy_IA

10.4 Punic_Amazigh

Target: Sephardic_Jew_o
Distance: 0.9508% / 0.00950770 | R4P
Populations: 19 | Iterations: 3774 | Time: 5.398 s

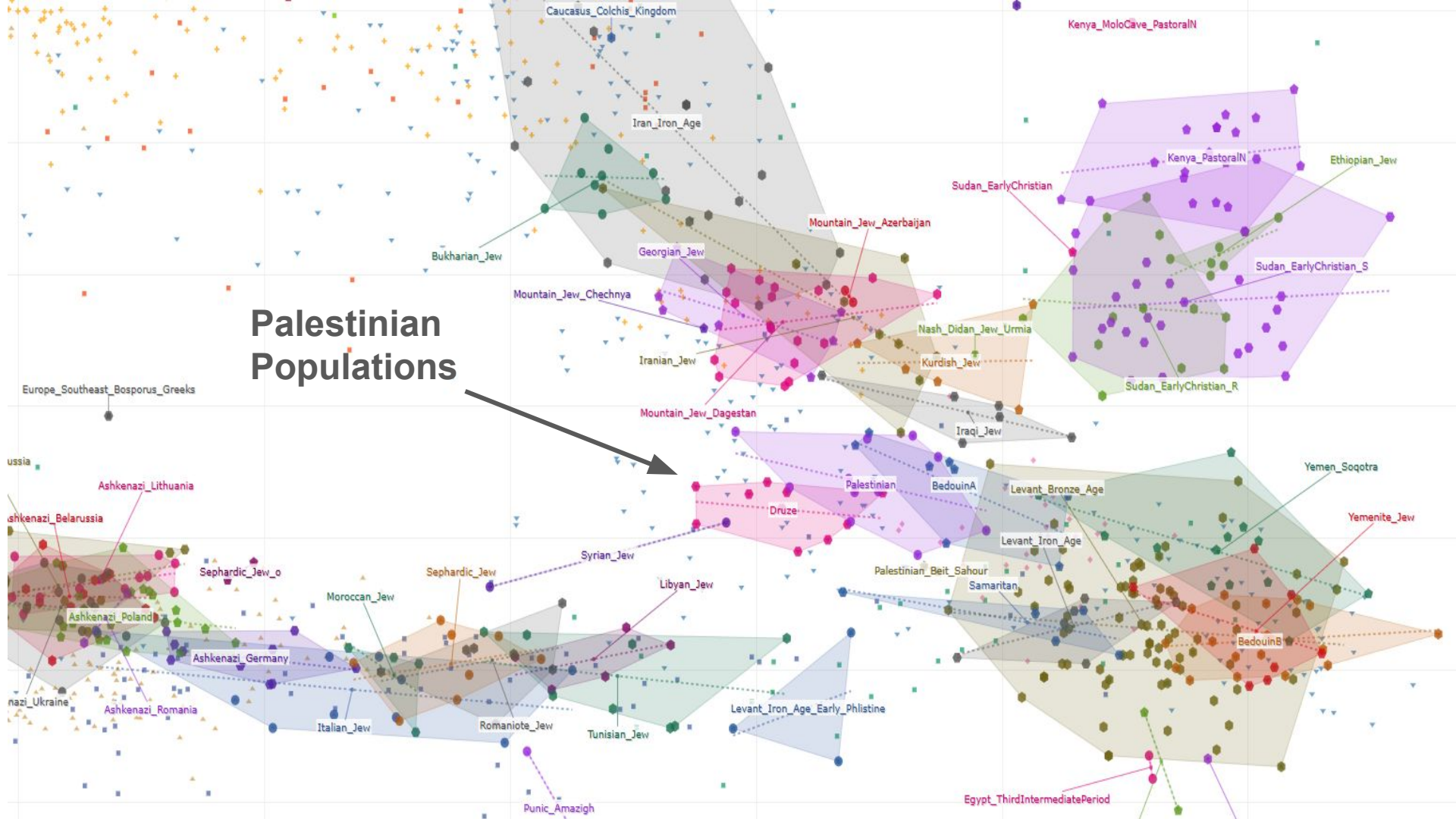
46.2 Levant_Bronze_Age

30.8 Albania_BA_IA

15.6 Europe_Eastern_Scythians

7.4 Punic_Amazigh

Palestinian Populations



Palestinian Christians



Target: Palestinian_Beit_Sahour:Beit_Sahour1
Distance: 1.4597% / 0.01459671 | R4P
Populations: 7 | Iterations: 1074 | Time: 2.323 s

50.4 Levant_Bronze_Age

27.2 Levant_Iron_Age

15.6 Punic_Mixed_Amazigh

6.8 Swat_Valley_Indo_Aryans_Vedic_Age

Target: Palestinian_Beit_Sahour:Beit_Sahour2
Distance: 1.0821% / 0.01082065 | R4P
Populations: 6 | Iterations: 901 | Time: 2.65 s

58.2 Levant_Bronze_Age

25.8 Iran_Iron_Age

13.6 Italy_IA

2.4 Sudan_EarlyChristian_S

Palestinian Muslims



Target: Palestinian:HGDP00684
Distance: 1.3063% / 0.01306331 | R4P
Populations: 12 | Iterations: 2059 | Time: 5.165 s

66.6 Levant_Bronze_Age

16.4 Yemen_Soqatra

8.6 Sudan_EarlyChristian_S

8.4 Kazakhstan_Taldysay_MLBA1

Target: Palestinian:HGDP00683
Distance: 1.6186% / 0.01618578 | R4P
Populations: 11 | Iterations: 1846 | Time: 3.462 s

65.8 Levant_Bronze_Age

14.2 Sudan_EarlyChristian_S

12.0 Kazakhstan_Sarmatian.SG

8.0 Punic_Amazigh

- **Takeaways:**

- Early studies hinted at shared roots; modern genome-wide studies confirmed them; aDNA settled the debate.
- Jews and Palestinians both descend largely from ancient Levantines.
- The future depends on moving from competing narratives to shared recognition.
- History and genetics won't solve the conflict, but they can help us tell a truer story — one that honors the deep connection of both peoples to this land.
- Genetics helped 'de-radicalize' by showing people that both people had a historical connection and at the same time no side was 'genetically pure' everyone is mixed, especially in the middle east.
- The native 'language' of the Middle East is the Family, Fictive Kinship.

Beyond Genetics: Post-Colonial Framing

- **Mutual Recognition of Historical Connection:**
 - Genetics confirms both peoples belong here.
 - But politics is about identity: Zionism vs. Palestinian nationalism often cancel each other.
 - Instead of exclusive indigeneity, embrace **mutual recognition**.
 - *“We are too intertwined to divide, too divided to unify — unless we recognize that both sides are rooted in this land.”*

Framing the Conflict

- **“Two anti-colonial movements in conflict”**
 - Describe how both Zionism and Palestinian nationalism arose as **anti-colonial movements**.
 - Yet both accuse the other of being foreign or colonial.
 - Suggest a new framing: *“Instead of fighting over exclusivity, can we move towards a **post-colonial Middle Eastern renaissance**, where both peoples recognize their shared roots and build a future together?”*

G25 Case Study I: The Samaritans

Are the Samaritans Descendants of the Israelites?

G25 Case Study I: The Samaritans

Are the Samaritans Descendants of the Israelites?

Genetic evidence (G25 / genome-wide context)

- Samaritans cluster **closest to Iron Age / Bronze Age Levantines**
- They sit **between Judeans and northern Levantine populations**
- Show **minimal later admixture** compared to Jews or Arabs
- Genetic continuity consistent with a **local Israelite population**
- Not consistent with:
 - Assyrian-imported populations
 - Large-scale population replacement

Genetic conclusion:

Samaritans preserve one of the **clearest genetic continuities** with ancient Israelites.

G25 Case Study I: The Samaritans

Are the Samaritans Descendants of the Israelites?

Historical dispute behind the question

Biblical archaeology debate

- **2 Kings 17** describes Assyrian deportation of Israelites
 - Traditional reading: *nearly total exile*
- **Modern archaeology & demography:**
 - Deportation was **partial**, mainly elites
 - Majority of rural population remained

Scholarly positions

- **Israel Knohl** — emphasizes biblical narrative of exile
- **Israel Finkelstein** — argues for population continuity

Samaritans



Target: Samaritan:GSM537032
Distance: 0.8652% / 0.00865171 | R4P
Populations: 5 | Iterations: 736 | Time: 1.718 s

77.8 Levant_Bronze_Age
8.6 Egyptian_Late_Kingdom_Period
7.6 Yemen_Soqatra
6.0 Aegean_Iron_Age_Sea_People

Target: Samaritan:168723
Distance: 1.2175% / 0.01217536 | R4P
Populations: 5 | Iterations: 736 | Time: 1.91 s

67.6 Levant_Bronze_Age
17.2 Iran_Iron_Age
9.6 Yemen_Soqatra
5.6 Punic_Mixed_Amazigh

G25 Case Study I: The Samaritans

Are the Samaritans Descendants of the Israelites?

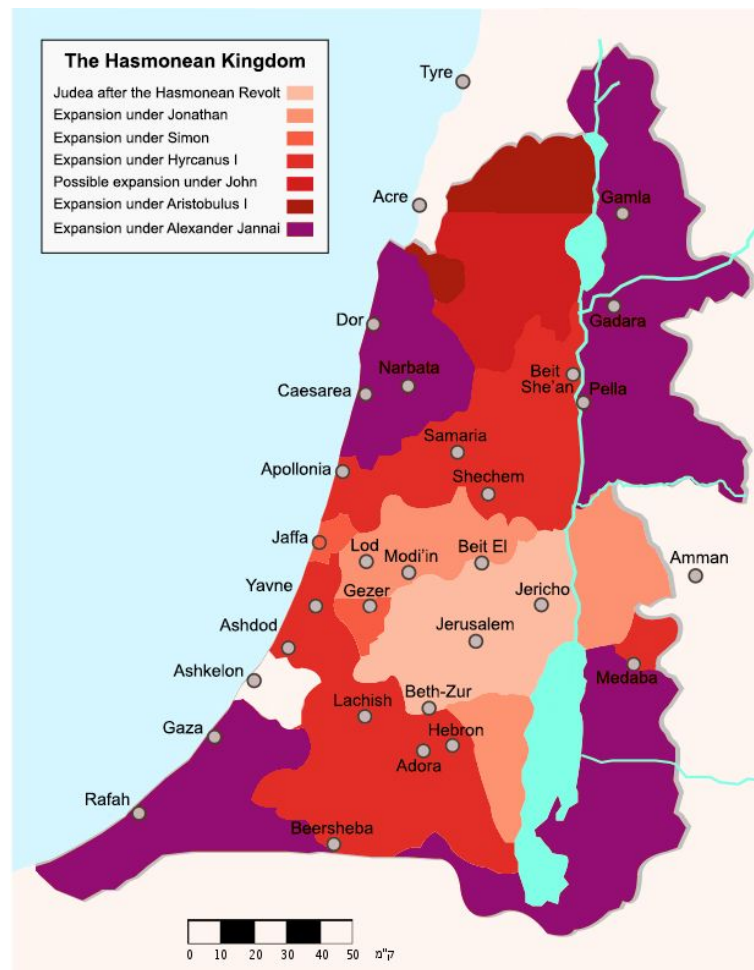
Textual layers & Hasmonean politics

“Cities of Samaria” — a later ideological lens

- Phrase appears in **Kings** and **Ezra–Nehemiah**
- Likely reflects **later Judean editorial perspective**
- Period of relevance:
 - **Hasmonean era**
 - Conflict between **John Hyrcanus** and the Samaritans

According to **Yonatan Adler**:

- This is the period when **Judeans increasingly adopt the name “Israel”**
- Especially visible in **Galilee**



G25 Case Study I: The Samaritans

Are the Samaritans Descendants of the Israelites?

Proposed historical interpretation

Hasmonean identity strategy

- **Two simultaneous moves:**
 - **Deny Samaritan Israelite identity**
 - **Claim “Israel” exclusively for Judeans**
- Political goals:
 - Unify Judeans with Galilean Israelites
 - Delegitimize Samaritan claims
 - Justify Hasmonean territorial & religious authority

Takeaway: Genetics supports the view that Samaritans are direct descendants of ancient Israelites, while later biblical framing reflects Hasmonean political and identity conflicts rather than population replacement.

Conclusion II: Judeans, Israelites, and the East

From Babylon to Persia: the consolidation of Israelite identity

Genetic pattern (east of the Arab world)

- Only **Jewish populations** show **high Bronze Age Levant ancestry** in:
 - Mesopotamia
 - Persia
 - Central Asia
 - South Asia
- Non-Jewish populations in these regions rarely exceed **~5%** Levantine ancestry
- Jewish populations often retain **~35–50% Bronze Age Levant ancestry**

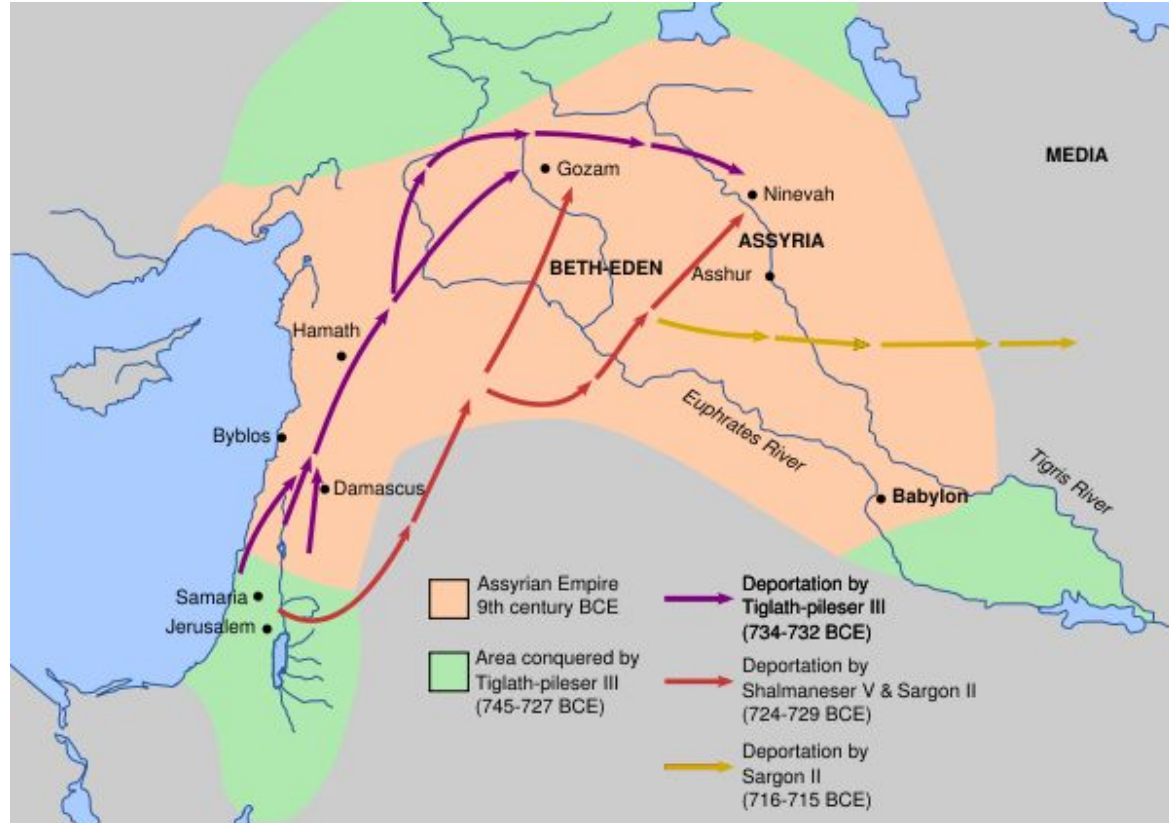
Genetic implication:

Israelites deported east were not absorbed into local populations — they **rejoined and persisted within Jewish communities**

Conceptual framing

- Introduce term: **Judeo-Israelites**
 - Jews of the East preserving Israelite ancestry
 - Integrated into Judean religious and legal tradition
- Reinforces a **shared Israelite core**, not fragmented “lost tribes”

The Lost Tribes of Israel?



The Lost Tribes of Israel: In Kurdistan or Iran?

Iranian and Kurdish non-Jews



Target: Kurdish

Distance: 0.6600% / 0.00659999 | R4P

Populations: 9 | Iterations: 1444 | Time: 1.292 s

87.4 Iran_Iron_Age

6.8 Kazakhstann_OtrarCulture_LIA_o

4.0 Europe_Southeast_Thracians

1.8 Caucasus_Colchis_Kingdom

Target: Iranian

Distance: 2.6445% / 0.02644497 | R4P

Populations: 9 | Iterations: 1444 | Time: 1.245 s

88.4 Iran_Iron_Age

5.8 Levant_Bronze_Age

3.6 Punic_Amazigh

2.2 Asia_China_Zhou_Dynasty

The Lost Tribes of Israel: In Kurdistan or Iran?

Iranian and Kurdish Jews



Target: Kurdish_Jew
Distance: 0.4858% / 0.00485787 | R4P
Populations: 3 | Iterations: 1 | Time: 0.183 s

54.6 Levant_Bronze_Age

42.2 Iran_Iron_Age

3.2 Caucasus_Colchis_Kingdom

Target: Iranian_Jew
Distance: 0.5073% / 0.00507252 | R4P
Populations: 6 | Iterations: 901 | Time: 1.368 s

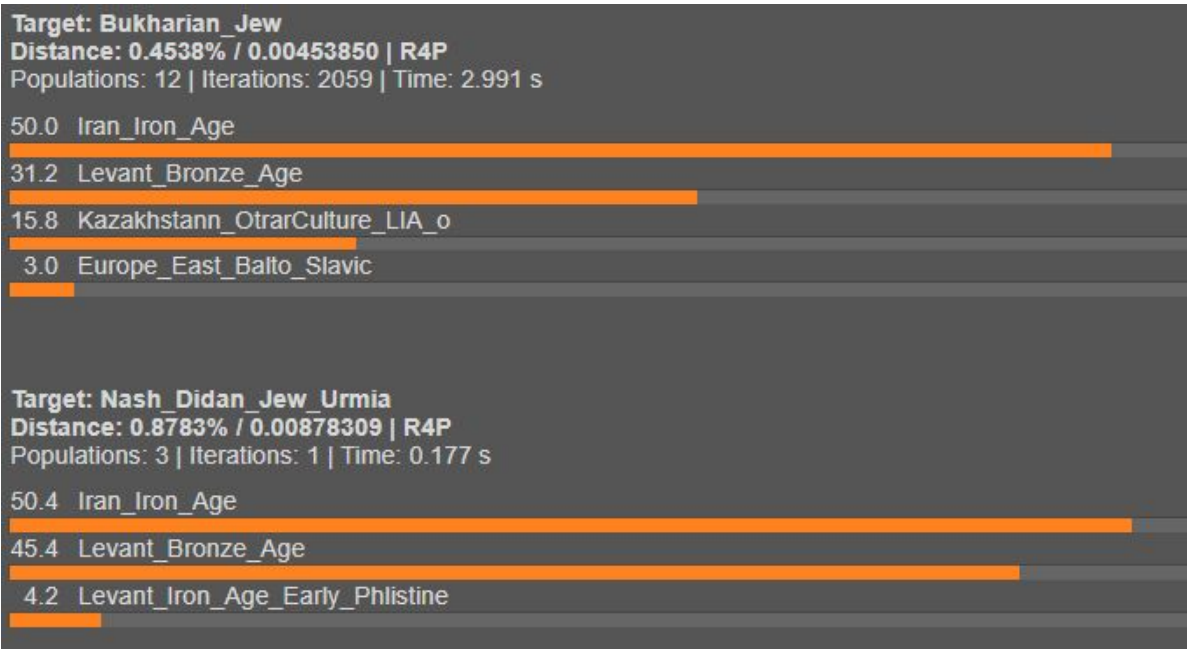
48.0 Iran_Iron_Age

35.0 Levant_Bronze_Age

12.0 Levant_Iron_Age

5.0 Europe_Southeast_Thracians

Bukharian Jews and Nash Didan Jews

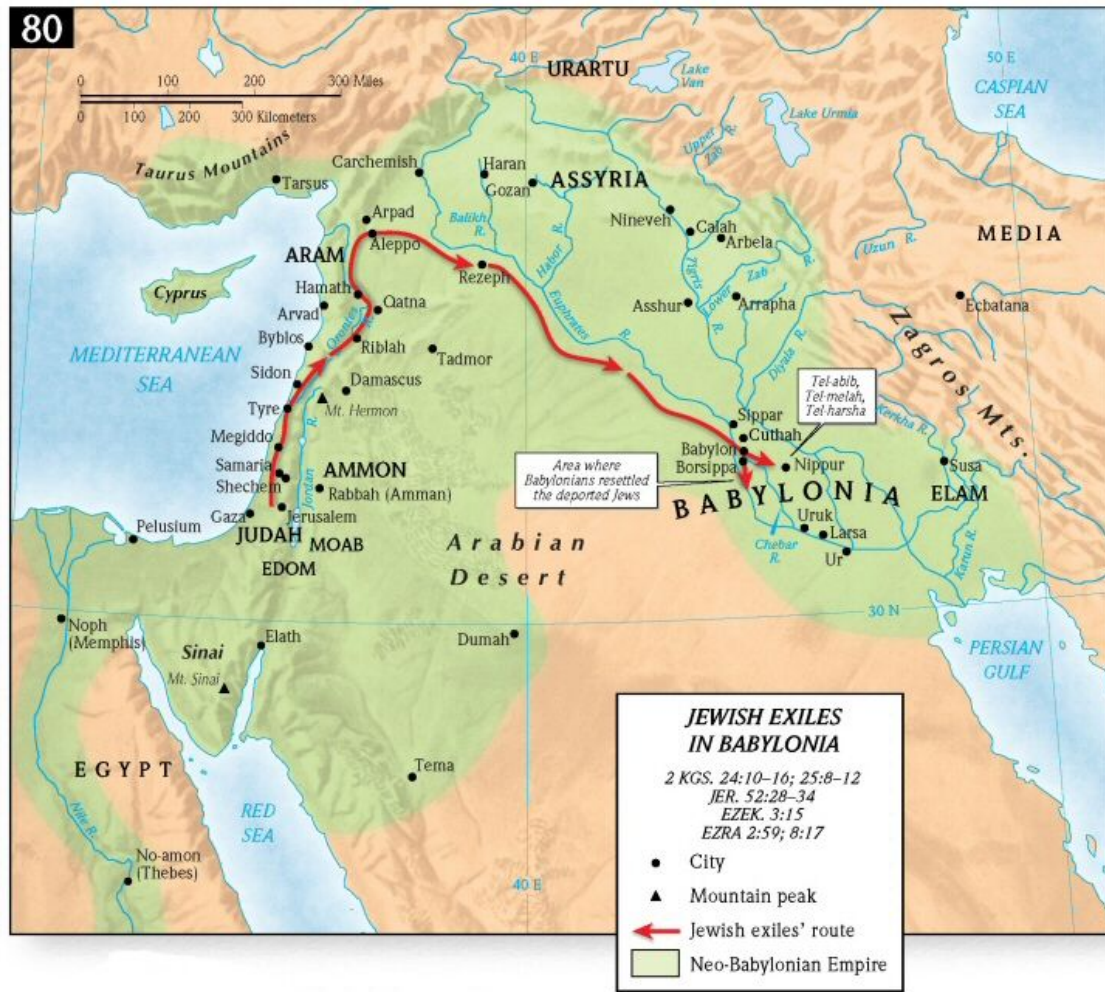


Conclusion II: Judeans, Israelites, and the East

From Babylon to Persia: the consolidation of Israelite identity

Textual & historical alignment

- As noted by **Yonatan Adler**:
 - In the **Talmud**, Jews overwhelmingly refer to themselves as **Israel**
- Suggests:
 - “Israel” becomes the primary self-designation
 - Especially outside Judea



Conclusion II: Judeans, Israelites, and the East

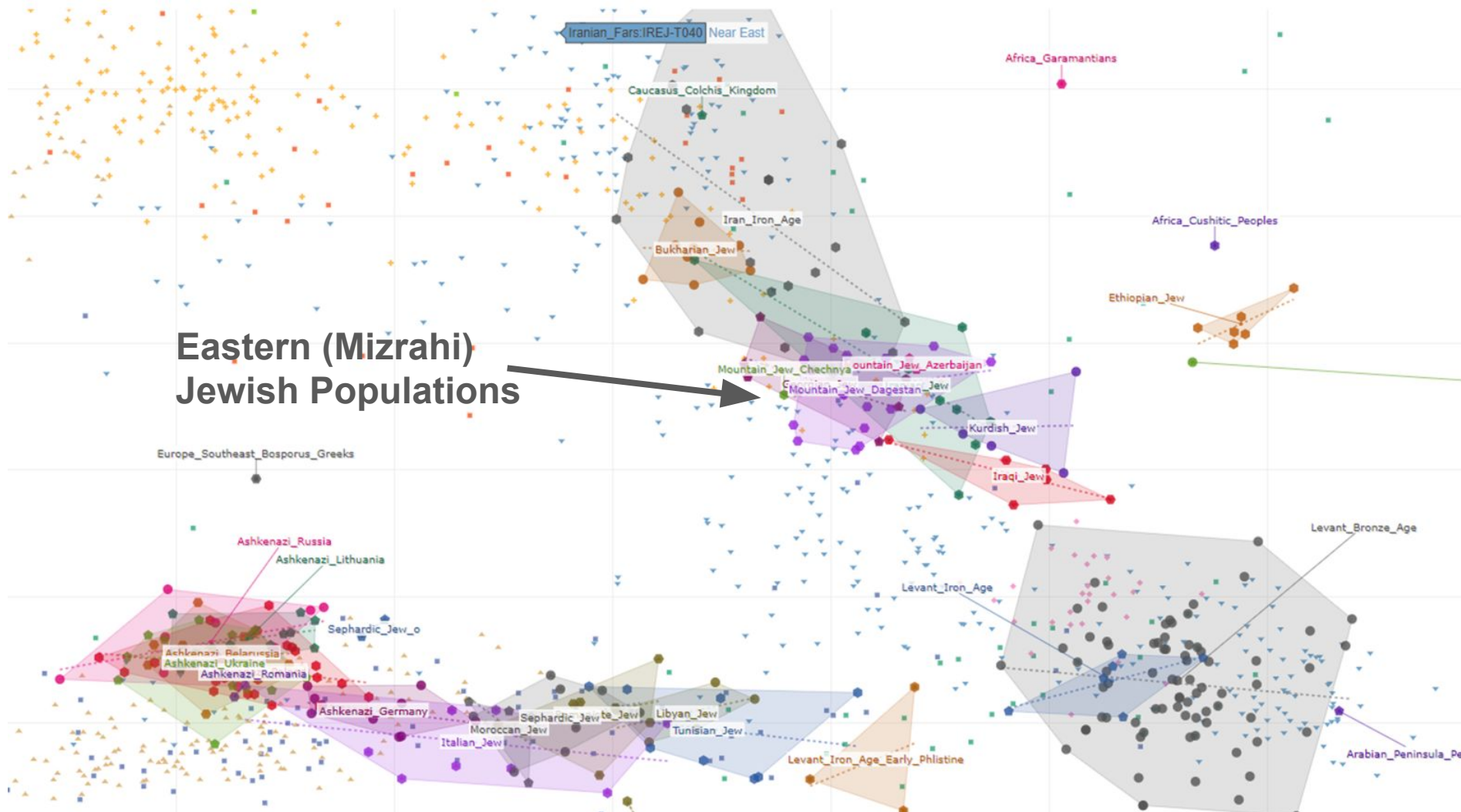
From Babylon to Persia: the consolidation of Israelite identity

Regional identity traditions

- **Urban centers** (Babylon, Susa):
 - Strong **Judean** identity
 - Rabbinic, Talmud-centered culture
- **Peripheral / rural regions:**
 - Assyria / Kurdistan
 - Rural Iran
 - Afghanistan, Yemen, Bukhara, India, Ethiopia
 - Traditions emphasize **Israelite**, not Judean, origin

Interpretation: A Judean religious core centered in Babylon, alongside a wide Israelite population across the Sasanian world

Eastern (Mizrahi) Jewish Populations



Iraqi Jews



Target: Iraqi_Jew

Distance: 0.9527% / 0.00952715 | R4P

Populations: 4 | Iterations: 1 | Time: 0.177 s

54.6 Levant_Bronze_Age

38.6 Iran_Iron_Age

6.0 Levant_Iron_Age_Early_Phlistine

0.8 Levant_Iron_Age

Indian Jews



Target: Cochin_Jew_A
Distance: 1.4048% / 0.01404798 | R4P
Populations: 13 | Iterations: 2280 | Time: 2.23 s

36.0 Levant_Bronze_Age

33.8 Kazakhstann_OtrarCulture_LIA_o

21.6 India_South_Dravidians

8.6 Punic_Mixed_Amazigh

Target: Cochin_Jew_B
Distance: 2.3682% / 0.02368181 | R4P
Populations: 5 | Iterations: 736 | Time: 0.952 s

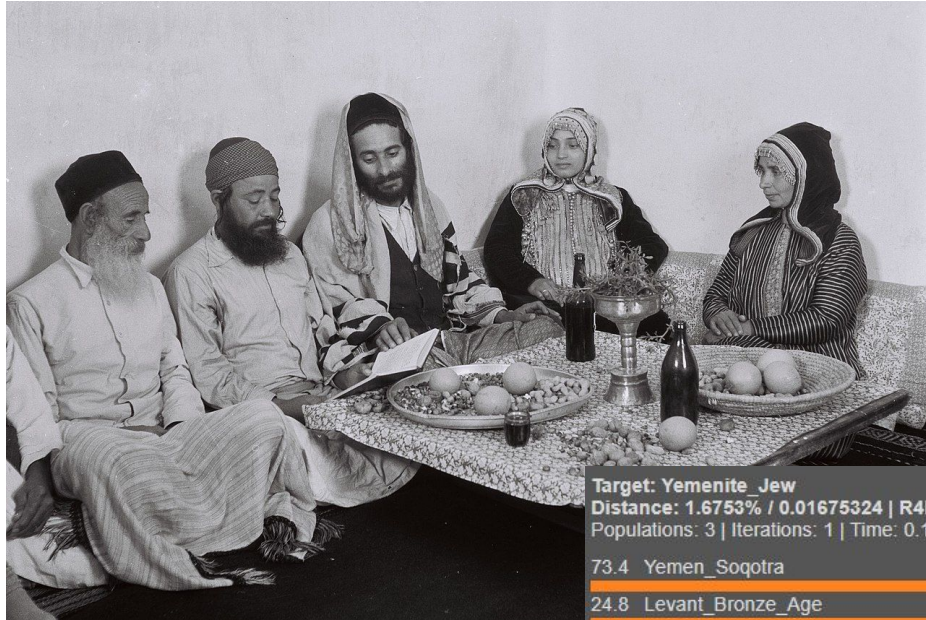
42.8 Swat_Valley_Indo_Aryans_Vedic_Age

38.2 India_South_Dravidians

10.6 Levant_Bronze_Age

8.4 Iran_Iron_Age

Yemenite Jews



Target: Yemenite_Jew
Distance: 1.6753% / 0.01675324 | R4P
Populations: 3 | Iterations: 1 | Time: 0.193 s

73.4 Yemen_Soqatra

24.8 Levant_Bronze_Age

1.8 Egyptian_Ptolemaic_Period

Ethiopian Jews “Beta Yisrael”



Target: Ethiopian_Jew
Distance: 1.0103% / 0.01010306 | R4P
Populations: 6 | Iterations: 901 | Time: 1.062 s

72.0 Kenya_PastoralN
19.2 Yemenite_Jew
7.2 Sudan_EarlyChristian_R
1.6 Africa(West)_Niger_Congo_Peoples

Conclusion II: Judeans, Israelites, and the East

From Babylon to Persia: the consolidation of Israelite identity

“Lost tribes” — partial echoes, not continuity

- **Pashtun tribes:**
 - Cultural traditions of Israelite origin
 - Genetics shows **minor ($\sim\leq 5\%$) Judeo-Israelite signal**
- Other cases:
 - Modern Persian Iranians
- Signals are minor and often **localized**, not population-wide
- Contrast:
 - Jewish communities retain **much higher Levantine ancestry**

The Lost Tribes of Israel: Pashtuns?



Target: Pashtun_Uthmankhel
Distance: 1.1973% / 0.01197335 | R4P
Populations: 16 | Iterations: 2991 | Time: 1.252 s

69.2 Swat_Valley_Indo_Aryans_Vedic_Age

19.8 Kazakhstan_Turk_Kangju_possible.SG

11.0 Bukharian_Jew

Target: Pashtun_Yusufzai
Distance: 0.6384% / 0.00638378 | R4P
Populations: 12 | Iterations: 2059 | Time: 1.061 s

59.4 Swat_Valley_Indo_Aryans_Vedic_Age

15.2 Iran_Iron_Age

12.8 Cochin_Jew_B

12.6 Kazakhstan_Shoendykoi_MLBA_Fedorovo

Conclusion II: Judeans, Israelites, and the East

From Babylon to Persia: the consolidation of Israelite identity

Synthesis

- Genetics, texts, and traditions align:
 - Judeans consolidate Israelite identity
 - Eastern Jewish communities preserve Israelite ancestry
 - Non-Jewish groups retain only faint traces, if any

Takeaway

East of the Levant, Israelite ancestry persists primarily within Jewish populations, reflecting a historical process in which Judeans absorbed and unified Israelite identity across the Babylonian and Persian worlds.

From DNA to History: Reassessing the United Monarchy

Genetics, memory, and political narrative

Starting point: no “lost tribes”

- Samaritan DNA shows **local Israelite continuity**
- Eastern Jewish populations retain **high Bronze Age Levant ancestry**
- No large Israelite populations disappear genetically
- Instead: **Israelites persist and consolidate within Jewish identity**

Implication:

Israel did not vanish — it remained a living people, in the land and the diaspora.

Historical argument (Farber & Faust)

Building on **Zev Farber** and **Avraham Faust**:

- **Saul** was the **first king to unite the Israelites**
- Conflict with Philistines (and Egypt) required:
 - Strategic control of **Judah**
- Judah was incorporated for **military necessity**, not ideology

A circular mosaic of King Solomon. He is depicted wearing a crown and a green robe over a purple garment. He holds a scepter in his right hand and a ring in his left. The mosaic is surrounded by a decorative border with the text 'SA LOM ON' on the right and 'ASCE DI SIA T' on the left.

AVRAHAM FAUST
ZEV I. FARBER



From DNA to History: Reassessing the United Monarchy

Genetics, memory, and political narrative

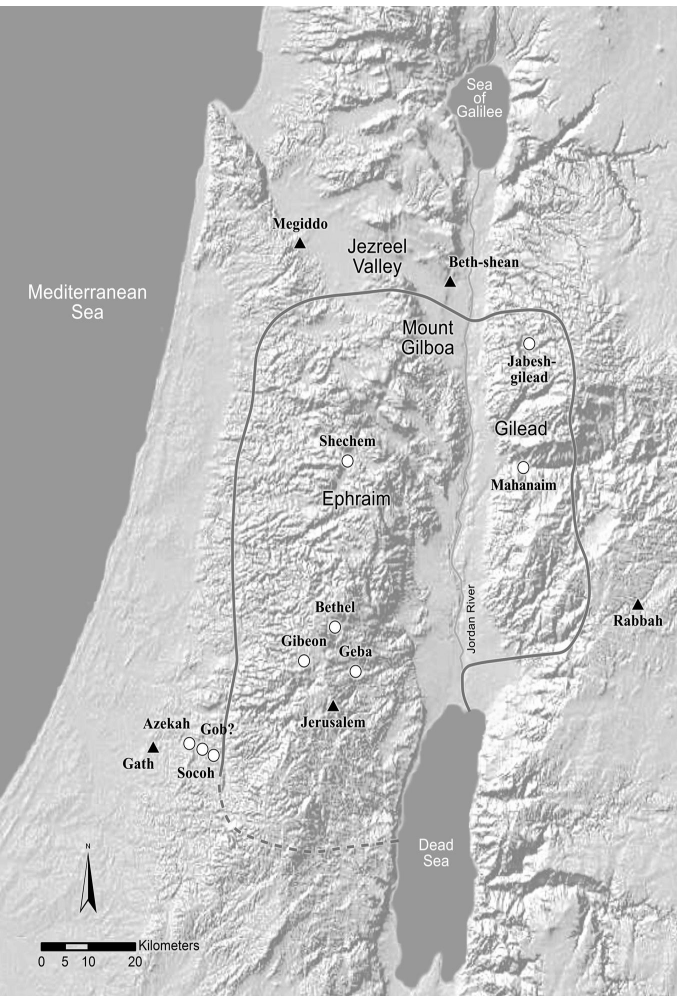
Davidic narrative as political repair

- Biblical texts show repeated efforts to:
 - Exonerate **David**
 - Distance him from:
 - Saul's death
 - Abner's death
 - Other pro-Saul figures
- Suggests:
 - Active **narrative reconciliation**
 - Written when **many Israelites joined Judah**

Key logic:

If Israel had disappeared, this apologetic effort would be unnecessary.

Do genetics point to a United Monarchy?



Kingdom of Saul



Four Room "Israelite House"

From DNA to History: Reassessing the United Monarchy

Genetics, memory, and political narrative

What the DNA adds

- Israelites continued to exist:
 - In Samaria
 - In Judah
 - In the eastern diaspora
- Shared genetic continuity supports:
 - Ongoing interaction
 - Eventual reintegration
- DNA aligns with a memory of **prior unity**, not invention
- **The Samaritans also say that David and Solomon were Kings of Judah and Israel!!!**

From DNA to History: Reassessing the United Monarchy

Genetics, memory, and political narrative

Samaritan Sources Acknowledge David as a Historical King

- **Genetics confirms Samaritans are indigenous Israelites**, not foreign settlers
- Despite rejecting Jerusalem and Davidic legitimacy, **Samaritan tradition accepts David as a real ruler**

Key Samaritan sources:

- **Samaritan Chronicle**
 - Mentions David as a **historical king**
 - Portrays him as a **Judahite ruler who dominated Israel**
 - Rejects his religious authority, not his existence
- **Asatir**
 - Includes David within a continuous Israelite historical framework
 - Treats his reign as a political rupture, not a myth
- **Book of Joshua (Samaritan version)**
 - Preserves an Israelite counter-memory that denies Jerusalem's chosenness
 - Assumes David's kingship as historical background

From DNA to History: Reassessing the United Monarchy

Genetics, memory, and political narrative

Why this matters

- If Samaritans were foreign settlers, this memory could be dismissed
- But as **Israelites**, their anti-David tradition reflects **shared historical knowledge**
- Just as northern Israelites who joined Judah in the days of **Josiah** retained belief in a united monarchy, Samaritan memory preserves the same framework from the opposite side

Conclusion: a remembered unity

- A **United Monarchy** under **David** and **Solomon**:
 - Was likely real, though limited in scale
 - Became a **foundational political memory**
- This memory was later reused to justify:
 - Late Iron Age reunification efforts
 - Hasmonean ideology
 - Rabbinic / Talmudic Israel identity

G25 Case Study II: The Origins of the Arab Peoples

Genetics, Language, and History

G25 Case Study II: The Origins of the Arab Peoples

Genetics, Language, and History

The Genetic Pattern (Big Picture)

- Using **G25 autosomal modeling**, most Arab populations show:
 - A strong **ancient Levantine genetic core**
 - Variable secondary inputs from:
 - Arabia
 - Iran
 - Africa
- The Levant, not Arabia, appears as the **primary shared ancestry** across Arab groups

Key point:

Arab identity spreads culturally and linguistically more than genetically.

G25 Case Study II: The Origins of the Arab Peoples

Genetics, Language, and History

Arabia vs. the Levant (G25 Signal)

- **Ancient Arabia proxy:** Socotra Island aDNA (limited but informative)
- **Findings:**
 - Yemen & Saudi Arabia:
 - Majority **Arabian** ancestry
 - Significant **Bronze Age Levant** minority
 - Iraq:
 - Minor Arabian ancestry
 - Larger **Levantine + Iranian** components
 - Levant:
 - **Very little Arabian ancestry** on average
 - Some individuals show minor Arabian signal
 - Egypt & North Africa:
 - Almost no Arabian ancestry
 - Exception: Libya (small Arabian minority)



Arabians



Target: Saudi
Distance: 2.3262% / 0.02326244 | R4P
Populations: 2 | Iterations: 1 | Time: 0.297 s

83.4 Yemen_Soqatra

16.6 Levant_Bronze_Age

Target: Yemenite_Mahra
Distance: 2.0810% / 0.02081046 | R4P
Populations: 2 | Iterations: 1 | Time: 0.308 s

90.4 Yemen_Soqatra

9.6 Levant_Bronze_Age

Target: Yemenite_Dhamar
Distance: 0.8066% / 0.00806558 | R4P
Populations: 3 | Iterations: 1 | Time: 0.319 s

62.6 Yemen_Soqatra

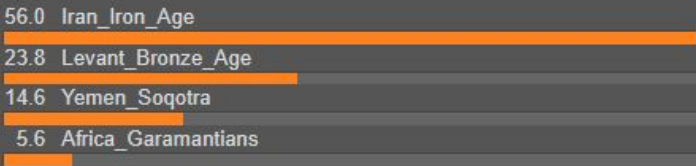
30.8 Levant_Bronze_Age

6.6 Sudan_EarlyChristian_S

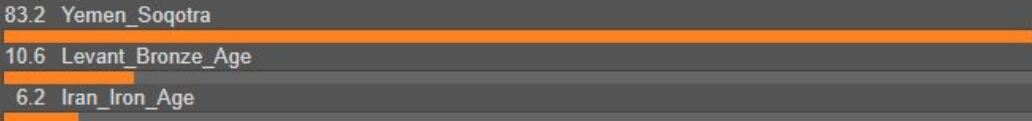
Iraqi and Gulf Arabs



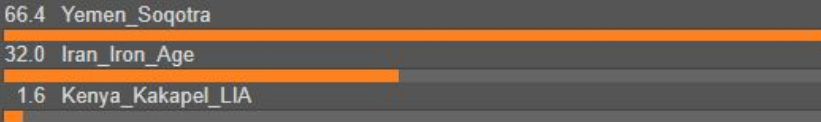
Target: Iraqi
Distance: 0.3319% / 0.00331883 | R4P
Populations: 16 | Iterations: 2991 | Time: 7.076 s



Target: EmiratiA
Distance: 2.9207% / 0.02920670 | R4P
Populations: 3 | Iterations: 1 | Time: 0.302 s



Target: EmiratiB
Distance: 1.6198% / 0.01619835 | R4P
Populations: 4 | Iterations: 1 | Time: 0.317 s



Levant Arabs



Target: Syrian
Distance: 0.1221% / 0.00122060 | R4P
Populations: 23 | Iterations: 4930 | Time: 12.58 s

54.6 Levant_Bronze_Age

27.4 Iran_Iron_Age

13.2 Europe_Eastern_Scythians

4.8 Africa_Garamantians

Target: Jordanian
Distance: 0.1460% / 0.00146012 | R4P
Populations: 25 | Iterations: 5556 | Time: 13.781 s

52.4 Levant_Bronze_Age

19.2 Levant_Iron_Age_Early_Phlistine

14.2 Kazakhstann_OtrarCulture_LIA

14.2 Sudan_EarlyChristian_S

Levant Arabs



Target: Lebanese_Muslim
Distance: 0.3707% / 0.00370681 | R4P
Populations: 19 | Iterations: 3774 | Time: 7.104 s

45.4 Levant_Bronze_Age

32.8 Iran_Iron_Age

15.4 Italy_IA

6.4 Sudan_EarlyChristian_S

Target: Lebanese_Christian
Distance: 0.2957% / 0.00295702 | R4P
Populations: 16 | Iterations: 2991 | Time: 6.846 s

41.8 Levant_Bronze_Age

32.6 Iran_Iron_Age

13.0 Levant_Iron_Age_Early_Phlistine

12.6 Punic_Mixed_Amazigh

Northeast African Arabs



Target: Libyan

Distance: 0.9194% / 0.00919387 | R4P

Populations: 14 | Iterations: 2509 | Time: 2.734 s

42.2 Punic_Amazigh

26.2 Egypt_ThirdIntermediatePeriod

23.0 Yemen_Soqatra

8.6 Africa_Bantu_Peoples

Target: Egyptian

Distance: 0.2205% / 0.00220491 | R4P

Populations: 16 | Iterations: 2991 | Time: 4.394 s

60.4 Levant_Bronze_Age

21.8 Sudan_EarlyChristian_S

15.0 Punic_Amazigh

2.8 Africa_Bantu_Peoples

Northeast African Arabs



Target: Egyptian_Copt
Distance: 0.7176% / 0.00717607 | R4P
Populations: 9 | Iterations: 1444 | Time: 2.062 s

53.0 Levant_Bronze_Age

25.6 Egypt_ThirdIntermediatePeriod

14.6 Sudan_EarlyChristian_S

6.8 Punic_Amazigh

Target: Sudanese
Distance: 2.0497% / 0.02049711 | R4P
Populations: 6 | Iterations: 901 | Time: 0.258 s

78.0 Africa_Nilo_Saharan_Peoples

9.0 Africa_Omotic_Peoples

6.8 Africa_Bantu_Peoples

6.2 Kenya_Kakapel_LIA

Northwest African Arabs



Target: Tunisia
Distance: 0.3578% / 0.00357807 | R4P
Populations: 13 | Iterations: 2280 | Time: 2.289 s

53.6 Punic_Amazigh

28.0 Levant_Bronze_Age

14.0 Italy_IA

4.4 Africa(West)_Niger_Congo_Peoples

Target: Moroccan
Distance: 1.1038% / 0.01103785 | R4P
Populations: 6 | Iterations: 901 | Time: 1.244 s

71.2 Punic_Amazigh

18.6 Levant_Bronze_Age

10.0 Africa(West)_Niger_Congo_Peoples

0.2 Africa_Garamantians

G25 Case Study II: The Origins of the Arab Peoples

Genetics, Language, and History

Genetic Interpretation

- Arabian ancestry alone **cannot explain** Arab populations
- The **common denominator** across Arabs is:
 - Ancient **Levantine ancestry**
- Arabia contributes:
 - Cultural prestige
 - Religious tradition
 - Elite lineages — not mass population replacement

G25 Case Study II: The Origins of the Arab Peoples

Genetics, Language, and History

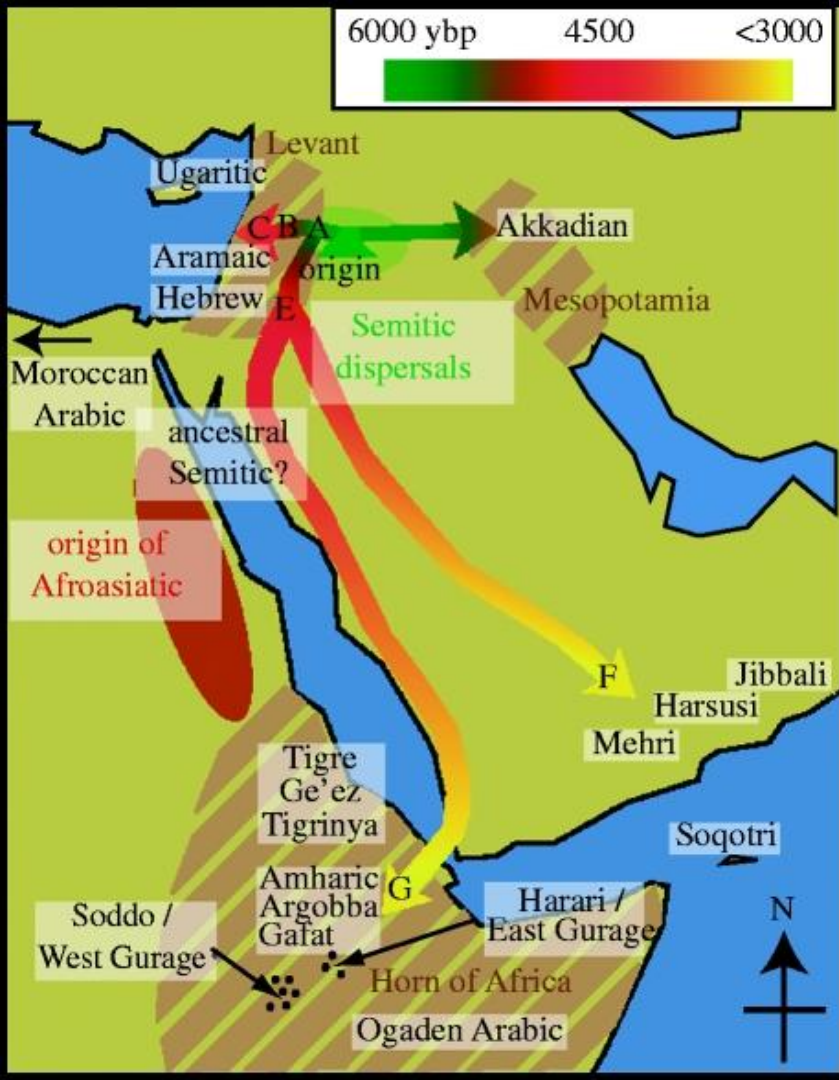
Linguistics: Arabic Is Not “Arabian” in Origin

- Arabic is a **Central Semitic language**
- Diverged from Hebrew $\approx$ **4,500 years ago**
- Likely homeland:
 - **Southern Levant / Syrian steppe**
 - Near the **Euphrates corridor**

Draws on work of **Ahmad Al-Jallad**

important nodes are indicated by letters: A, West Semitic; B, Central Semitic; C, Ugaritic–Hebrew–Aramaic; D, Arabic; E, South Semitic; F, MSA; and G, Ethiosemitic.





Phylogeny of Semitic languages.

important nodes are indicated by letters: A, West Semitic; B, Central Semitic; C, Ugaritic–Hebrew–Aramaic; D, Arabic; E, South Semitic; F, MSA; and G, Ethiosemitic.

Andrew Kitchen Et Al. Bayesian phylogenetic analysis of Semitic languages identifies an Early Bronze Age origin of Semitic in the Near East, Proc Biol Sci (2009)

G25 Case Study II: The Origins of the Arab Peoples

Genetics, Language, and History

Early Arab Heartland (Archaeology)

- Likely proto-Arab core:
 - Arava Valley
 - Timna & Faynan copper regions
 - Midian / Northwest Arabia
- Arabs initially:
 - Traders
 - Caravan organizers
 - Metal economy intermediaries

Arab origins = Levantine periphery, not deep Arabia

G25 Case Study II: The Origins of the Arab Peoples

Genetics, Language, and History

Earliest Evidence for Arabs

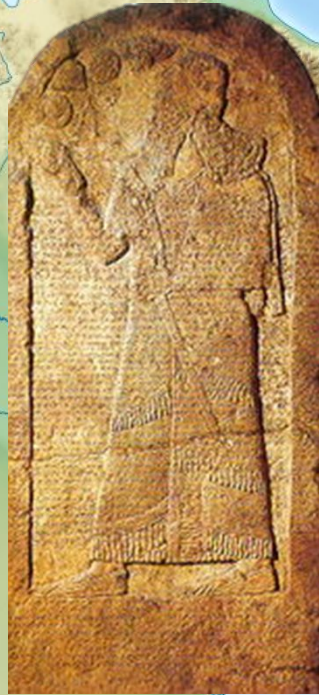
- **Kurk Monolith** (853 BCE): first Assyrian reference to “Arabs”
- **Bayer inscription**: earliest Arabic language attestation
- Early Arab polities:
 - **Qedar**
 - **Nabataea**
 - Possibly Midian, Iturea

Centered in:

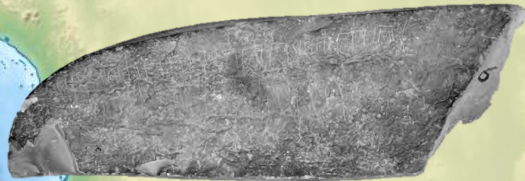
- Negev
- Jebel Druze
- Petra region



Arab Kingdom of
Qedar 450 BCE



Kurkh stela of
Shalmaneser 853
BCE



Oldest Arabic Inscription

5th Century BCE



Avdat, Israel

G25 Case Study II: The Origins of the Arab Peoples

Genetics, Language, and History

Arabs Enter Arabia (Late Process)

- Large-scale Arab presence in Arabia occurs **late**
- Second half of 1st millennium BCE:
 - Qaryat al-Faw
 - Najran
- Arabs were **minority groups** among:
 - Himyarites
 - Dedanites
 - Other Old South Arabian peoples

Arabia was **not originally Arab**.

-



A First Century BCE Arabic Inscription In Musnad Script At Qaryat Al-Faw



Qaryat Al-Faw

G25 Case Study II: The Origins of the Arab Peoples

Genetics, Language, and History

Religion Before Islam

Drawing on **Ahmad Al-Jallad**:

- Pre-Islamic Arabs:
 - a. Often **monotheistic**
 - b. Jewish, Christian, or hybrid forms
- Inscriptions show:
 - a. Anti-idolatry
 - b. Biblical language
- Possible continuity with earlier Arabian monotheism
 - a. As noted by **Israel Knohl** (e.g., Minaeans)
-

G25 Case Study II: The Origins of the Arab Peoples Genetics, Language, and History

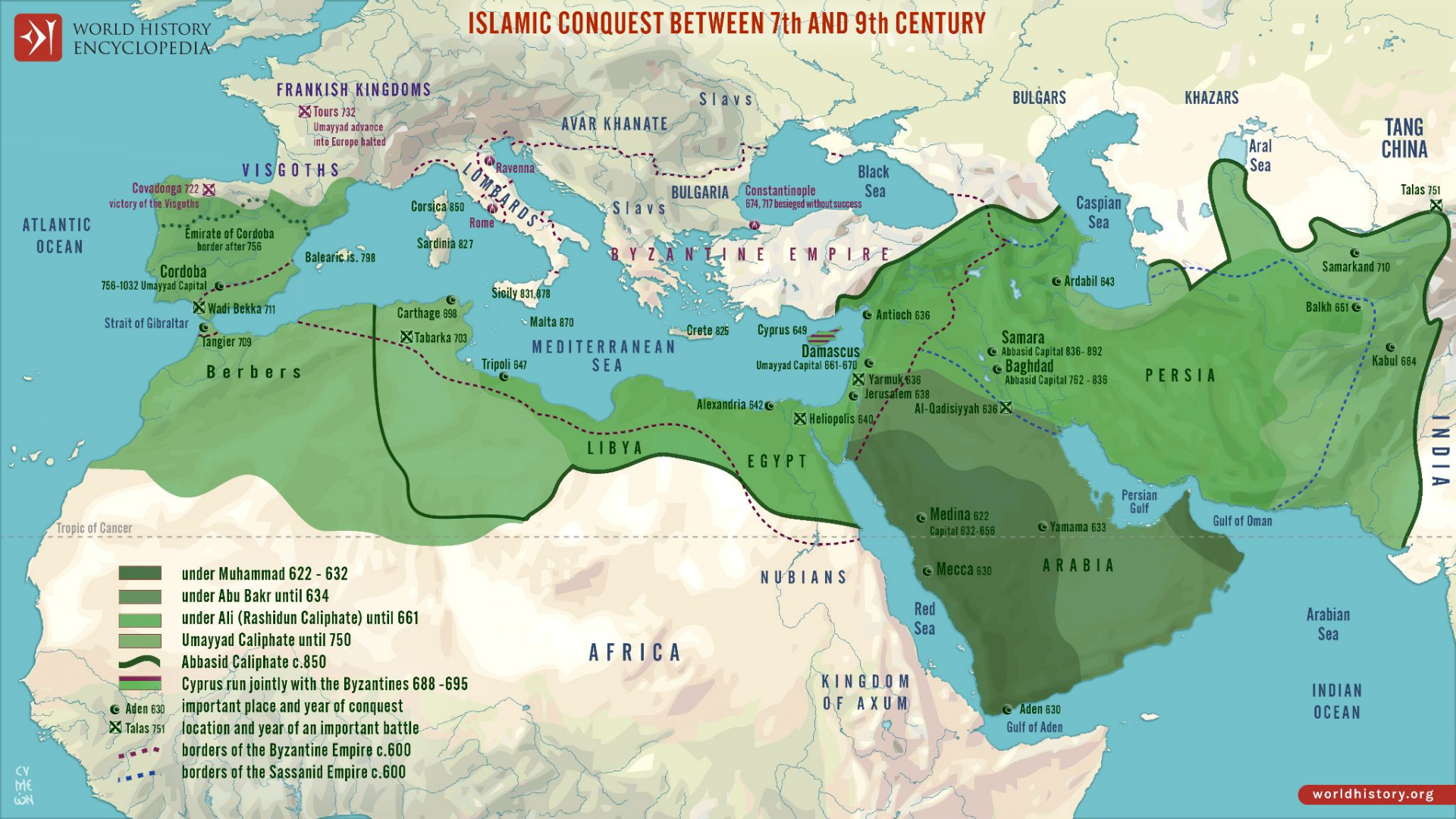
Muhammad in Context

- Muhammad was **not the first** monotheistic preacher
- He was:
 - Exceptionally charismatic
 - Militarily decisive
 - Politically successful
- In the Hijaz:
 - Islam spread rapidly
 - Jews & Christians:
 - Converted
 - Fled
 - Or were eliminated

Comparable to:

- Hasmonean forced conversions under John Hyrcanus

ISLAMIC CONQUEST BETWEEN 7th AND 9th CENTURY



G25 Case Study II: The Origins of the Arab Peoples

Genetics, Language, and History

After Muhammad: Expansion Without Mass Conversion

- Outside Arabia:
 - Conversion was **slow**
 - Often incomplete
- Early Caliphate founded **amsar**:
 - Kufa
 - Basra
 - Mosul
- Explains:
 - Minor Arabian ancestry in Iraq
 - Very limited Arabian signal elsewhere
-

G25 Case Study II: The Origins of the Arab Peoples

Genetics, Language, and History

The Umayyad Shift (Levantine Arabs)

- Umayyads were Arabian by origin
- But ruled:
 - A mostly **Levantine population**
- Likely early adopters of Islam:
 - Arabic-speaking Christians
 - Nabataean-descended Levantines
- These Levantine Arabs:
 - Founded Ramla
 - Founded Fustat
 - Founded Kairouan
- Expanded Islam **westward**, not eastward



A silver dirham minted in Fars in 690/91 in the name of Abd Allah ibn al-Zubayr

G25 Case Study II: The Origins of the Arab Peoples

Genetics, Language, and History

Synthesis: Who Are the Arabs?

- Arabs are best understood as:
 - A **Levantine-origin population**
 - United by:
 - Arabic language
 - Islamic tradition
 - Arabian sacred geography
- Genetics shows:
 - Cultural Arabization > Arabian ancestry
- This explains:
 - Levantine core in Palestinians
 - Minimal Arabian ancestry in North Africa
 - Regional diversity under a shared identity

Modern Arab populations are genetically rooted largely in the ancient Levant, with Arabia contributing language, religion, and prestige rather than mass ancestry.

G25 Case Study IIB: The Origins of the Palestinian People

What the G25 Pattern Suggests

G25: Palestinians sit on an ancient Levantine core

- Palestinian Muslims and Christians both show strong continuity with **Bronze / Iron Age Levant**
- Differences between groups are mostly explained by **later layers**:
 - Arabia (varies)
 - Africa (varies)
 - Local regional inputs

Implication:

The dominant ancestry signal is **local Levantine**, consistent with continuity.

[illegible]

Palestinian Christians



Target: Palestinian_Beit_Sahour:Beit_Sahour1
Distance: 1.4597% / 0.01459671 | R4P
Populations: 7 | Iterations: 1074 | Time: 2.323 s

50.4 Levant_Bronze_Age

27.2 Levant_Iron_Age

15.6 Punic_Mixed_Amazigh

6.8 Swat_Valley_Indo_Aryans_Vedic_Age

Target: Palestinian_Beit_Sahour:Beit_Sahour2
Distance: 1.0821% / 0.01082065 | R4P
Populations: 6 | Iterations: 901 | Time: 2.65 s

58.2 Levant_Bronze_Age

25.8 Iran_Iron_Age

13.6 Italy_IA

2.4 Sudan_EarlyChristian_S

Palestinian Muslims



Target: Palestinian:HGDP00684
Distance: 1.3063% / 0.01306331 | R4P
Populations: 12 | Iterations: 2059 | Time: 5.165 s

66.6 Levant_Bronze_Age

16.4 Yemen_Soqatra

8.6 Sudan_EarlyChristian_S

8.4 Kazakhstan_Taldysay_MLBA1

Target: Palestinian:HGDP00683
Distance: 1.6186% / 0.01618578 | R4P
Populations: 11 | Iterations: 1846 | Time: 3.462 s

65.8 Levant_Bronze_Age

14.2 Sudan_EarlyChristian_S

12.0 Kazakhstan_Sarmatian.SG

8.0 Punic_Amazigh

G25 Case Study IIB: The Origins of the Palestinian People

Do Palestinians have Jewish ancestry?

The Question

Do Palestinians have Jewish / Israelite ancestry?

- Genetics can't identify "religion" directly
- But it can detect **shared ancestry** with ancient Levantines and with Jewish populations
- The best framing is:
 - **shared Levantine roots**
 - plus **historical conversions and admixture**

Key point:

The question is not "Jewish or not," but **how much shared ancestry exists and why.**



Do Palestinians have Jewish Roots?

G25 Case Study IIB: The Origins of the Palestinian People

Do Palestinians have Jewish ancestry?

Shared Ancestry With Jews

Shared ancestry is expected

- Jews and Palestinians overlap strongly because both derive from:
 - **ancient southern Levant populations**
- Later history pushed populations in different directions:
 - Jewish diasporas add European / North African / Mesopotamian layers
 - Many Palestinian lineages add Arabian and African layers

Takeaway:

Genetic distance today often reflects **later admixture**, not separate origins.

G25 Case Study IIB: The Origins of the Palestinian People

Do Palestinians have Jewish ancestry?

Historical Mechanisms That Could Create “Jewish Ancestry”

How could Israelite/Jewish ancestry enter Palestinian lineages?

- **Continuity:** many families descend from ancient local Levantines who never left
- **Conversion:** some groups likely adopted Judaism in the Hasmonean / Herodian era
- **Christianization** → **Islamization:** later religious shifts can preserve ancestry while changing identity
- **Regional mixing:** Edomites, Moabites, Arameans, Nabateans contribute to the same pool

Key message:

Shared ancestry does not require mass “replacement” or simple stories.

G25 Case Study IIB: The Origins of the Palestinian People

Do Palestinians have Jewish ancestry?

A Useful Regional Lens

Multiple ancestral layers, one Levantine base

- Palestinians likely reflect ancestry from:
 - ancient local Levantines
 - plus neighboring Iron Age populations (Edom/Moab/Aram/Nabataea)
- These groups themselves were often closely related genetically

Interpretation:

“Jewish ancestry” is often better described as **Israelite-era southern Levant ancestry**, shared across neighboring peoples.

G25 Case Study IIB: The Origins of the Palestinian People

Do Palestinians have Jewish ancestry?

Druze as an Illustrative Case

Druze: geography meets history

- Druze live in regions historically connected to:
 - Iturea
 - Herodian-era political influence
- Traditions and genetics suggest deep local Levant continuity
- They help illustrate how:
 - identity changes over time
 - ancestry persists locally

Druze



Target: Druze:HGDP00561
Distance: 0.9078% / 0.00907842 | R4P
Populations: 14 | Iterations: 2509 | Time: 5.396 s

71.0 Levant_Bronze_Age

12.0 Kazakhstan_Sarmatian_IA

10.4 Levant_Iron_Age_Early_Phlistine

6.6 Punic_Amazigh

Target: Druze:GS000016136
Distance: 0.7442% / 0.00744155 | R4P
Populations: 11 | Iterations: 1846 | Time: 4.542 s

49.4 Levant_Bronze_Age

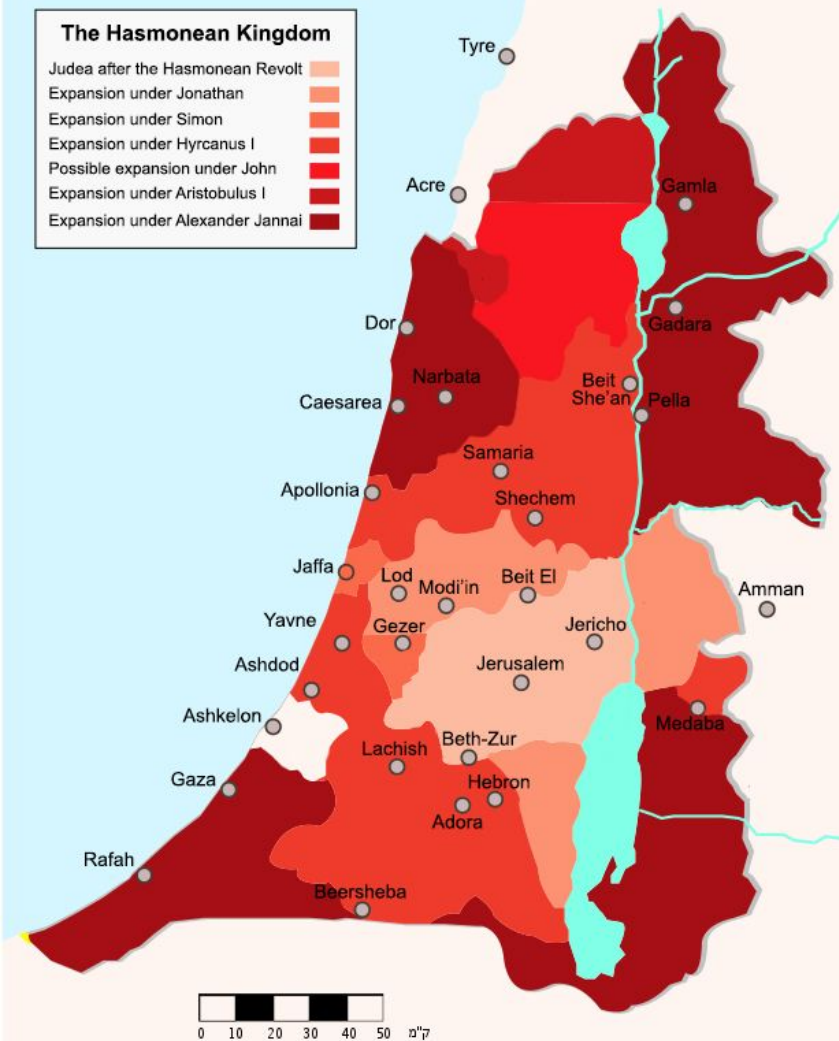
26.2 Iran_Iron_Age

21.4 Europe_Southeast_Thracians

3.0 Sudan_EarlyChristian_S

The Hasmonean Kingdom

- Judea after the Hasmonean Revolt
- Expansion under Jonathan
- Expansion under Simon
- Expansion under Hyrcanus I
- Possible expansion under John
- Expansion under Aristobulus I
- Expansion under Alexander Jannai



G25 Case Study IIB: The Origins of the Palestinian People

Do Palestinians have Jewish ancestry?

Summary / careful conclusion

So... do Palestinians have Jewish ancestry?

- **Many Palestinians likely have some Israelite/Jewish-connected ancestry**, but:
 - it is usually mixed with other Levantine regional inputs
 - it cannot be assigned to individuals without clear historical and genetic context
- The strongest statement genetics supports is:
 - **shared ancient Levantine roots**, with complex later history

One-line takeaway:

Palestinians are not “foreigners,” and Jews are not “outsiders”—both are deeply rooted in the Levant, with different historical layers.

-

G25 Case Study IIB: The Origins of the Palestinian People

Do Palestinians have Jewish ancestry?

Two Broad Bedouin Profiles (G25)

G25 suggests two main patterns

1. **Levantine-like Bedouin**

- Cluster near other Palestinians / southern Levantines
- Low-to-moderate Arabian signal

2. **Arabian-shifted Bedouin**

- Stronger “Arabian” component (your Socotra proxy)
- More separated from Levantine averages

Bedouin



Target: BedouinA

Distance: 0.3494% / 0.00349379 | R4P

Populations: 20 | Iterations: 4051 | Time: 10.81 s

51.4 Levant_Bronze_Age

24.8 Iran_Iron_Age

14.8 Sudan_EarlyChristian_S

9.0 Punic_Amazigh

Target: BedouinB

Distance: 2.2906% / 0.02290602 | R4P

Populations: 3 | Iterations: 1 | Time: 0.308 s

77.2 Yemen_Soqatra

19.8 Levant_Bronze_Age

3.0 Sudan_EarlyChristian_S

Bedouin (From Arabia?)



Target: BedouinA
Distance: 0.2750% / 0.00275022 | R4P
Populations: 19 | Iterations: 3774 | Time: 9.205 s

75.4 Levant_Bronze_Age

11.2 Africa_Garamantians

7.6 Iran_Iron_Age

5.8 Sarmatian

Target: BedouinB
Distance: 0.7871% / 0.00787118 | R4P
Populations: 7 | Iterations: 1074 | Time: 2.17 s

92.8 Saudi

3.4 Punic_Amazigh

2.6 Sudan_EarlyChristian_S

1.2 Egyptian_Late_Kingdom_Period

Target: Gaza_Memluk-Era
Distance: 1.4762% / 0.01476169 | R4P
Populations: 5 | Iterations: 736 | Time: 0.806 s

82.2 Saudi

14.6 Yemen_Soqatra

3.2 Italy_IA

G25 Case Study IIB: The Origins of the Palestinian People

Do Palestinians have Jewish ancestry?

Bedouin and Palestinians

Why some Bedouin resemble Palestinians

- Many tribes likely reflect:
 - long-term residence in the southern Levant
 - assimilation and intermarriage
- Their genetics track **local continuity** more than migration

Interpretation:

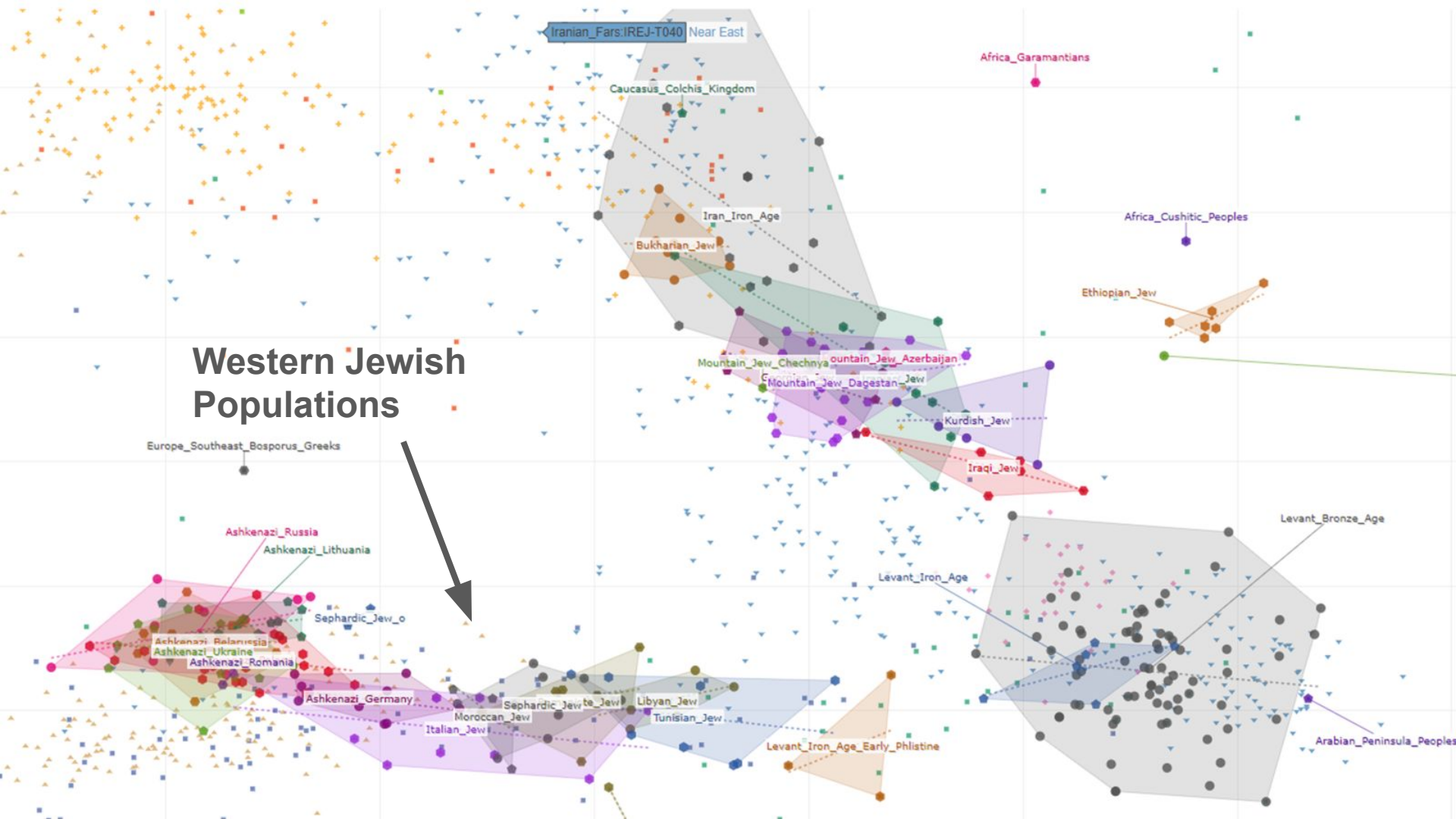
Some “Bedouin” are best understood as local Levantines with Bedouin tribal identity.

Slide B4 — Bedouin With Strong Arabian Signals

Some tribes look like true migrants from Arabia

- A minority of tribes show a high Arabian component
- This pattern is consistent with:
 - later historic migrations
 - tribal expansions and movement through Sinai / Hijaz routes

G25 Case Study III: The Ashkenazi Jews, Middle Eastern Origins with European Admixture.
But, with which Europeans?



North African Jews



Target: Tunisian_Jew

Distance: 0.3434% / 0.00343429 | R4P

Populations: 21 | Iterations: 4336 | Time: 7.591 s

53.6 Levant_Bronze_Age

23.0 Europe_South_Central_Western_Illyrians

20.0 Punic_Amazigh

3.4 Egyptian_Late_Kingdom_Period

Target: Moroccan_Jew

Distance: 0.8675% / 0.00867539 | R4P

Populations: 10 | Iterations: 1641 | Time: 3.141 s

42.6 Levant_Bronze_Age

23.2 Macedonia_IA

22.0 Punic_Amazigh

12.2 Spain_IA

Sephardi Jews



Target: Sephardic_Jew
Distance: 0.4890% / 0.00489001 | R4P
Populations: 20 | Iterations: 4051 | Time: 6.877 s

52.6 Levant_Bronze_Age
23.2 Albania_BA_IA
13.8 Italy_IA
10.4 Punic_Amazigh

Target: Sephardic_Jew_o
Distance: 0.9508% / 0.00950770 | R4P
Populations: 19 | Iterations: 3774 | Time: 5.398 s

46.2 Levant_Bronze_Age
30.8 Albania_BA_IA
15.6 Europe_Eastern_Scythians
7.4 Punic_Amazigh

Ashkenazi Jews



Target: Ashkenazi_Ukraine

Distance: 0.5645% / 0.00564459 | R4P

Populations: 25 | Iterations: 5556 | Time: 6.129 s

37.0 Levant_Bronze_Age

25.4 Europe_South_Central_Western_Illyrians

23.4 Ukraine_Scythian.SG

14.2 Punic_Mixed_Amazigh

Target: Ashkenazi_Russia

Distance: 0.5887% / 0.00588749 | R4P

Populations: 24 | Iterations: 5239 | Time: 7.028 s

36.0 Levant_Bronze_Age

28.6 Europe_South_Central_Western_Illyrians

23.2 Europe_Eastern_Scythians

12.2 Punic_Mixed_Amazigh

G25 Case Study III: The Ashkenazi Jews, Middle Eastern Origins with European Admixture.

Ashkenazi Jews: Framing the Question

Western Jewish Populations: The Shared Core

Sephardi, North African, and Ashkenazi Jews

- All Western Jewish populations show:
 - A significant **Bronze Age Levantine** component
 - A small **Amazigh / North African** component
 - **Southern European** admixture
- Differences between groups reflect:
 - Geography of the diaspora
 - Timing and location of admixture

Key point:

Western Jews are not separate origins — they are regional variations of the same Levantine-derived population.

G25 Case Study III: The Ashkenazi Jews, Middle Eastern Origins with European Admixture.

Ashkenazi Jews: Identifying the European Component

The Ashkenazi genetic profile

- Ashkenazim show:
 - Clear Levantine ancestry
 - Substantial European admixture
- The key questions:
 - **Where did the European ancestry come from?**
 - **When did it enter the population?**

G25 Case Study III: The Ashkenazi Jews, Middle Eastern Origins with European Admixture.

Initial Signal: “Illyrian”

First pass G25 modeling

- Early models suggested:
 - An Illyrian / Balkan-like signal
- But:
 - This signal is likely **a proxy**, not a true source
 - Suggests **Eastern / Central Europe**, not Italy alone

Interpretive caution:

PCA and admixture labels often reflect nearest available references, not literal ancestry.

Ashkenazi Jews



Target: Ashkenazi_Ukraine
Distance: 0.3966% / 0.00396642 | R4P
Populations: 34 | Iterations: 8769 | Time: 12.547 s

- 46.0 Slovakia_IA_Vekerzug
- 43.4 Levant_Bronze_Age
- 6.2 Punic_Amazigh
- 4.4 Kazakhstan_Turk.SG

Target: Ashkenazi_Russia
Distance: 0.4854% / 0.00485374 | R4P
Populations: 32 | Iterations: 7999 | Time: 13.477 s

- 47.6 Slovakia_IA_Vekerzug
- 41.4 Levant_Bronze_Age
- 5.6 Punic_Amazigh
- 5.4 Kazakhstan_Turk.SG

G25 Case Study III: The Ashkenazi Jews, Middle Eastern Origins with European Admixture.

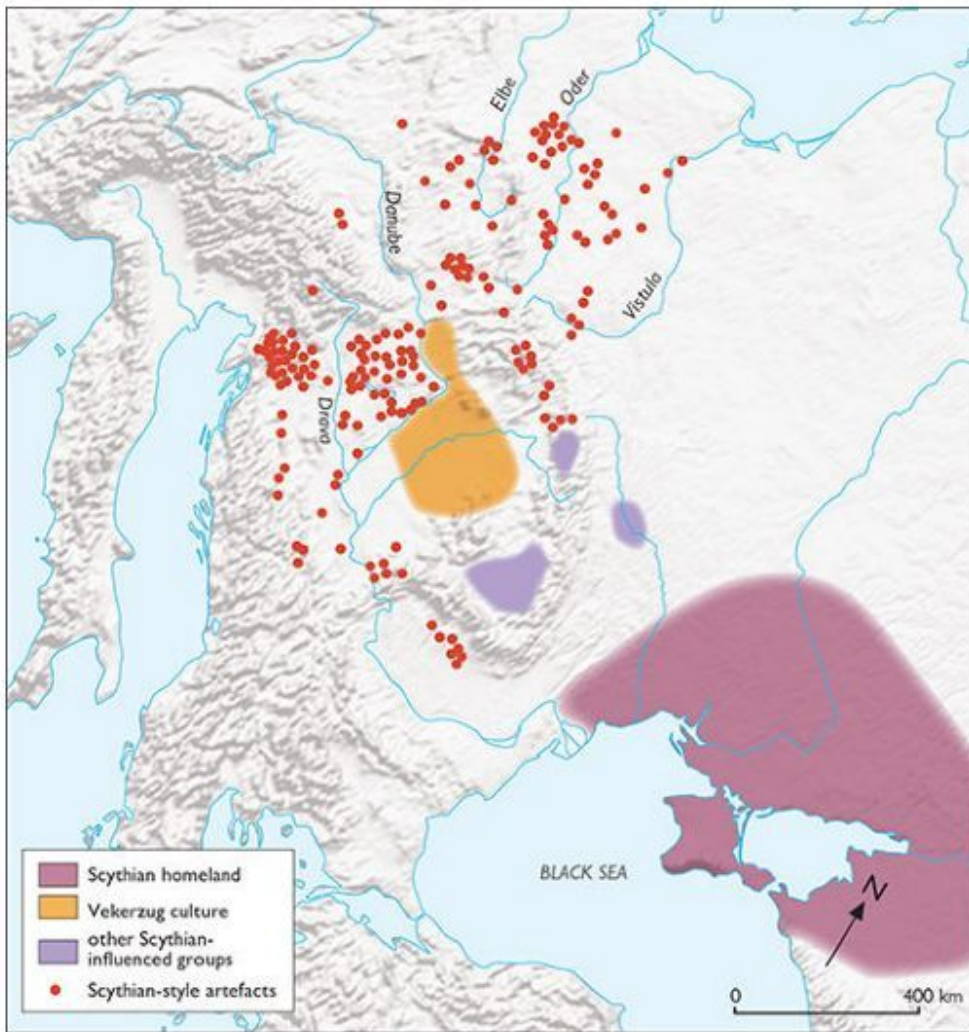
Adding Iron Age Eastern Europe

Refining the model

- After adding Iron Age Eastern European samples:
 - Slovakian Iron Age
 - Minor Turkic-related components
- This combination suggested:
 - **A Central–Eastern European origin**
 - Likely **post–Iron Age admixture**

Takeaway:

The signal looks continental and medieval — not classical Roman.



Vekerzug culture

Vekerzug culture was a group of Iron-Age Scythian-influenced people located near the Danube and Vistula rivers.

Scythian cultures and the distribution of Scythian-style artifacts across Central Europe and the Pontic Steppe between the 7th and 3rd centuries BC

Ashkenazi Jews



Target: Ashkenazi_Ukraine

Distance: 0.1848% / 0.00184751 | R4P

Populations: 34 | Iterations: 8769 | Time: 24.387 s

42.8 Levant_Bronze_Age

28.2 Hungary_Conqueror_Commoner

23.2 Hungary_EarlyAvar

5.8 Punic_Amazigh

Target: Ashkenazi_Russia

Distance: 0.2329% / 0.00232853 | R4P

Populations: 37 | Iterations: 9984 | Time: 25.837 s

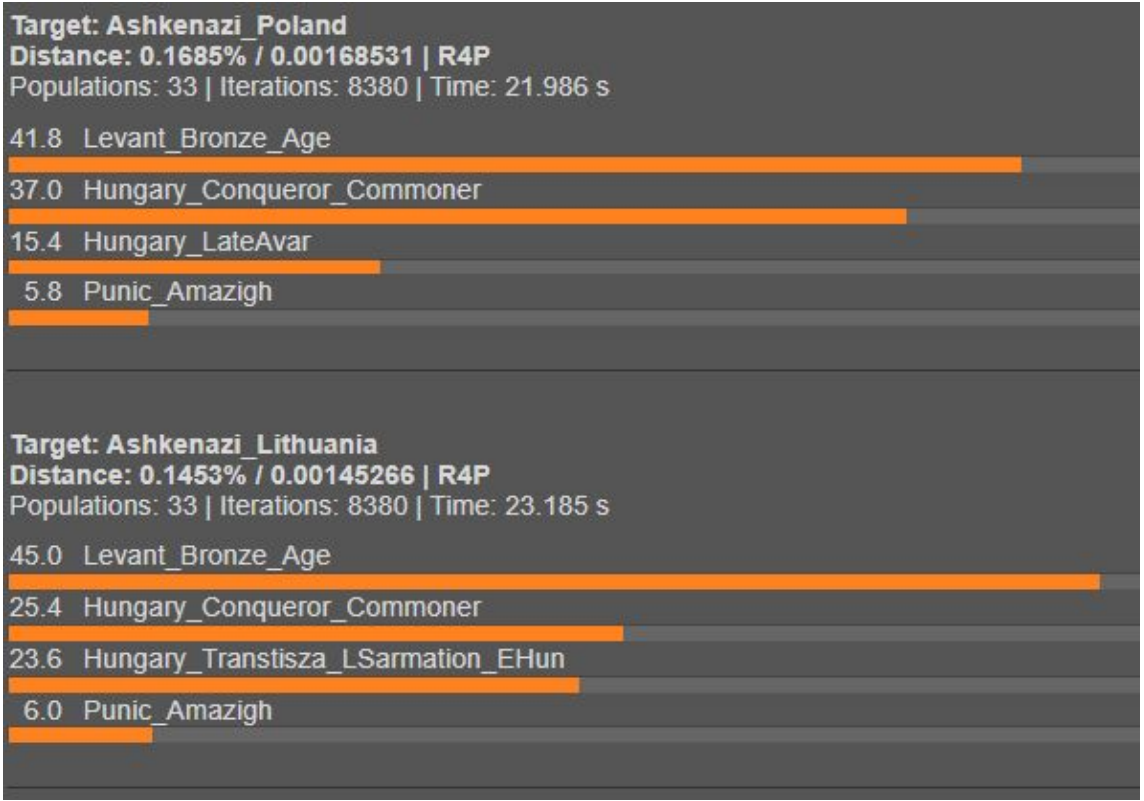
44.0 Levant_Bronze_Age

32.8 Hungary_EarlyAvar

17.2 Slovakia_Poprad.SG

6.0 Punic_Amazigh

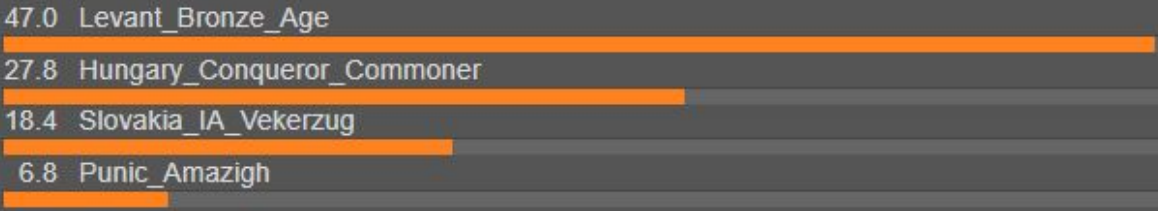
Ashkenazi Jews



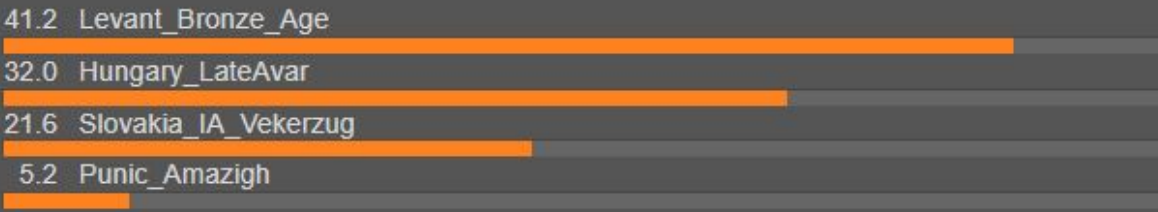
Ashkenazi Jews



Target: Ashkenazi_Germany
Distance: 0.0169% / 0.00016860 | R4P
Populations: 33 | Iterations: 8380 | Time: 34.964 s



Target: Ashkenazi_Belarussia
Distance: 0.0362% / 0.00036197 | R4P
Populations: 39 | Iterations: 10834 | Time: 48.586 s



G25 Case Study III: The Ashkenazi Jews, Middle Eastern Origins with European Admixture.

Medieval Hungary as the Missing Link

Slide 5 — Why Medieval Hungary Matters

Looking beyond Italy

- Medieval Eastern Europe offers:
 - Better temporal fit
 - Richer ancient DNA sampling
- Hungarian datasets (Avar + Conquest period):
 - Repeatedly emerge as dominant contributors

Key observation:

Hungarian medieval ancestry fits Ashkenazi data better than Southern Italy alone.



G25 Case Study III: The Ashkenazi Jews, Middle Eastern Origins with European Admixture.

Historical Traditions: Hungary and Judea

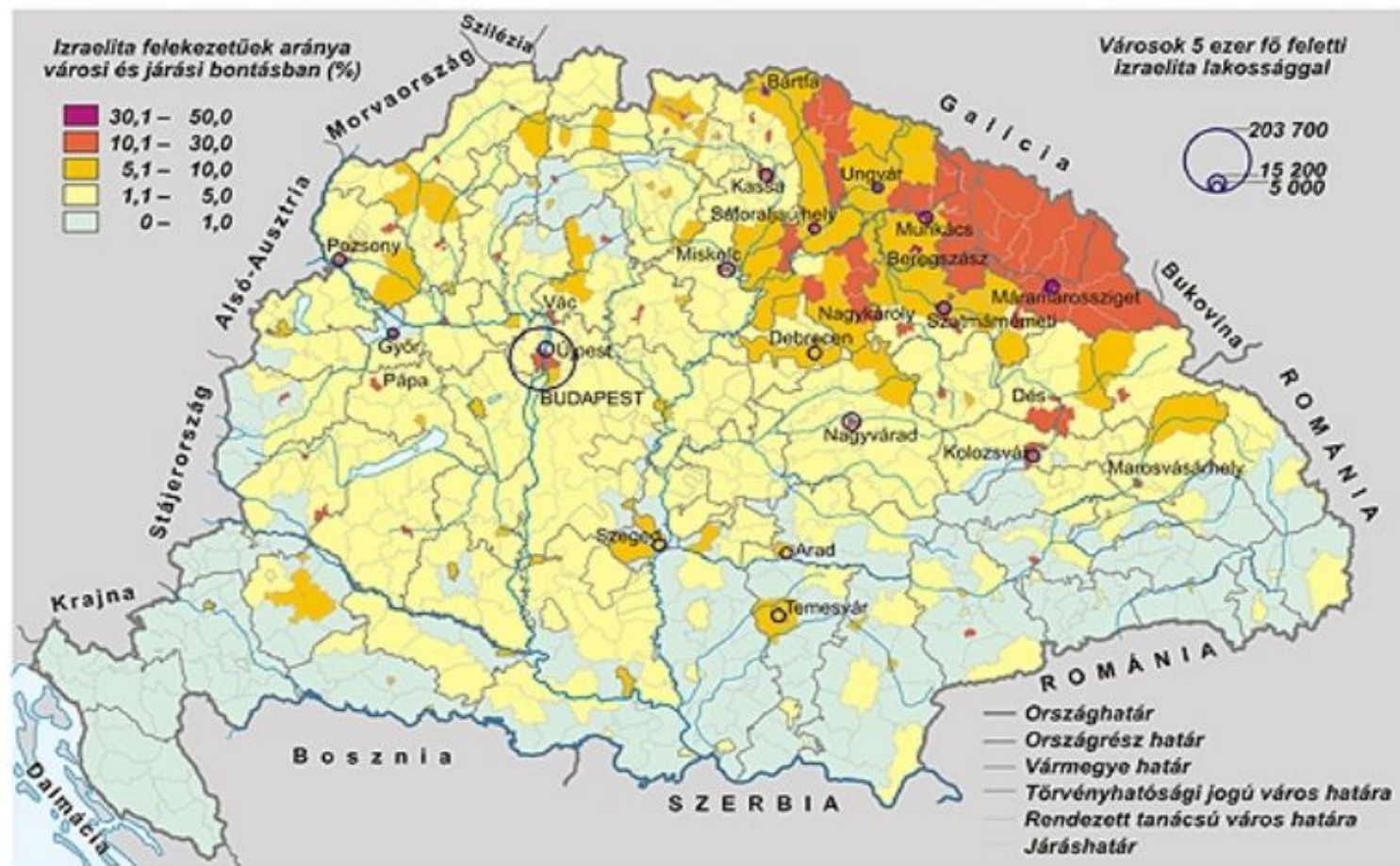
Textual traditions align with genetics

- Traditions describe:
 - Judean soldiers settling in the Carpathian Basin
 - Possible Roman-era transfers of Jewish captives
- These narratives explain:
 - **Male-biased Levantine ancestry**
 - Inter-marriage with local women
 - High maternal European contribution

Interpretation:

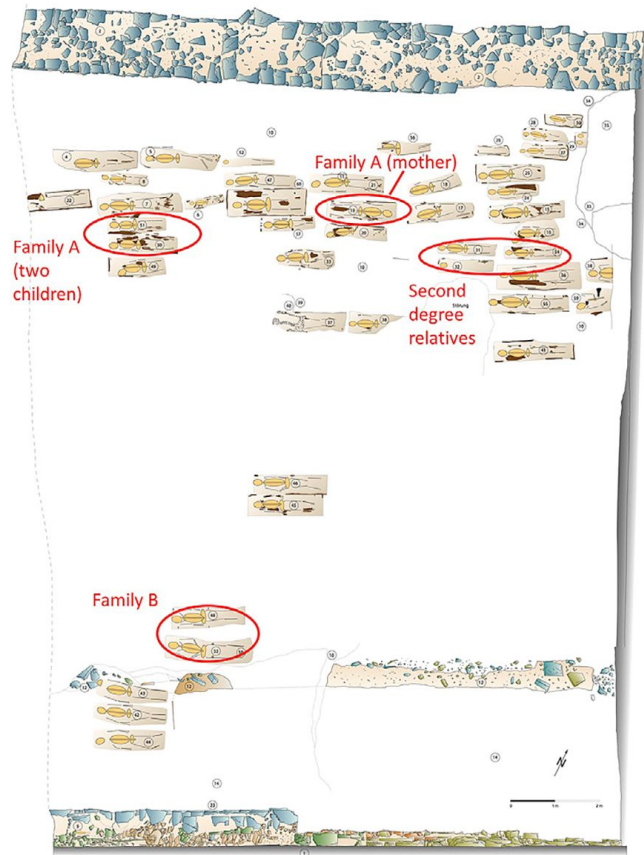
A small group of Judean men integrating into Central Europe is historically plausible — and genetically visible.

Geographic Distribution of the Jewish Population of Hungary, 1900



Erfurt Graveyard Study

A



Target: Erfurt_EU:I13866
Distance: 1.2253% / 0.01225252 | R4P
Populations: 27 | Iterations: 6214 | Time: 11.743 s

69.6 Hungary_Conqueror_Commoner

23.8 Levant_Bronze_Age

3.4 India_South_Dravidians

3.2 Punic_Amazigh

Target: Erfurt_ME:I13861
Distance: 1.2357% / 0.01235696 | R4P
Populations: 10 | Iterations: 1641 | Time: 2.979 s

55.8 Levant_Bronze_Age

18.4 Italy_IA

14.8 Europe_Northwest_Armoricians

11.0 Macedonia_IA

G25 Case Study III: The Ashkenazi Jews, Middle Eastern Origins with European Admixture.

Erfurt Graveyard: Internal Structure of Ashkenazim

The Erfurt Study Changes the Picture

Medieval Ashkenazi diversity

- The Erfurt samples split into:
 - **More Middle Eastern-leaning Jews**
 - **More European-leaning Jews**
- G25 modeling shows:
 - European-leaning individuals → strong **Hungarian medieval signal**
 - Middle Eastern-leaning individuals → stronger **Levantine + Mediterranean signal**

Key insight:

European admixture was uneven and socially structured within early Ashkenazi communities.

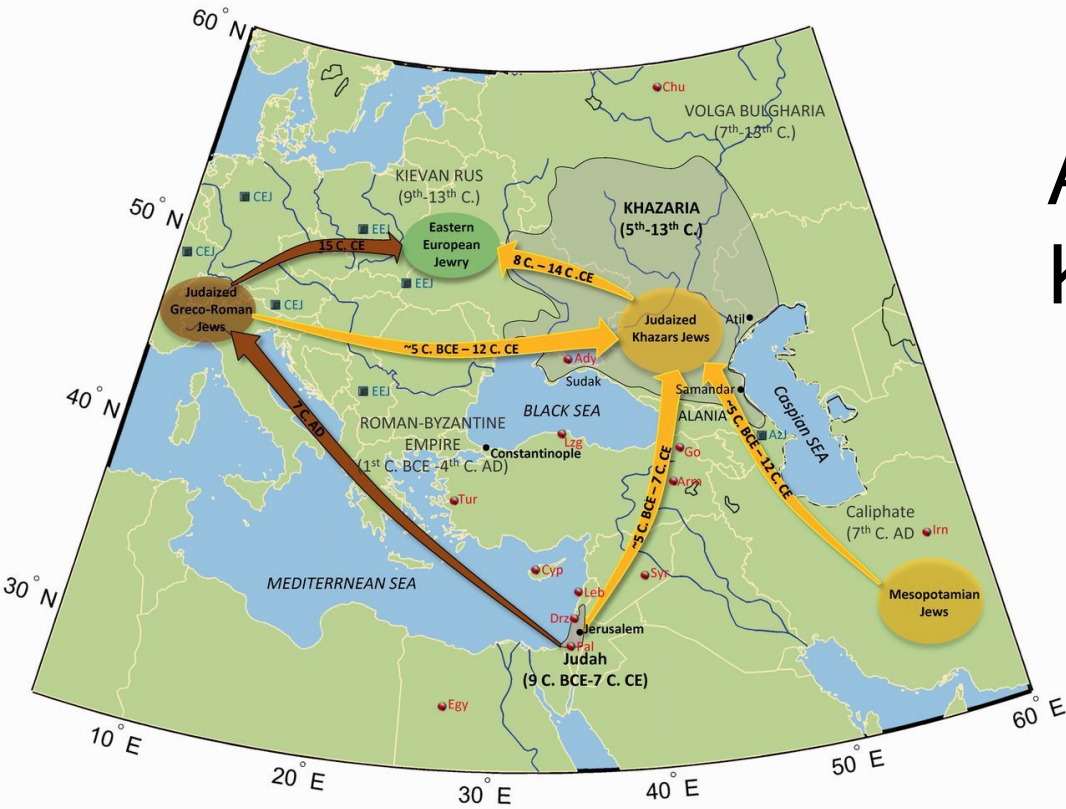
G25 Case Study III: The Ashkenazi Jews, Middle Eastern Origins with European Admixture.

Rethinking “Italian Origin”

Italy is not the full story

- Southern European ancestry exists
- But:
 - Medieval Eastern Europe explains more variance
 - Fits both genetics and historical timing
- Suggests:
 - **Multiple entry points**
 - With **Central Europe playing a major role**

Ashkenazim from Khazaria?



Elhaik (2012, Genome Biology and Evolution): The Missing Link of Jewish European Ancestry: Contrasting the Rhineland and the Khazarian Hypotheses,

G25 Case Study III: The Ashkenazi Jews, Middle Eastern Origins with European Admixture.

The Khazar Question — Tested Directly

Testing the Khazar Hypothesis

What happens when Khazar samples are added?

- Two Khazar-period samples were included
- Result:
 - **No meaningful Khazar signal** in Ashkenazi Jews
- If Khazar ancestry were substantial:
 - We would expect strong Iranian / steppe components
 - Similar to Mizrahi or Mountain Jews

But this is not observed.

G25 Case Study III: The Ashkenazi Jews, Middle Eastern Origins with European Admixture.

Where to Look for Khazar Converts

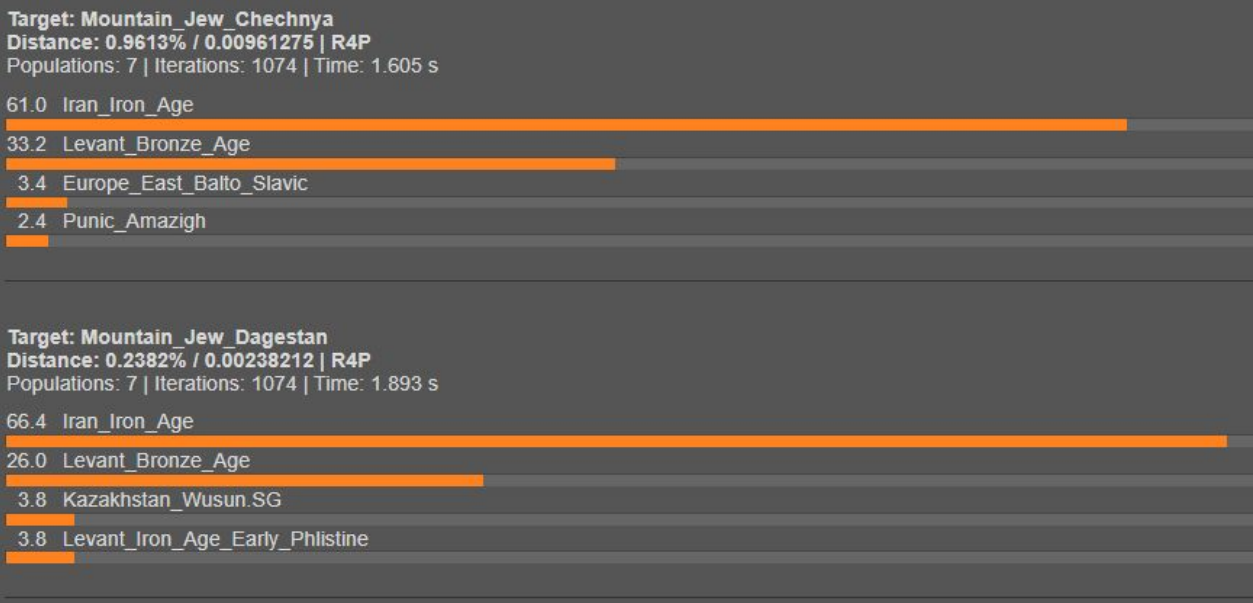
If they existed, where would they be today?

- Most likely candidates:
 - Mountain Jews
 - Caucasus-region Jewish populations
- These groups:
 - Do show Iranian / Caucasus components
- Ashkenazim do not

Conclusion:

Ashkenazi Eastern European ancestry is **not Khazar** — it is **Central European, especially Hungarian**.

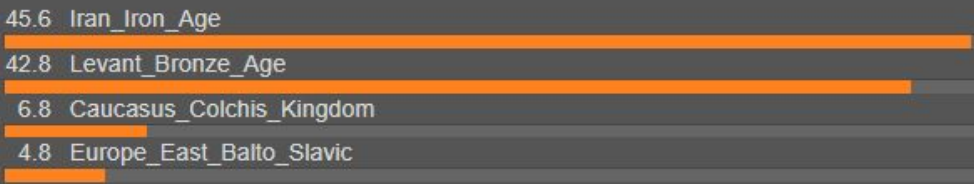
Mountain Jews



Georgian and Azerbaijani Jews



Target: Georgian_Jew
Distance: 0.6380% / 0.00637975 | R4P
Populations: 8 | Iterations: 1255 | Time: 1.886 s



Target: Mountain_Jew_Azerbaijan
Distance: 0.9798% / 0.00979770 | R4P
Populations: 3 | Iterations: 1 | Time: 0.183 s



G25 Case Study III: The Ashkenazi Jews, Middle Eastern Origins with European Admixture.

Western Edge Cases: Conversos and Southern Italy

Iberian Conversos

Belmonte & Minorca

- Converso populations show:
 - Similar structure to other Western Jews
 - But:
 - Less Levantine
 - More European ancestry
- Consistent with:
 - Forced conversion
 - Gradual genetic dilution

Conversos: Spanish/Portuguese



Target: Spanish_Menorca
Distance: 0.4902% / 0.00490236 | R4P
Populations: 20 | Iterations: 4051 | Time: 5.2 s

36.6 Italy_IA
35.4 Europe_Southwest_Iberia
15.6 Libyan_Jew
12.4 Netherlands_IA

Target: Belmonte_Jew:Belmonte1
Distance: 0.9748% / 0.00974783 | R4P
Populations: 18 | Iterations: 3505 | Time: 4.965 s

59.2 Spain_Roman_South
18.8 Ashkenazi_Ukraine
14.2 Levant_Bronze_Age
7.8 Spain_Roman_oLocal

G25 Case Study III: The Ashkenazi Jews, Middle Eastern Origins with European Admixture.

Southern Italians: The Inverse Pattern

A mirror image

- Southern Italians show:
 - Elevated Levantine ancestry
- Likely explanation:
 - Jewish Christians assimilated into local populations
 - Jews who remained Jewish were expelled repeatedly

Key asymmetry:

Jews who stayed Jewish were removed; Jews who converted were absorbed.

Conversos: in Southern Italy?

Target: Italian_Abruzzo

Distance: 0.3252% / 0.00325204 | R4P

Populations: 25 | Iterations: 5556 | Time: 7.683 s

46.6 Italy_IA

31.0 Ashkenazi_Ukraine

15.8 Iran_Iron_Age

6.6 Levant_Iron_Age_Early_Phlistine

Target: Italian_Calabria

Distance: 0.3783% / 0.00378278 | R4P

Populations: 24 | Iterations: 5239 | Time: 4.131 s

34.4 Italy_IA

24.4 Italian_Jew

21.2 Iran_Iron_Age

20.0 Sephardic_Jew



G25 Case Study III: The Ashkenazi Jews, Middle Eastern Origins with European Admixture.

Ashkenazi Jews: Synthesis

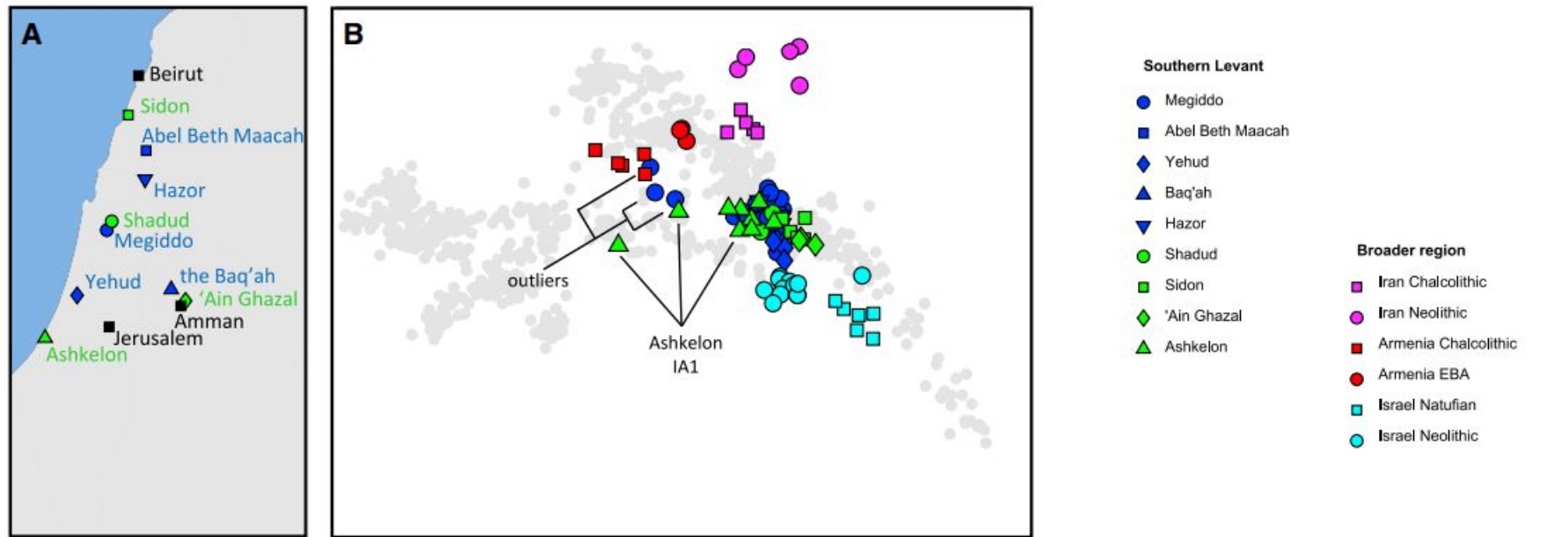
What the data suggest

- Ashkenazi Jews derive from:
 - A Levantine ancestral core
 - Mixed primarily with **Central–Eastern Europeans**
- Medieval Hungary emerges as:
 - A major admixture source
 - Historically and genetically consistent
- No evidence supports:
 - A Khazar origin
 - Large-scale conversion from steppe populations

One-line takeaway:

Ashkenazi Jews are a Levantine people shaped by medieval Central Europe — not a European people with a Near Eastern myth.

G25 Case Study IV: The Iron Age Levant, what historic migratory processes shaped the people and how is their genetic legacy still visible today?



Ancient DNA Samples, Cell 2020
The Genomic History of the Bronze Age Southern Levant

Early Bronze Age Levant - Canaanites and Ammonites



Target: Levant_Bronze_Age:Early_Canaanite_Israel_IBA_Megiddo
Distance: 1.7937% / 0.01793737 | R4P
Populations: 5 | Iterations: 736 | Time: 0.481 s

77.8 Israel_C

19.0 Iran_C_TepeHissar

1.8 Morocco_Iberomaurusian

1.4 Iran_C_SehGabi

Target: Levant_Bronze_Age:Early_Ammonite_Jordan_EBA_'Ain_Ghazal_(Levant_EBA_South)
Distance: 2.6463% / 0.02646344 | R4P
Populations: 5 | Iterations: 736 | Time: 0.442 s

78.8 Israel_C

15.6 Iran_C_TepeHissar

3.8 Morocco_Iberomaurusian

1.8 Steppe

Late Bronze Age Canaanites



Target: Levant_Bronze_Age:Late_Canaanite_Israel_LBA_Ashkelon
Distance: 1.5887% / 0.01588701 | R4P
Populations: 7 | Iterations: 1074 | Time: 0.872 s

59.0 Israel_C

23.2 Iran_C_TepeHissar

14.4 Anatolian

3.4 Steppe

Target: Levant_Bronze_Age:Canaanite_Israel_MLBA_Megiddo
Distance: 0.4446% / 0.00444557 | R4P
Populations: 8 | Iterations: 1255 | Time: 0.8 s

63.6 Israel_C

25.2 Iran_C_SehGabi

7.4 Iran_C_TepeHissar

3.8 Steppe



Ebla

Ebla

Mari

Assyria

Sumeria

Sam'al

Ursa'um

Hazuwan

Carchemish

Harran

Urkish

Nagar

Kahat

Nineveh

Assur

Alalakh

Halab

Tell Bazi

(Armi ?)

Burman

Emar

Belan

Tuttul

Tell

Munbateh

Hama

Qatna

Terqa

Mari

Ugarit

Byblos

Damascus

Hazor

Eshnunna

Rapiqum

Sippar

Akshak

Der

Kish

Nippur

Adab

Isin

Umma

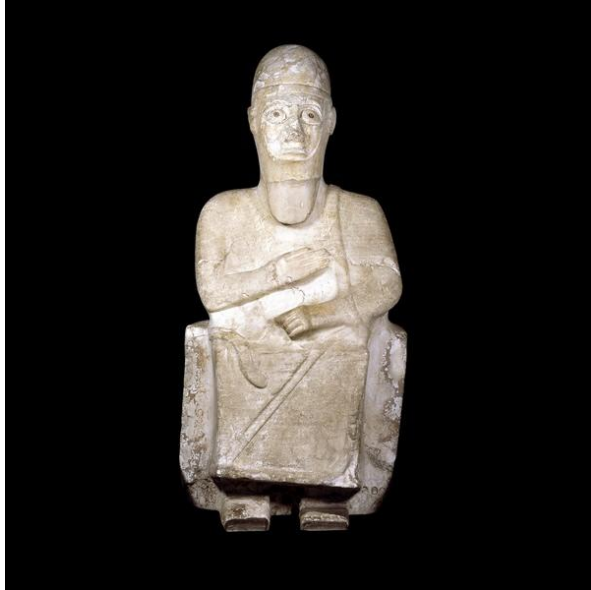
Uruk

Lar

Lagash

anaan

Northern Levant - Amorites, Ebla and Alalakh



Target: Levant_Bronze_Age:Amorite_Syria_EMBA_Ebla
Distance: 0.5469% / 0.00546933 | R4P
Populations: 6 | Iterations: 901 | Time: 0.605 s

43.6 Israel_C

23.2 Anatolian

21.6 Iran_C_SehGabi

11.6 Armenian

Target: Levant_North_Alalakh_MLBA:Amorite_Hatay_MLBA_Alalakh
Distance: 0.4962% / 0.00496189 | R4P
Populations: 8 | Iterations: 1255 | Time: 0.944 s

41.6 Anatolian

32.0 Israel_C

23.4 Iran_C_SehGabi

3.0 Steppe



Early Philistine - Minoan and other Sea Peoples



Target: Levant_Iron_Age_Early_Phlistine:Israel_IAI_Ashkelon_Philistine_(Non_Local_Profile)
Distance: 2.9888% / 0.02988810 | R4P
Populations: 9 | Iterations: 1444 | Time: 1.361 s

42.4 Minoan_Bronze_Age

35.8 Anatolian

14.0 Greece_BA_Mycenaean

7.8 Iran_ShahriSokhta_BA1

Target: Levant_Iron_Age_Early_Phlistine:Israel_IAI_Ashkelon_Philistine_(Non_Local_Profile)
Distance: 2.8913% / 0.02891322 | R4P
Populations: 14 | Iterations: 2509 | Time: 2.197 s

39.6 Minoan

36.6 Turkey_EBA

12.0 Spain_EBA

11.8 Romania_BA_Arman



 *Greece in the Bronze Age. Three distinctive civilizations—Cycladic, Minoan, and Mycenaean—developed around the Aegean Sea in the third and second millennia B.C.E.*

Minoan and Mycenaean



Target: Greece_MiddleMinoan
Distance: 2.8758% / 0.02875835 | R4P
Populations: 6 | Iterations: 901 | Time: 0.715 s

63.6 Aegeon

15.6 Anatolian

11.0 Iran_C_TepeHissar

9.8 Israel_C

Target: Greece_BA_Mycenaean
Distance: 0.7206% / 0.00720602 | R4P
Populations: 10 | Iterations: 1641 | Time: 1.08 s

40.8 Anatolian

36.2 Romania_C_Bodrogkeresztur

13.2 Aegeon

9.8 Steppe

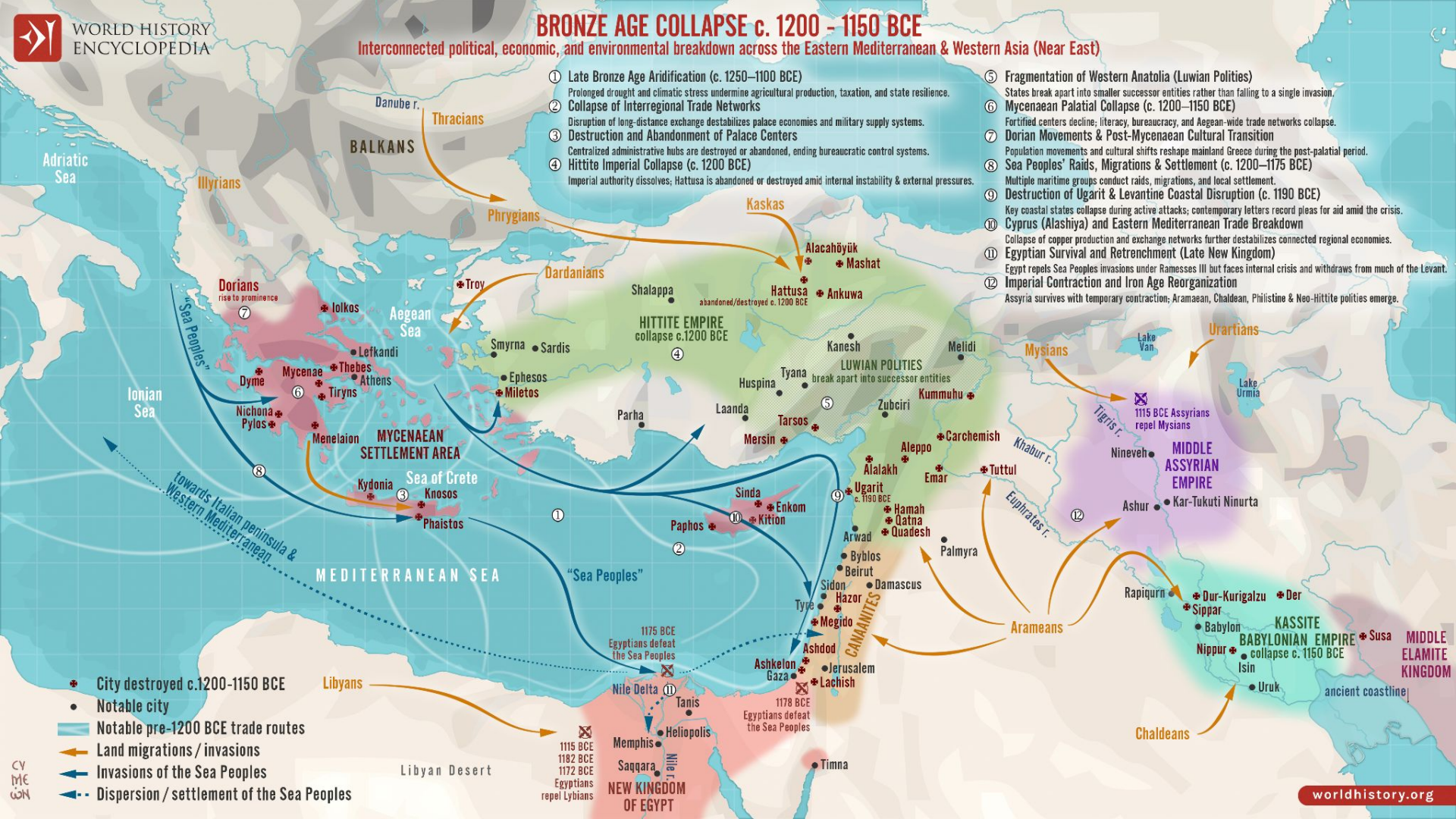


BRONZE AGE COLLAPSE c. 1200 - 1150 BCE

Interconnected political, economic, and environmental breakdown across the Eastern Mediterranean & Western Asia (Near East)

- 1 Late Bronze Age Aridification (c. 1250–1100 BCE)
Prolonged drought and climatic stress undermine agricultural production, taxation, and state resilience.
- 2 Collapse of Interregional Trade Networks
Disruption of long-distance exchange destabilizes palace economies and military supply systems.
- 3 Destruction and Abandonment of Palace Centers
Centralized administrative hubs are destroyed or abandoned, ending bureaucratic control systems.
- 4 Hittite Imperial Collapse (c. 1200 BCE)
Imperial authority dissolves; Hattusa is abandoned or destroyed amid internal instability & external pressures.

- 5 Fragmentation of Western Anatolia (Luwian Polities)
States break apart into smaller successor entities rather than falling to a single invasion.
- 6 Mycenaean Palatial Collapse (c. 1200–1150 BCE)
Fortified centers decline; literacy, bureaucracy, and Aegean-wide trade networks collapse.
- 7 Dorian Movements & Post-Mycenaean Cultural Transition
Population movements and cultural shifts reshape mainland Greece during the post-palatial period.
- 8 Sea Peoples' Raids, Migrations & Settlement (c. 1200–1175 BCE)
Multiple maritime groups conduct raids, migrations, and local settlement.
- 9 Destruction of Ugarit & Levantine Coastal Disruption (c. 1190 BCE)
Key coastal states collapse during active attacks; contemporary letters record pleas for aid amid the crisis.
- 10 Cyprus (Alashiya) and Eastern Mediterranean Trade Breakdown
Collapse of copper production and exchange networks further destabilizes connected regional economies.
- 11 Egyptian Survival and Retrenchment (Late New Kingdom)
Egypt repels Sea Peoples invasions under Ramesses III but faces internal crisis and withdraws from much of the Levant.
- 12 Imperial Contraction and Iron Age Reorganization
Assyria survives with temporary contraction; Aramean, Chaldean, Philistine & Neo-Hittite polities emerge.



- City destroyed c. 1200–1150 BCE
- Notable city
- Notable pre-1200 BCE trade routes
- Land migrations / invasions
- Invasions of the Sea Peoples
- Dispersion / settlement of the Sea Peoples

Later Philistine - Integration with Local Levantine peoples



Target: Levant_Iron_Age:Late_Phlistine_Israel_IAll_Ashkelon_Philistine

Distance: 1.0563% / 0.01056277 | R4P

Populations: 8 | Iterations: 1255 | Time: 2.123 s

38.8 Levant_North_Alalakh_MLBA

33.8 Levant_Bronze_Age

17.0 Egyptian_Old_Kingdom_Period_Gizeh

10.4 Levant_North_Ebla

Target: Levant_Iron_Age_Early_Phlistine:Israel_IAl_Ashkelon_Philistine_(Levant_Mixed_Profile)

Distance: 3.2671% / 0.03267072 | R4P

Populations: 10 | Iterations: 1641 | Time: 2.07 s

44.8 Levant_Bronze_Age

26.8 Italy_Sardinia_EBA_o

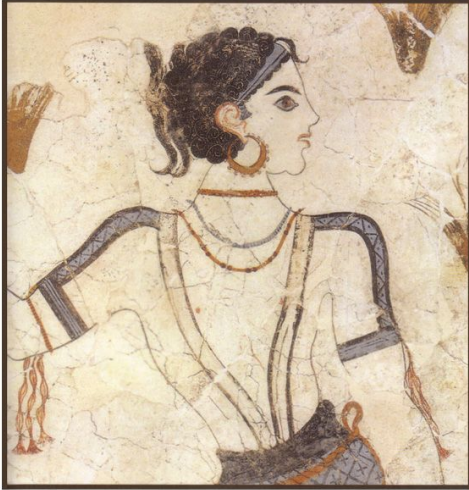
26.0 Armenia_EBA_KuraAraxes_Kaps

2.4 Morocco_Iberomaurusian

Northern Philistines?



Phoenicians - Iron Age Canaanites



Target: Levant_Iron_Age:Phoenician_Lebanon_IAll_Beirut
Distance: 1.1574% / 0.01157420 | R4P
Populations: 9 | Iterations: 1444 | Time: 2.411 s

75.6 Levant_Bronze_Age

15.0 Levant_North_Alalakh_MLBA

7.0 Minoan

2.4 Estonia_BA.SG

Target: Levant_Iron_Age:Phoenician_Lebanon_IAlll_Beirut
Distance: 0.1796% / 0.00179631 | R4P
Populations: 23 | Iterations: 4930 | Time: 7.885 s

68.2 Levant_Bronze_Age

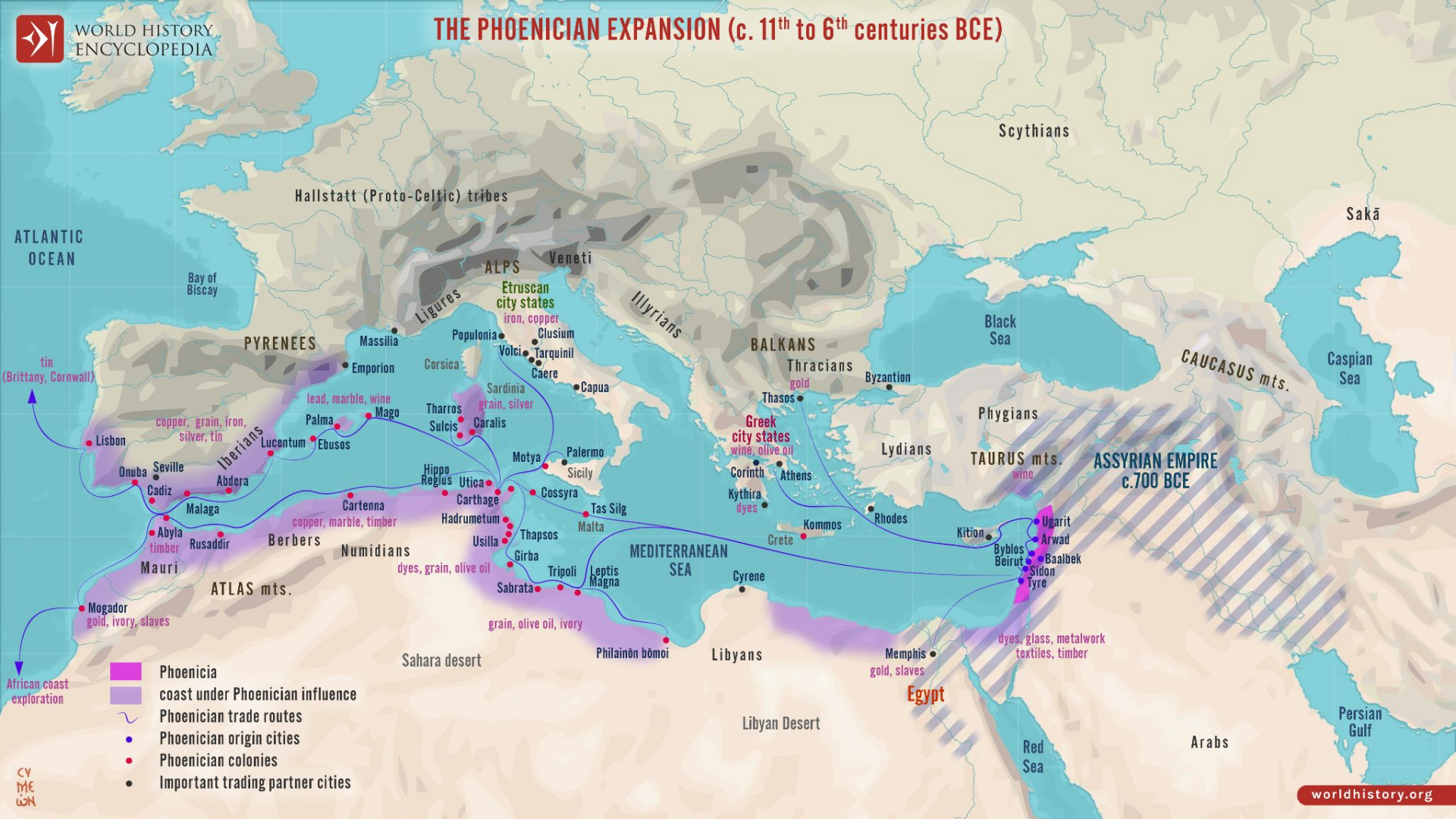
13.6 Minoan_Bronze_Age

12.4 Armenia_LBA_EIA

5.8 Levant_North_Ebla



THE PHOENICIAN EXPANSION (c. 11th to 6th centuries BCE)



- Phoenicia
- coast under Phoenician influence
- Phoenician trade routes
- Phoenician origin cities
- Phoenician colonies
- Important trading partner cities

Iron Age Israelites



Iron Age Israelites



Target: Levant_Iron_Age:Israelite_Israel_IA_Megiddo
Distance: 1.4493% / 0.01449310 | R4P
Populations: 8 | Iterations: 1255 | Time: 1.878 s

68.8 Levant_Bronze_Age

13.4 Levant_North_Ebla

9.6 Egyptian_Old_Middle_Kingdom_Period_Dahshur

8.2 Armenia_EBA_KuraAraxes_Kamut_o

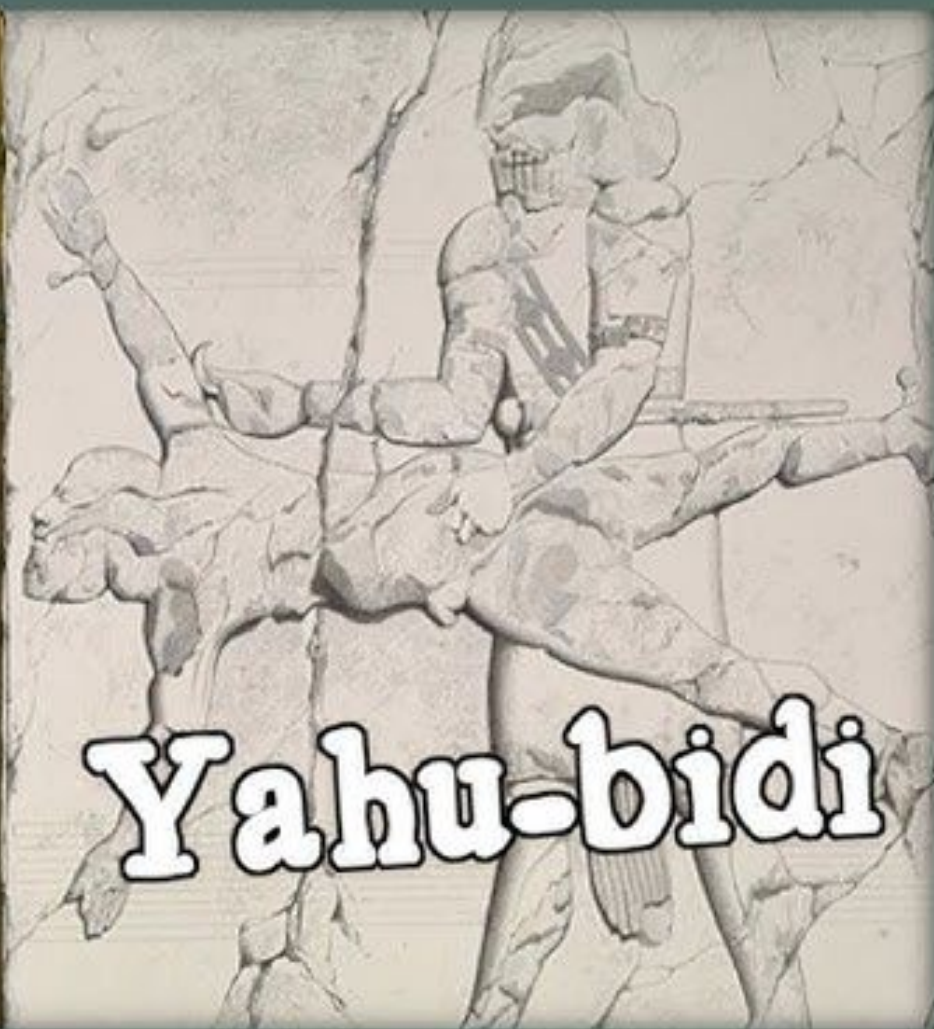
Target: Levant_Iron_Age:Israelite_Israel_IA_Abel_Beth_Maacah
Distance: 1.0362% / 0.01036181 | R4P
Populations: 12 | Iterations: 2059 | Time: 3.423 s

44.8 Levant_North_Alalakh_MLBA

33.6 Levant_Bronze_Age

14.4 Yemen_Soqatra

7.2 Greece_Delphi_BA_Mycenaean



Yahu-bidi

Hurrians - Bronze Age Armenians



Target: Armenia_LBA_EIA:I14051
Distance: 2.1372% / 0.02137165 | R4P
Populations: 11 | Iterations: 1846 | Time: 0.978 s

41.4 Armenian

21.6 Iran_C_TepeHissar

20.0 Steppe

17.0 Romania_C_Bodrogkeresztur

Target: Armenia_EBA_KuraAraxes_Karnut_o:I14812
Distance: 2.6912% / 0.02691187 | R4P
Populations: 8 | Iterations: 1255 | Time: 0.723 s

50.8 Armenia_C_Areni

31.8 Armenian

12.8 Iran_C_SehGabi

4.6 Israel_C



Old Kingdom Egypt



Target: Egyptian_Old_Middle_Kingdom_Period_Dahshur:I10020

Distance: 4.9151% / 0.04915127 | R4P

Populations: 7 | Iterations: 1074 | Time: 0.917 s

68.4 Israel_C

17.4 Morocco_Iberomaurusian

11.4 Iranian

2.8 Iran_C_TepeHissar

Target: Egyptian_Old_Kingdom_Period_Gizeh:I6409

Distance: 4.7868% / 0.04786754 | R4P

Populations: 6 | Iterations: 901 | Time: 0.725 s

78.0 Israel_C

17.6 Morocco_Iberomaurusian

2.6 Asian

1.8 Basal_Eurasian

The Shasu - Midianites?



Target: Yemen_Soqatra
Distance: 4.9666% / 0.04966605 | R4P
Populations: 7 | Iterations: 1074 | Time: 0.835 s

74.8 Israel_C

15.2 Iran_Wezmeh_N.SG

8.0 Morocco_Iberomaurusian

2.0 Asian



Iron Age Israelites



Target: Levant_Iron_Age:Israelite_Israel_IA_Megiddo
Distance: 1.4493% / 0.01449310 | R4P
Populations: 8 | Iterations: 1255 | Time: 1.878 s

68.8 Levant_Bronze_Age

13.4 Levant_North_Ebla

9.6 Egyptian_Old_Middle_Kingdom_Period_Dahshur

8.2 Armenia_EBA_KuraAraxes_Kamut_o

Target: Levant_Iron_Age:Israelite_Israel_IA_Abel_Beth_Maacah
Distance: 1.0362% / 0.01036181 | R4P
Populations: 12 | Iterations: 2059 | Time: 3.423 s

44.8 Levant_North_Alalakh_MLBA

33.6 Levant_Bronze_Age

14.4 Yemen_Soqatra

7.2 Greece_Delphi_BA_Mycenaean

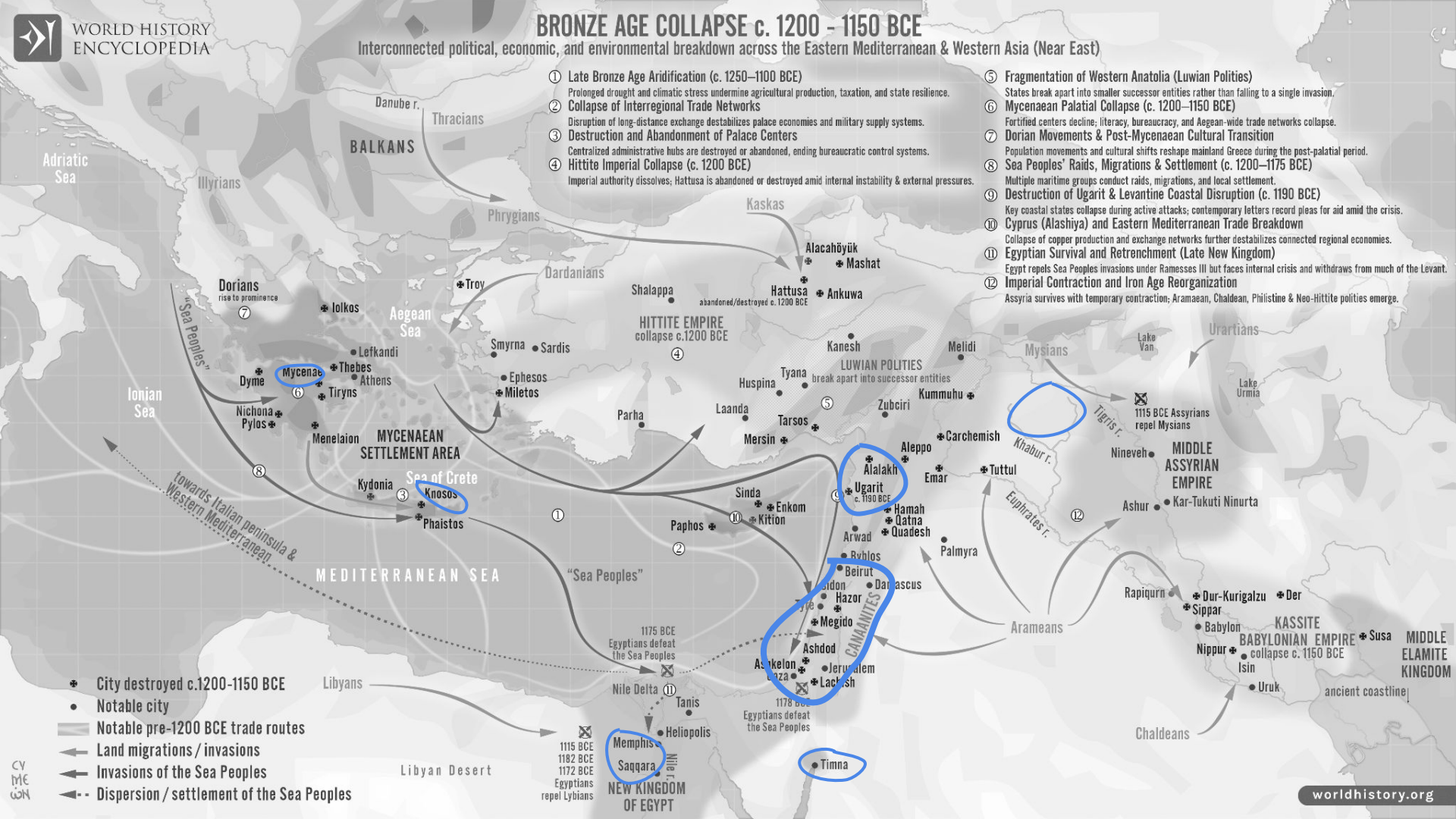


BRONZE AGE COLLAPSE c. 1200 - 1150 BCE

Interconnected political, economic, and environmental breakdown across the Eastern Mediterranean & Western Asia (Near East)

- 1 Late Bronze Age Aridification (c. 1250–1100 BCE)
Prolonged drought and climatic stress undermine agricultural production, taxation, and state resilience.
- 2 Collapse of Interregional Trade Networks
Disruption of long-distance exchange destabilizes palace economies and military supply systems.
- 3 Destruction and Abandonment of Palace Centers
Centralized administrative hubs are destroyed or abandoned, ending bureaucratic control systems.
- 4 Hittite Imperial Collapse (c. 1200 BCE)
Imperial authority dissolves; Hattusa is abandoned or destroyed amid internal instability & external pressures.

- 5 Fragmentation of Western Anatolia (Luwian Polities)
States break apart into smaller successor entities rather than falling to a single invasion.
- 6 Mycenaean Palatial Collapse (c. 1200–1150 BCE)
Fortified centers decline; literacy, bureaucracy, and Aegean-wide trade networks collapse.
- 7 Dorian Movements & Post-Mycenaean Cultural Transition
Population movements and cultural shifts reshape mainland Greece during the post-palatial period.
- 8 Sea Peoples' Raids, Migrations & Settlement (c. 1200–1175 BCE)
Multiple maritime groups conduct raids, migrations, and local settlement.
- 9 Destruction of Ugarit & Levantine Coastal Disruption (c. 1190 BCE)
Key coastal states collapse during active attacks; contemporary letters record pleas for aid amid the crisis.
- 10 Cyprus (Alashiya) and Eastern Mediterranean Trade Breakdown
Collapse of copper production and exchange networks further destabilizes connected regional economies.
- 11 Egyptian Survival and Retrenchment (Late New Kingdom)
Egypt repels Sea Peoples invasions under Ramesses III but faces internal crisis and withdraws from much of the Levant.
- 12 Imperial Contraction and Iron Age Reorganization
Assyria survives with temporary contraction; Aramaean, Chaldean, Philistine & Neo-Hittite polities emerge.

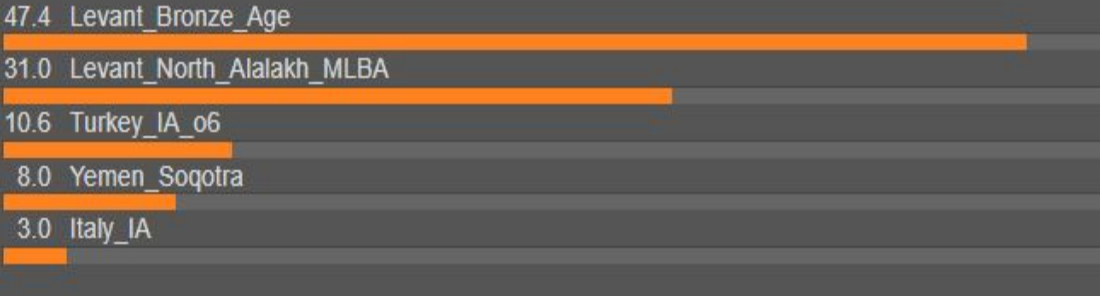


- * City destroyed c.1200-1150 BCE
- Notable city
- ▬ Notable pre-1200 BCE trade routes
- ➡ Land migrations / invasions
- ➡ Invasions of the Sea Peoples
- ➡ Dispersion / settlement of the Sea Peoples

Samaritans



Target: Samaritan
Distance: 0.5498% / 0.00549784 | R5P
Populations: 12 | Iterations: 2563 | Time: 4.31 s



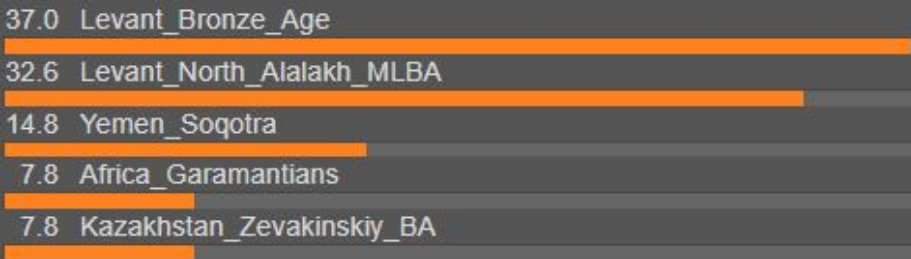
Palestinians



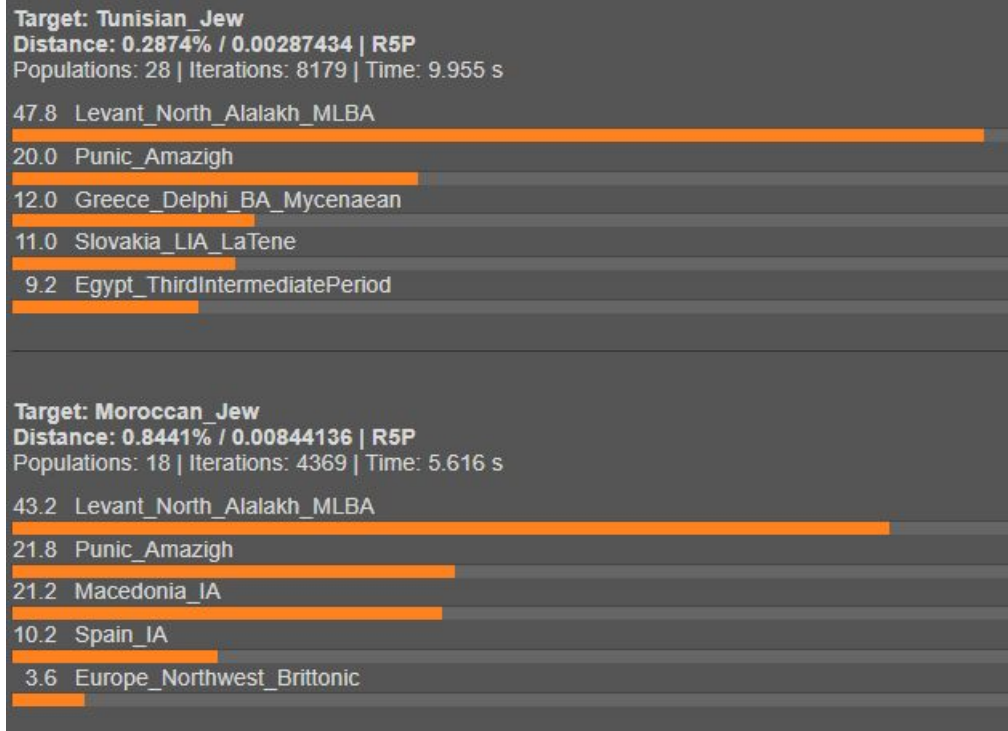
Target: Palestinian_Beit_Sahour
Distance: 0.9946% / 0.00994615 | R5P
Populations: 16 | Iterations: 3727 | Time: 5.176 s



Target: Palestinian
Distance: 0.1013% / 0.00101319 | R5P
Populations: 25 | Iterations: 6931 | Time: 12.789 s



North African Jews



Iranian and Kurdish Jews



Target: Iranian_Jew

Distance: 0.4521% / 0.00452089 | R5P

Populations: 11 | Iterations: 2297 | Time: 4 s

41.8 Iran_Iron_Age

34.0 Levant_Bronze_Age

12.0 Turkey_IA

7.0 Levant_Iron_Age

5.2 Greece_Delphi_BA_Mycenaean

Target: Kurdish_Jew

Distance: 0.2224% / 0.00222429 | R5P

Populations: 8 | Iterations: 1559 | Time: 3.374 s

35.2 Levant_Bronze_Age

18.6 Turkey_IA

17.4 Iran_Iron_Age

17.0 Levant_North_Alalakh_MLBA

11.8 Armenia_LIA_o2

Ashkenazi Jews



Target: Ashkenazi_Ukraine

Distance: 0.1702% / 0.00170182 | R5P

Populations: 45 | Iterations: 16951 | Time: 26.144 s

43.6 Hungary_Conqueror_Commoner

30.2 Levant_North_Alalakh_MLBA

12.4 Egyptian_Old_Middle_Kingdom_Period_Dahshur

9.0 Greece_BA_Mycenaean

4.8 Minoan_Bronze_Age

Target: Ashkenazi_Russia

Distance: 0.2263% / 0.00226303 | R5P

Populations: 38 | Iterations: 12989 | Time: 24.913 s

32.0 Hungary_EarlyAvar

28.2 Levant_North_Alalakh_MLBA

17.8 Slovakia_Poprad.SG

16.0 Levant_Bronze_Age

6.0 Punic_Amazigh

Ashkenazi Jews

