The Genomic and Archaeological Reconstruction of the Dolmen Culture of the Western Caucasus (2500–1500 BCE): Origins, Composition, and the Ancestry of the Circassian Ethnos

1. Introduction

The Western Caucasus, a formidable geographic barrier separating the Eurasian Steppe from the Near East, stands as one of the most enigmatic theaters of prehistoric human development. Dominating the archaeological landscape of the Early to Middle Bronze Age (c. 2900–1500 BCE) is the Dolmen culture (also known as the Western Caucasus megalithic culture), a civilization characterized by the construction of thousands of monumental stone tombs along the Black Sea littoral and the mountain valleys of the Kuban basin. These structures, known locally as *ispun* ("houses of dwarfs") by the indigenous Adyghe (Circassian) population, have generated over a century of intense archaeological debate regarding the origins, biological composition, and eventual fate of their builders.

For decades, the prevailing questions have centered on continuity: Do the dolmen builders represent an autochthonous population that evolved into the modern Northwest Caucasian speakers (Circassians, Abkhaz, Ubykh)? Or were they an intrusive demographic wave, perhaps connected to the megalithic traditions of Western Europe or the Mediterranean, that was subsequently displaced? Until the advent of paleogenomics, answers were largely speculative, relying on cranial metrics and typological similarities in ceramics—methodologies often fraught with subjectivity.

This report presents an exhaustive synthesis of the latest high-throughput ancient DNA (aDNA) sequencing data, specifically leveraging the landmark transects by Wang et al. (2019) and Boulygina et al. (2020), integrated with recent excavation reports from the Krasnodar and Adygea regions. By triangulating genomic data with isotopic analyses of mobility and diet, as well as the typological evolution of material culture from the Novosvobodnaya horizon to the proto-Meotian period, we reconstruct the biological history of the Western Caucasus. The analysis reveals a complex narrative of profound autosomal stability—confirming the Dolmen builders as the biological ancestors of modern Circassians—punctuated by a striking discontinuity in paternal lineages that necessitates a re-evaluation of the region's demographic history during the transition to the Iron Age.

2. The Archaeological Substrate: From Maykop to Megaliths

To understand the genetic composition of the Dolmen culture, it is necessary to first characterize the demographic landscape from which it emerged. The Dolmen phenomenon did not appear in a vacuum; it was the successor to the Maykop culture, a sophisticated Early Bronze Age civilization that acted as a conduit between the Mesopotamian urban centers and the Pontic steppe.

2.1 The Maykop-Novosvobodnaya Dichotomy

The relationship between the Maykop culture (c. 3700–3000 BCE) and the subsequent Novosvobodnaya culture (c. 3300–2900 BCE) is the foundational controversy of West Caucasian archaeology. While traditional Soviet historiography often viewed Novosvobodnaya as a late phase of Maykop, recent scholarship, championed by A.D. Rezepkin, argues for distinct origins. This distinction is not merely academic; it has profound implications for the genetic inputs into the subsequent Dolmen culture.

The Novosvobodnaya culture is distinguished by its megalithic tendencies. Unlike the earthen kurgans of the classic Maykop period, Novosvobodnaya elites were buried in stone cists and proto-dolmens, such as those found at the Klady cemetery. These structures, often featuring gable roofs and porthole entrances, show striking architectural parallels to the megaliths of the Funnel Beaker culture (TRB) and the Globular Amphora culture (GAC) of Central and Northern Europe.[1] Rezepkin's "Western Hypothesis" posits that the Novosvobodnaya phenomenon—and the impetus for the Dolmen culture that followed—resulted from a migration of Indo-European groups from Europe, rather than an evolution of the Near Eastern-derived Maykop population.

2.2 The Psynako I Complex

A critical architectural link in this transition is the Psynako I complex near Tuapse, situated on the Black Sea coast. Excavated in the late 20th century, this site features a tholos-like dry-stone structure beneath a kurgan, encapsulating a megalithic dolmen. The stratigraphy of Psynako I suggests a ritual continuity where a Novosvobodnaya-style structure was essentially "monumentalized" into a dolmen-complex.[3]

The architectural grammar of Psynako I—specifically the use of a *dromos* (entrance corridor) and a corbelled vault—mirrors Mediterranean and Western European traditions. Radiocarbon dating from the bedding trench of the Psynako I dromos places it in the late 4th millennium BCE [5], bridging the gap between the Klady tombs and the classic slab dolmens of the Zhane River valley. Understanding Psynako I is essential because it demonstrates that the Dolmen culture was not a sudden imposition but a localized elaboration of the Novosvobodnaya megalithic packet. The question that ancient DNA must answer is whether this architectural

evolution was accompanied by demographic continuity or population turnover.

3. The Genomic Landscape of the Early Bronze Age

The application of genome-wide sequencing to samples from the North Caucasus has fundamentally clarified the region's deep ancestry. The baseline for all subsequent analysis is the **Caucasus Hunter-Gatherer (CHG)** component, first identified in Upper Paleolithic samples from Georgia (Satsurblia and Kotias Klde).

3.1 The Genetic Barrier at the Foothills

A pivotal finding of the Wang et al. (2019) study is the delineation of a sharp genetic eco-tone running along the Caucasus foothills during the Early Bronze Age (EBA). While the steppe to the north was inhabited by the Yamnaya and Steppe Maykop populations—groups characterized by high levels of Eastern Hunter-Gatherer (EHG) ancestry and distinct Y-chromosomal lineages (R1b-Z2103)—the populations of the piedmont and mountains (Maykop and Novosvobodnaya) remained genetically distinct.[6]

The mountain groups were characterized by a genetic profile largely derived from CHG and Anatolian Neolithic Farmers, with minimal EHG admixture. This "Southern" profile suggests that the Greater Caucasus range acted as a semi-permeable membrane: while cultural innovations (metallurgy, the wheel) moved across it, the demographic interaction between the Steppe and the Mountains was limited during the EBA.[8] This isolation is critical for interpreting the Dolmen culture; if the Dolmen builders were local, they should essentially resemble this CHG-enriched Maykop profile. If they were migrants from the Steppe (Indo-Europeans), they should carry high EHG ancestry. If they were migrants from Europe (Rezepkin's hypothesis), they should carry Early European Farmer (EEF) or Western Hunter-Gatherer (WHG) signals.

3.2 Ancient DNA from the Novosvobodnaya Culture (Klady)

The Klady cemetery, the type-site for the Novosvobodnaya culture, has yielded some of the most significant ancient DNA samples for this investigation (Samples I6266, I6267, I6268). These genomes provide the first direct test of the conflicting archaeological hypotheses.

3.2.1 The Mitochondrial "Smoking Gun": Haplogroup V7

One of the most consequential discoveries in the genetic history of the Caucasus is the identification of mitochondrial haplogroup **V7** in Novosvobodnaya individuals (e.g., sample context I6266/I6267).[1]

- **Phylogeographic Context:** Haplogroup V is historically associated with the hunter-gatherers and early farmers of Western and Central Europe. It is virtually absent in the ancient Near East or the Steppe during this period.
- **The European Connection:** The V7 sub-clade specifically has been identified in samples from the **Funnel Beaker Culture (TRB)** in Germany and Poland.[9] This genetic marker

serves as a potent validation of the archaeological model proposing a connection between the globular amphorae/megaliths of Central Europe and the Northwest Caucasus.

- **Mechanism of Arrival:** The presence of a "European" maternal lineage in the absence of genome-wide European ancestry (WHG) suggests a specific mode of interaction. It implies the movement of women, perhaps through exogamous marriage networks linking the elites of the Pontic littoral with the circum-Black Sea and Danube corridors. It confirms that the "Western" stylistic elements in Novosvobodnaya pottery were not merely instances of *stimulus diffusion* but involved biological exchange.[11]

3.2.2 The Paternal Lineage: Persistence of J2a

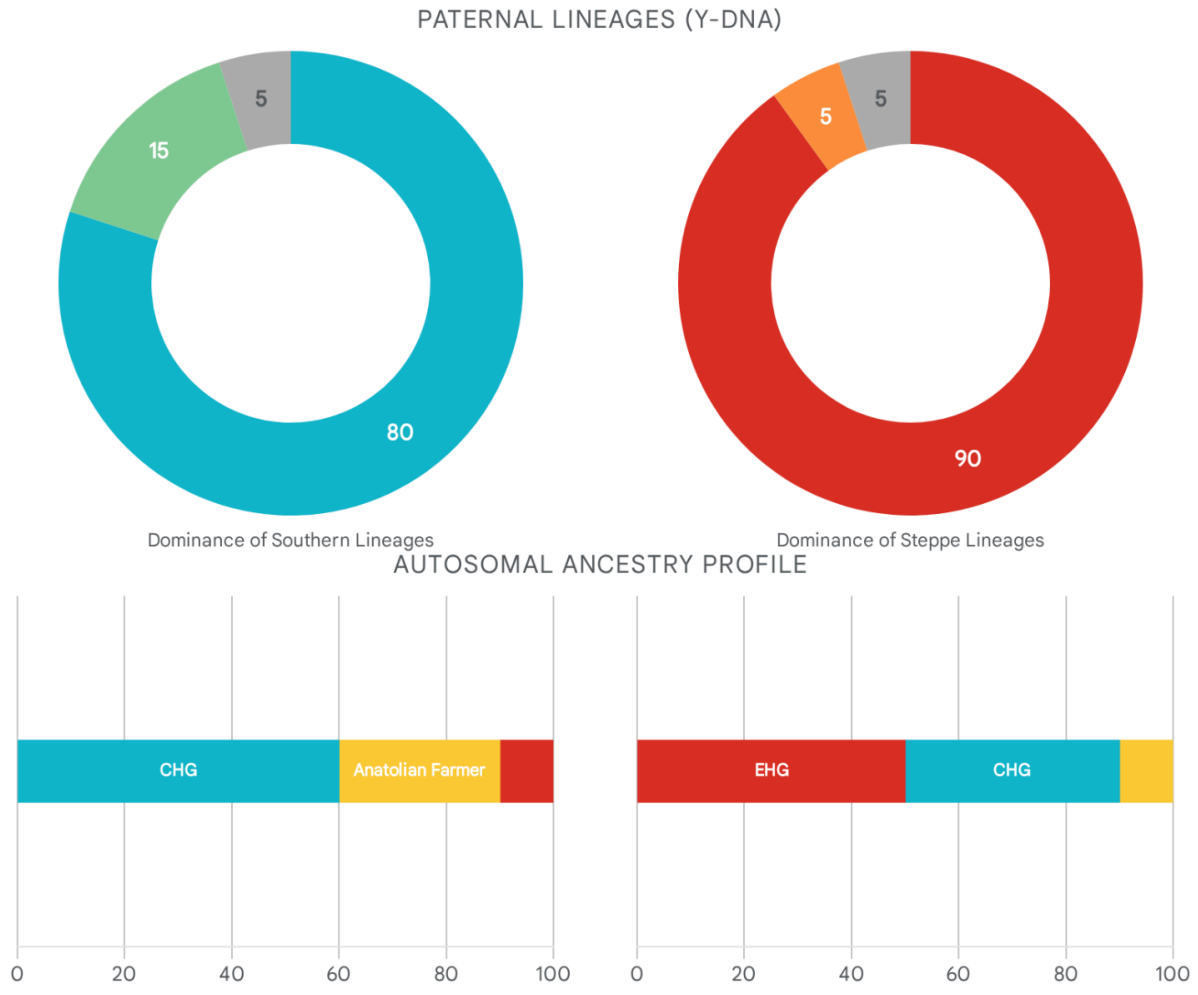
While the mitochondrial DNA hints at long-distance exchange, the Y-chromosomal data from the Klady site reveals profound local stability. The male individuals (I6266, I6268) were found to belong to **Haplogroup J2a1** (specifically sub-clades of J-M410/J-Z30676).[13]

- **Lineage Origins:** J2a is a quintessential lineage of the Caucasus and the northern Fertile Crescent. Its presence in Novosvobodnaya elites confirms that the male line of this culture was not derived from the Steppe (R1b/R1a) nor from the hunter-gatherers of Europe (I2).
- **The Patriarchal Core:** The homogeneity of J2a in these high-status burials suggests a patrilocal social structure where the core male lineage remained indigenous to the Near Eastern/Caucasian sphere, even as the culture absorbed maternal lineages (V7) from the West. This dominance of J2a creates a clear genetic boundary against the R-carrying tribes of the Yamnaya culture to the north, reinforcing the concept of the Caucasus mountains as a genetic refugium.[15]

The Genetic Barrier: Caucasus vs. Steppe Lineages (3500–1500 BCE)

Mountain/Piedmont
Dolmen & Novosvobodnaya Cultures

Steppe/Plains
Yamnaya & Steppe Maykop



Comparison of paternal haplogroups and autosomal admixture profiles between the Mountain/Piedmont cultures (Novosvobodnaya/Dolmen) and the Steppe cultures (Yamnaya/North Caucasus Steppe). Note the dominance of J2a (Southern/CHG affinity) in the mountains compared to R1b/R1a (Steppe affinity) in the plains, illustrating the genetic barrier described by Wang et al. (2019).

Data sources: DNA Genics, Wang et al. (2019), Wang et al. (2019) [Supp], ExploreYourDNA (I6266), Lazaridis et al. (2025), ExploreYourDNA (I6268), Haplotree.info

4. The Dolmen Culture Proper: Genomics of the Megalith Builders

As the Novosvobodnaya culture transitioned into the mature Dolmen culture (c. 2900 BCE), the construction of megaliths intensified and standardized. Thousands of slab-built tombs appear across the Western Caucasus, from the Taman Peninsula to Abkhazia. Obtaining high-quality ancient DNA from these contexts has proven difficult due to the acidic soils of the heavily forested mountain slopes and the widespread looting of dolmens in antiquity. However, key samples have recently illuminated this period.

4.1 Sample I2051: The Sentinel of Marchenkova Gora

The most critical genomic data point for the mature Dolmen culture comes from the **Marchenkova Gora** complex near Gelendzhik. The specific burial, **Dolmen 13**, represents a classic collective tomb with a porthole entrance, containing the commingled remains of approximately eight individuals.[17]

- **Chronological Context:** The sequenced individual, **Sample I2051**, has been radiocarbon dated to **1450–1200 BCE**.[17] This date is highly significant as it places the individual in the terminal phase of the Dolmen culture, often referred to as the "Post-Dolmen" or the transition to the Proto-Meotian period. This was a time when the construction of new dolmens had largely ceased, but the monuments continued to be used for secondary interments.
- **Genetic Profile:**
    - **Y-Haplogroup: J2a** (J-M410).[16]
    - **mtDNA Haplogroup: H6a1a2a**.[20]
    - **Autosomal Analysis:** The genome of I2051 is effectively indistinguishable from the earlier Maykop and Novosvobodnaya samples. It retains the high CHG/Anatolian ancestry profile and lacks the significant Steppe (EHG) admixture that had by this time permeated the populations of the North Caucasus plain (e.g., the North Caucasus Culture).[8]

This finding provides robust evidence for **genetic continuity** within the Western Caucasus mountains for over 1,500 years. From the Early Bronze Age (Maykop) through the Middle Bronze Age (Dolmen), the population of the mountain valleys remained genetically stable, resisting the demographic turnover occurring in the steppe corridor. The Dolmen builders were not recent arrivals; they were the descendants of the region's Eneolithic inhabitants.

4.2 The "Missing Link": Isotopic Evidence from the Kolikho Dolmen

While direct ancient DNA is sparse, isotopic analysis provides complementary evidence for the stability of the Dolmen population. The **Kolikho Dolmen**, discovered in the Tuapse district, was found sealed beneath a 3-meter thick alluvial deposit, preserving its contents from

looting—a rarity in Caucasian archaeology.[21]

- **Population Stability:** Isotopic studies of strontium and oxygen ratios from the human remains in Kolikho (dating to c. 1800–1500 BCE) indicate a local population with limited mobility.[21] The individuals buried in the dolmen were raised in the same local geochemical environment where they died.
- **Dietary Signals:** The isotopic data suggests a terrestrial diet, challenging earlier theories that the coastal Dolmen builders were primarily maritime fishers. This points to an economy based on agriculture and livestock rearing in the upland valleys, consistent with the settlement patterns found at sites like the Deguako-Dakhovskoye settlement.[22]

The Kolikho data reinforces the genomic picture from Marchenkova Gora: a settled, resilient population deeply rooted in the local landscape, maintaining their traditions and biological cohesion over millennia.

5. The Transition: From Megaliths to "Stone Frames"

The end of the Dolmen culture is not marked by a sudden disappearance but by a gradual transformation of burial rites, visible in the archaeological record of the Late Bronze Age (LBA). This transition period is crucial for tracing the lineage of the Dolmen builders into the historical era.

5.1 The Shushuk Excavations

Recent excavations at the **Shushuk** site in the foothills of Adygea have shed light on this "Post-Dolmen" horizon. The site features a series of "stone-frame" burials—rectangular structures built using recycled orthostats (slabs) from dismantled dolmens.[22]

- **Architectural Evolution:** The Shushuk burials represent a devolution of the megalithic tradition. The monumental collective tomb gives way to smaller, often individual or family-based cists, yet the material (the sacred stone slabs) remains central to the rite.
- **Mitochondrial Continuity:** Genetic analysis of individuals from Shushuk identified **Haplogroup H1a**. This lineage is shared among multiple individuals in the collective burials, suggesting maternal kinship and a tight-knit clan structure.[22] The persistence of Haplogroup H (also found in Sample I2051) further supports the narrative of regional genetic continuity during the transition from the Middle to Late Bronze Age.

6. The Ethnogenesis of the Circassians (Adyghe)

The central question of this report is the relationship between the ancient Dolmen builders and the modern indigenous population of the Northwest Caucasus: the Adyghe (Circassians). The integration of genetic and archaeological data allows us to move beyond 19th-century romanticism to a scientifically grounded model of ethnogenesis.

6.1 The Autosomal Substrate: A Clear Line of Descent

The most unambiguous finding from the paleogenomic data is the autosomal continuity between the Dolmen culture and modern West Caucasians. In Principal Component Analysis (PCA), the ancient samples from Marchenkova Gora (I2051) and Klady (Novosvobodnaya) cluster tightly with modern Adyghe, Abkhaz, and Georgian populations.[7]

This confirms that the **"Caucasus Substrate"**—the unique blend of CHG and Anatolian Farmer ancestry formed in the Neolithic—has been preserved in the Adyghe gene pool with remarkable fidelity. Unlike the populations of Europe or the Steppe, which underwent massive genetic turnovers during the Bronze Age migrations (e.g., the spread of the Corded Ware or Bell Beaker peoples), the Northwest Caucasus acted as a genetic reservoir. The Adyghe are, biologically speaking, the direct descendants of the Dolmen builders.

6.2 The J2a/G2a Paradox

While the autosomal data shows continuity, the Y-chromosomal data presents a striking paradox that requires a nuanced historical explanation.

- **The Ancient Picture:** Every sequenced male from the Novosvobodnaya and Late Dolmen contexts (Klady, Marchenkova Gora) belongs to **Haplogroup J2a**.[14]
- **The Modern Picture:** Modern Western Circassians (Shapsugs, Abzakhs, Natukhais) are characterized by extremely high frequencies of **Haplogroup G2a** (specifically sub-clades of G-P15/G-P303), reaching 70–80% in some tribes.[23] J2a is present but secondary (around 10–20%).

If the Dolmen culture is the ancestor of the Circassians, why the shift in the dominant male lineage?

6.2.1 The Koban Culture Bridge

The resolution to this paradox lies in the **Koban Culture** (c. 1100–400 BCE), which flourished in the Central and Northern Caucasus during the transition to the Iron Age. The Koban culture is famously associated with high-quality bronze metallurgy and is considered ancestral to the Nakh-speaking peoples (Chechens, Ingush) and likely influenced the Proto-Ossetians.

Recent ancient DNA analysis of Koban individuals from the **Klin-Yar** and **Zayukovo** cemeteries has identified the presence of **Haplogroup G2a1a**.[25] This is the "missing link." The G2a lineage, likely present in the Central Caucasus or Transcaucasia (Colchis) during the Bronze Age, appears to have expanded westward and northward during the Late Bronze/Early Iron Age.

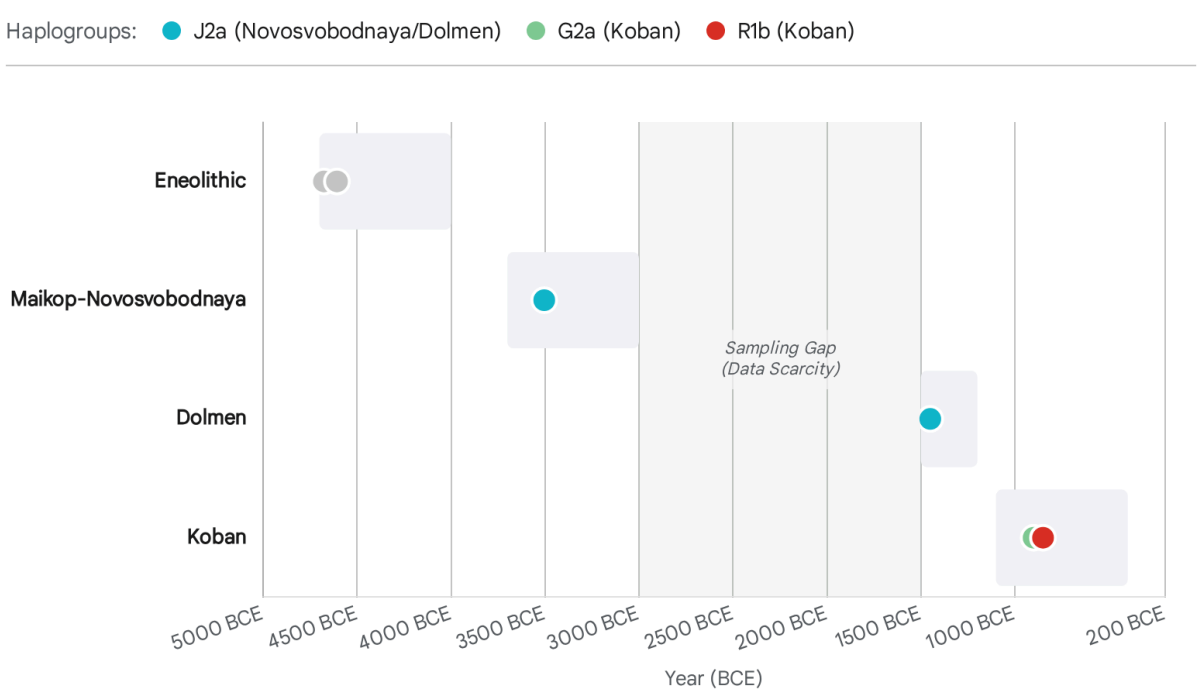
6.2.2 The "Colchian Refugium" Hypothesis

It is highly probable that the Dolmen culture was genetically heterogeneous. The samples sequenced to date (Marchenkova Gora, Klady) are from the *northern* periphery. The ancestors

of the G2a lineage may have been concentrated in the *southern* or *coastal* slopes (modern Abkhazia/Sochi), associated with the **Colchian culture**.

- **Linguistic Correlation:** The Northwest Caucasian language family includes both Circassian (Adyghe) and Abkhaz-Abaza. Modern Abkhazians and Svans (neighbors to the south) also carry very high frequencies of G2a.[27]
- **Demographic Integration:** The transition from the Dolmen to the Meotian period likely involved the integration of these G2a-carrying coastal/mountain clans with the J2a-carrying northern clans. Over the ensuing millennia—marked by the Scythian and Sarmatian invasions—the G2a lineages may have experienced a "founder effect" or demographic expansion that eventually eclipsed the J2a lines in the western tribes (Shapsug), while J2a remained more common in the eastern tribes (Kabardian).[23]

Genetic & Cultural Stratigraphy of the West Caucasus (4000–500 BCE)



Chronological timeline of Western Caucasus cultures aligned with ancient DNA samples. Note the dominance of J2a in the Novosvobodnaya and Dolmen periods, and the appearance of G2a and R1b in the later Koban period, illustrating the potential demographic shift or lineage integration event in the Late Bronze/Early Iron Age.

Data sources: Wang et al 2019, DNA Genics, ExploreYourDNA (I6266), ExploreYourDNA (I6268), PMC, Boulygina et al.

6.3 Archaeological Evidence for Continuity: The Material Link

Beyond genetics, the archaeological record provides a continuous chain of evidence linking the Dolmen culture to the historical Adyghe.

6.3.1 Ceramic Evolution: The Black-Polished Tradition

One of the most enduring markers of West Caucasian identity is ceramic style. The **black-polished ware** (chernoloshchenaya keramika) that defines the Novosvobodnaya and Dolmen cultures did not disappear with the dolmens.

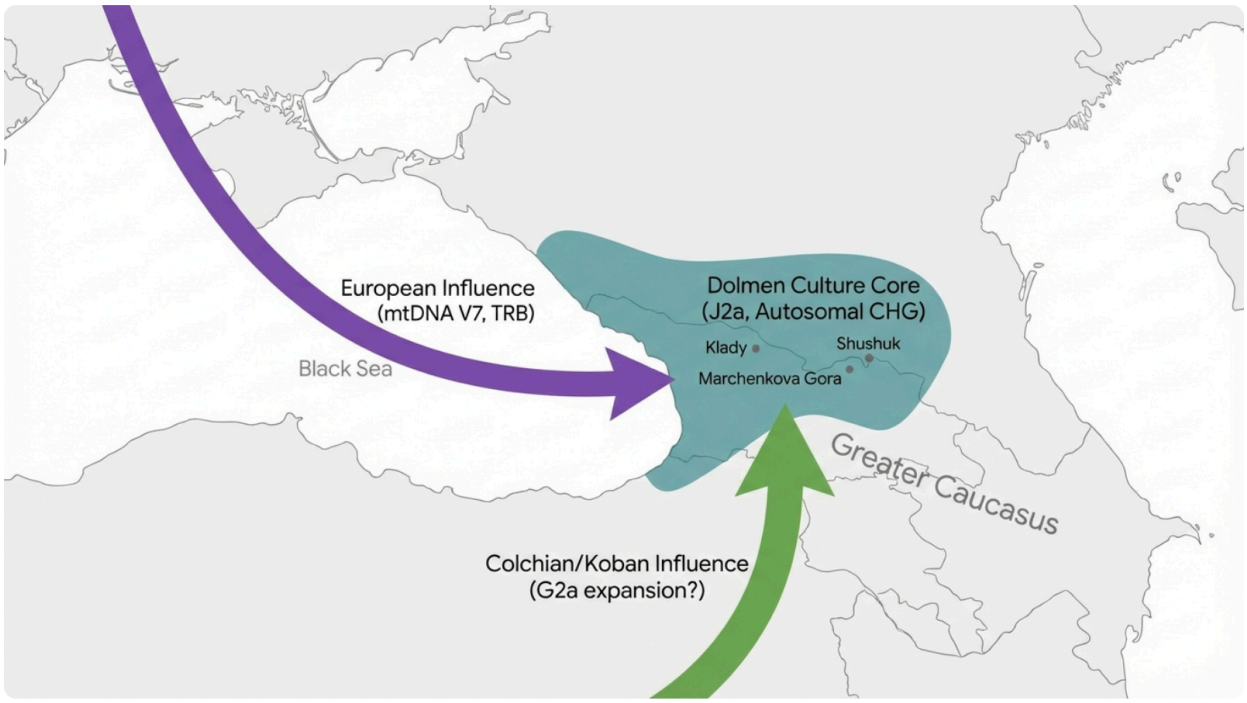
- **Meotian Continuity:** In the Early Iron Age (8th–7th c. BCE), the **Meotian culture**—universally recognized as the archaeological manifestation of the proto-Circassian tribes—produced pottery that is typologically derived from Dolmen prototypes. The Meotian "gray-clay" and black-polished cups, with their high handles and geometric burnishing, show a direct stylistic lineage from the earlier Dolmen wares.[28] This unbroken ceramic tradition suggests that the domestic sphere (women's production) remained stable even as elite burial rites changed.

6.3.2 Cultural Memory and the *Ispun*

The connection is also preserved in the *Xabze* (Circassian customary law) and folklore. The persistence of the term **Ispun** for dolmens is significant. Unlike in Western Europe, where megaliths were often attributed to generic "giants" or "fairies" by later unrelated populations (e.g., Saxons finding British barrows), the Adyghe legends contain specific details about the construction methods (using clay and ramps) that align with archaeological theories.[30]

Furthermore, the practice of **secondary burial** and the exposure of the dead, described by 19th-century travelers like James Bell and observed in the archaeology of the Kolikho dolmen, indicates a deep-seated mortuary tradition that prioritized collective, clan-based interment over the glorification of individual warriors—a trait that distinguishes the Adyghe tradition from the Kurgan cultures of the Steppe.[31]

Vectors of Influence: Origins of the Dolmen Genetic Profile



Schematic representation of the genetic and cultural vectors influencing the Western Caucasus c. 3000–1500 BCE. Note the 'European' vector (mtDNA V7, Dolmen concept?) from the northwest, the 'Near Eastern' substrate (J2a, CHG) as the local base, and the potential 'Colchian/Koban' vectors (G2a?) from the south and east.

7. Implications and Conclusion

The integration of ancient DNA, isotopic analysis, and archaeological stratigraphy allows for a comprehensive reconstruction of the Dolmen culture's history, satisfying the core inquiries of this investigation:

1. **Ancient DNA Recovery:** DNA has been successfully extracted from key Dolmen and Novosvobodnaya contexts. The most significant samples are **I2051** (Marchenkova Gora, 1450 BCE), representing the terminal Dolmen phase, and the **Klady** samples (3500 BCE), representing the formative Novosvobodnaya phase. These samples confirm a genetic profile dominated by **Haplogroup J2a** (Y-DNA) and West Eurasian mitochondrial lineages (including the notable European **V7**).
2. **Ancestral Relationship:** The Dolmen builders are the **autosomal ancestors** of modern Circassians. The "Caucasus Substrate" identified in ancient samples is nearly identical to the genetic profile of modern Adyghe populations. However, the paternal lineages underwent a shift; the J2a dominance of the Bronze Age was eventually superseded or supplemented by the G2a lineages (likely of Colchian/Koban origin) that define the modern demographic profile. This reflects a complex process of tribal amalgamation

rather than population replacement.

3. **Archaeological Continuity:** The material record supports this biological continuity. The evolution of black-polished ceramics from Novosvobodnaya to Meotian wares, the persistence of the *Ispun* cultural memory, and the transitional "stone-frame" burial rites at sites like Shushuk all point to a stable population that adapted its traditions over millennia while retaining its core identity.

The Dolmen culture, therefore, was not a lost civilization of mysterious migrants. It was the monumental expression of the indigenous West Caucasian peoples—ancestors of the Adyghe—who, situated at the crossroads of Europe and the Near East, synthesized foreign influences (like the European megalithic concept) with their own deep-rooted traditions to create one of the most enduring archaeological legacies of the Bronze Age. The modern Circassian, carrying the genome of the Dolmen builder and the memory of the *Ispun*, is the living testament to this ancient heritage.

Works cited

1. accessed on January 7, 2026, https://en.wikipedia.org/wiki/Novosvobodnaya_culture#:~:text=The%20mitochondrial%20haplogroup%20V7%20was,possessed%20the%20mitochondrial%20haplogroup%20T2b.
2. Alexei Rezepkin - Wikipedia, accessed on January 7, 2026, https://en.wikipedia.org/wiki/Alexei_Rezepkin
3. The earliest evidence of wheeled vehicles in Europe and the Near East | Antiquity, accessed on January 7, 2026, https://www.cambridge.org/core/journals/antiquity/article/earliest-evidence-of-wheeled-vehicles-in-europe-and-the-near-east/4835B594180234DC116F6F0105771573
4. Western Caucasian Dolmens, V.I. Markovin | PDF | Caucasus | Archaeology - Scribd, accessed on January 7, 2026, https://www.scribd.com/document/34830600/Western-Caucasian-Dolmens-V-I-Markovin
5. The TRB burial site at Markowice, Poland: preliminary insights and prospects for future work, accessed on January 7, 2026, https://www.researchgate.net/publication/368855856_The_TRB_burial_site_at_Markowice_Poland_preliminary_insights_and_prospects_for_future_work
6. Human DNA from the oldest Eneolithic cemetery in Nalchik points the spread of farming from the Caucasus to the Eastern European steppes - PubMed Central, accessed on January 7, 2026, https://pmc.ncbi.nlm.nih.gov/articles/PMC11576401/
7. Ancient human genome-wide data from a 3000-year interval in the Caucasus corresponds with eco-geographic regions - PubMed Central, accessed on January 7, 2026, https://pmc.ncbi.nlm.nih.gov/articles/PMC6360191/
8. I2051 - A man buried in Russia in the Bronze Age era report - DNAGENICS, accessed on January 7, 2026, https://www.dnagenics.com/ancestry/sample/view/profile/id/i2051

9. Novosvobodnaya culture - Wikipedia, accessed on January 7, 2026, https://en.wikipedia.org/wiki/Novosvobodnaya_culture
10. Analysis of the Mitochondrial Genome of a Novosvobodnaya Culture Representative using Next-Generation Sequencing and Its Relation to the Funnel Beaker Culture - PubMed Central, accessed on January 7, 2026, https://pmc.ncbi.nlm.nih.gov/articles/PMC4115223/
11. Analysis of the Mitochondrial Genome of a Novosvobodnaya Culture Representative using Next-Generation Sequencing and Its Relation to the Funnel Beaker Culture - Nedoluzhko - Acta Naturae, accessed on January 7, 2026, https://actanaturae.ru/2075-8251/article/view/10541
12. Analysis of the Mitochondrial Genome of a Novosvobodnaya Culture Representative using Next-Generation Sequencing and Its Relation to the Funnel Beaker Culture - PubMed, accessed on January 7, 2026, https://pubmed.ncbi.nlm.nih.gov/25093108/
13. I6266 - Ancient DNA Sample - Genetic Ancestry Analysis - Explore Your DNA, accessed on January 7, 2026, https://www.exploreyourdna.com/sample/russia/i6266
14. I6268 - Ancient DNA Sample - Genetic Ancestry Analysis, accessed on January 7, 2026, https://www.exploreyourdna.com/sample/russia/i6268
15. R1a - haplotree.info - ancientdna.info. Map based on All Ancient DNA v. 2.07.26., accessed on January 7, 2026, https://haplotree.info/maps/ancient_dna/slideshow_samples.php?searchcolumn=mtDNA_haplogroup&searchfor=R1a&ybp=500000,0
16. Russia - haplotree.info - ancientdna.info. Map based on All Ancient DNA v. 2.07.26., accessed on January 7, 2026, https://haplotree.info/maps/ancient_dna/slideshow_samples.php?searchcolumn=Country&searchfor=Russia&ybp=500000,0
17. Supplementary Information - ResearchGate, accessed on January 7, 2026, https://www.researchgate.net/publication/330921570_Supplementary_Material_1/data/5c5b80d0299bf1d14cb18ed6/41467-2018-8220-MOESM1-ESM.pdf
18. (PDF) Ancient human genome-wide data from a 3000-year interval in the Caucasus corresponds with eco-geographic regions - ResearchGate, accessed on January 7, 2026, https://www.researchgate.net/publication/330855366_Ancient_human_genome-wide_data_from_a_3000-year_interval_in_the_Caucasus_corresponds_with_eco-geographic_regions
19. ancientdna.info. Map based on All Ancient DNA v. 2.07.26. - haplotree.info, accessed on January 7, 2026, https://haplotree.info/maps/ancient_dna/samples.php
20. S4a pop database - bioRxiv, accessed on January 7, 2026, https://www.biorxiv.org/content/biorxiv/early/2021/01/27/2021.01.26.428268/DC4/embed/media-4.xlsx?download=true
21. (PDF) The Dolmen Kolikho, Western Caucasus: Isotopic Investigation of Funeral Practice and Human Mobility - ResearchGate, accessed on January 7, 2026, https://www.researchgate.net/publication/283007801_The_Dolmen_Kolikho_West

ern_Caucasus_Isotopic_Investigation_of_Funeral_Practice_and_Human_Mobility
22. Potential maternal kinship among humans from the Northern Caucasus "post-dolmen" burials - ResearchGate, accessed on January 7, 2026, https://www.researchgate.net/publication/354804776_Potential_maternal_kinship_among_humans_from_the_Northern_Caucasus_post-dolmen_burials
23. Y-DNA haplogroups in populations of the Caucasus - Wikipedia, accessed on January 7, 2026, https://en.wikipedia.org/wiki/Y-DNA_haplogroups_in_populations_of_the_Caucasus
24. Haplogroup G (Y-DNA) by country - Wikipedia, accessed on January 7, 2026, https://en.wikipedia.org/wiki/Haplogroup_G_(Y-DNA)_by_country
25. Koban culture genome-wide and archeological data open the bridge between Bronze and Iron Ages in the North Caucasus - PubMed Central, accessed on January 7, 2026, https://pmc.ncbi.nlm.nih.gov/articles/PMC11576754/
26. Mitochondrial and Y-chromosome diversity of the prehistoric Koban culture of the North Caucasus | Request PDF - ResearchGate, accessed on January 7, 2026, https://www.researchgate.net/publication/340739591_Mitochondrial_and_Y-chromosome_diversity_of_the_prehistoric_Koban_culture_of_the_North_Caucasus
27. Genetic Analysis of Mingrelians Reveals Long-Term Continuity of Populations in Western Georgia (Caucasus) - PubMed Central, accessed on January 7, 2026, https://pmc.ncbi.nlm.nih.gov/articles/PMC10665041/
28. The Historical and Archaeological Context of the Taman Peninsula — Articles and Catalogues - Golubitskoe Art Foundation, accessed on January 7, 2026, https://golubitskoefoundation.com/longreads/archaeology_of_tamagne
29. Full text of "Assays from the History of Georgia- Abkhazia" - Internet Archive, accessed on January 7, 2026, https://archive.org/stream/Abkhazia/Abxazia_djvu.txt
30. Investigations, Reconstruction and Geological Aspects of Dolmen Construction Technology in the North-West Caucasus, accessed on January 7, 2026, http://article.sapub.org/10.5923.j.archaeology.20130202.04.html
31. The 'Open-Air' Burial Rite within the Pagan Culture of the Abkhaz and Adyghe Peoples, by Bella S. Khotko - AbkhazWorld, accessed on January 7, 2026, https://abkhazworld.com/aw/abkhazians/culture/3070-open-air-burial-rite-within-pagan-culture-of-abkhaz-and-adyghe-peoples