Introduction

Hello, and welcome to the December 2013 issue of DNA Tribes® Digest. This month’s article explores inter-regional links in Central Europe, including genetic components related to Northeast Europe, the Aegean and Balkan Peninsula, and the British Isles.

In particular, the historical background includes a discussion of how newly available ancient DNA and segment sharing analysis provide chronological information about the timing of early population expansions.

This chronological data will then be compared to an admixture analysis that makes use of the uniquely thorough geographical coverage of autosomal STR data available for Europe. Results express how these multiple waves of expansion and long term inter-population contacts have shaped the genetic landscape of Central Europe.

Best regards,
Lucas Martin
DNA Tribes
Mountains, Seas, and Steppe: Early Geographical Crossings in Central Europe

Historical Background

Since early periods, Central Europe has been a historical nexus in which population movements and technological changes from surrounding areas have come in contact, often generating new forms of culture that synthesized multiple elements and helped connect neighboring peoples.

In prehistory, this is where peoples of the Atlantic coasts, North and Baltic seas, Mediterranean, and Adriatic have met inland cultures of the Balkan Peninsula and forest and steppe lands of Eastern Europe. In relation to Eurasia as a whole, Central Europe was sometimes a migration outlet where large population movements from near civilization centers of West Asia (via the Balkan Peninsula) were integrated in the more localized cultural streams of Europe.

The historical background section of this article will first discuss archaeological evidence for some of these periods of mixture and synthesis since the Neolithic period. This will then be compared to ancient DNA studies that provide a new source of chronological information, followed by an autosomal STR analysis that explores how these processes have shaped Central Europe.

Archaeological Evidence

Last month’s Digest included a detailed discussion of Marija Gimbutas’ “Old European and Kurgan” model of Late Neolithic prehistory, in which she proposed that early European cultures were descended from two cultural streams: Neolithic Farmers (related to present day Mediterranean populations) and Pastoralist “Kurgan” cultures that invaded Europe from north of the Black Sea (related both to present day Eastern Europeans and Caucasus Mountains populations).

Gimbutas emphasized that both cultural streams played a necessary formative role in shaping later civilizations, often living side by side in early mixed communities (such as the Baden culture near the Danube River). Later, populations from these successfully combined farmer-pastoralist societies became ancestors of present day European cultures.

However, subsequent historians have sometimes emphasized only the “Kurgan” half of Gimbutas’ two-part model of prehistory, neglecting discussion of the equally important (although less dominant) “Old European” Farming traditions. Nevertheless, these settled farming communities established foundations for later complex societies, in the form of hidden “substrate” populations throughout Europe.

This process of integration was turbulent and at times chaotic. In some cases, Old European societies relocated to avoid the advance of the energetic but less advanced Kurgan cultures that pushed westward through the Balkan Peninsula. For instance, Kurgan expansions forced Karanovo refugees (formerly living in Bulgaria) to seek the safety of caves in the Transylvanian Alps and islands of the Danube River (causing a chain reaction of resettlements in the Balkan Peninsula).

Similarly, another Kurgan expansion into the Balkan Peninsula triggered the “Lengyel Exodus.” In this exodus, longhouse-building Lengyel communities fled Hungary and Austria for safer homes to the west and north, along the Upper Danube, Elbe, and Oder Rivers and protective caves of


See Marija Gimbutas, The Kurgan Culture and the Indo-Europeanization of Europe, p. 211.
the Alpine region. Notably, the Lengyel culture was itself a “Kurganized” Old European culture that preserved substrate roots in the Old European Baalberge and Salzmünde cultures. This Lengyel culture became one of several elements later integrated in the broader **Globular Amphora Culture** (c. 3,400 – 2,800 BCE) that also assimilated substrate elements of megalithic related Funnelbeaker Culture (TRB) farmers with new Maykop related (Sredny Stog) Kurgan elements from the east.3

After this Neolithic process of relocation and mixture, Central Europe emerged as an important focal point of complex societies in West Eurasia. For instance, the Bronze Age **Urnfield culture** (c. 1,300– 750 BCE) was a connecting factor across a large area of Europe, integrating multiple trade and cultural networks from surrounding areas (see map in **Figure 1**).

![Figure 1: Map of Regional links in Late Bronze Age and Iron Age Central Europe.](image)

In the 1300’s and 1200’s BCE, Urnfield societies were a center of military power that eventually took part in the swarming “**Sea Peoples**” migrations that overwhelmed the East Mediterranean palace societies.4 After resettling in some of the only Western urban centers of the early Iron Age, descendants of these “Sea Peoples” populations participated in the formation of later Greek, Phoenician, Hebrew, and Neo-Hittite cultures of West Asia and the Aegean.5

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3 See Gimbutas, *The Kurgan Culture and the Indo-Europeanization of Europe*, pp.224, 227-8. It is worth noting that the Globular Amphora territory somewhat resembled the later Gothic migrations and early modern border zone between the Polish-Lithuanian Commonwealth and Russian Empire.

4 See *ibid.*, pp. 26-30. For instance, Northern Italian (Urnfield culture related) “Naue II” Bronze Age swords appear in Anatolia and the Levant around the time of the “Sea Peoples” invasions.

5 Following the Bronze Age Collapse, the Aegean world entered a “Dark Age” that was only ended amid the re-entry of West Asian urban culture during the later Orientalizing Period. This can be compared to the gap in South Asian urbanism between the Late Harappan period and Iron Age (more than 1,000 years later). See
Between approximately 800-450 BCE, another major cultural formation emerged in Central Europe: **Hallstatt C**, named for an ancient salt mining settlement. Although located far from the West Asian empires of the Iron Age, the Hallstatt culture was shaped by an influx of Urartian and Assyrian technologies, brought west via the Caucasus Mountains (Koban culture) and Danube River (Basarabi culture) known as the **Thraco-Cimmerian migrations**.6

Notably, this northern Thraco-Cimmerian migration paralleled the contemporary Orientalizing Period that transmitted West Asian urban culture to Greek and Etruscan cultures of Southern Europe (possibly in response to the increasingly aggressive expansions of the Neo-Assyrian Empire). Although this influx enriched cultures in Central Europe, these migrations cut off trade routes and effectively isolated Scandinavia, which reverted to a local “Dark Age” characterized by a rural, egalitarian way of life that maintained older traditions of the Urnfield period.7

A later, brief wave of culture that shaped Central Europe during the time of the Roman Republic was the **La Tène culture** (450 BCE – 1st century BCE), associated with historical Celtic speaking peoples described by Greek and Roman writers. La Tène emerged from the previous Hallstatt C culture and encompassed a swath of territories between present day France in the west through Central Europe to Poland and Romania in the east. However, the La Tène culture was specifically derived from the “consciously archaic” Western Hallstatt culture, which had avoided luxury imports and trade with the cities of Classical Greece and Italy.

Finally, another series of migrations and cultural changes that reshaped Central Europe took place in the **Migration Period**, in which polyethnic barbarian confederations8 of Eastern Europe moved west in advance of Hunnic invasions from Central Asia and Siberia. It was in this period that the Slavic cultures later emerged (probably from local farming settlements to the north of the Carpathian Mountains), repopulating Central and Eastern Europe after the retreat of Attila’s short-lived Hunnic Empire.

In summary, archaeological evidence supports multiple population movements in Central Europe. These included:

- Mixed **Old European** (Farmer) and **Kurgan** (Pastoralist) populations expanding from Southeastern Europe since the Neolithic period.
- The Bronze Age **Urnfield culture** related to the Sea Peoples that later appeared in the East Mediterranean.
- The Iron Age **Hallstatt C culture** influenced by Thraco-Cimmerian expansions from the Danube, Black Sea, and Caucasus Mountains.
- The **La Tène culture** associated with classical period Celtic cultures.

[http://dnatribes.com/dnatribes-digest-2013-10-01.pdf](http://dnatribes.com/dnatribes-digest-2013-10-01.pdf). Perhaps recalling this Dark Age hiatus of literacy and urban civilization, Classical Greek literature often featured themes of wandering and “nostos” or homecoming. One famous nostos was the return of the Heracleidae, whose progenitor was associated with wanderings in the Iberian Peninsula and Central Europe; however, the associations of Heracles with the Phoenician Melqart suggest early links with the East Mediterranean.

6 See Europe Before History by Kristiansen and Larsson, pp. 185-209.

7 *Ibid.*, pp. 306; 343-4. It is worth noting that some cultural forms of the Bronze Age East Mediterranean also appear in Scandinavian contexts: for instance, the horned helmets associated with medieval Vikings resembled the much earlier Egyptian and Sardinian depictions of migratory “Sea Peoples.”

8 For instance, the Ostrogothic confederations of Ermanaric and Theodoric included Finns, Slavs, Heruli, Alans, Huns, and Sarmatians. These tribal confederations (unlike territorial nation-states) joined multiple populations during this period of change that reshaped European civilization.
• The Migration Period, in which Slavic speaking societies repopulated Central and Eastern Europe after the retreat of the Hunnic steppe confederation.

New Evidence from Ancient DNA

Until recently, it has been largely unknown how these cultural progressions related to actual population movements and expansions that shaped and reshaped the population landscape of ancient Europe. Archaeologists often (correctly) point out that pots do not always equate to peoples: that is, changes in artwork and technology do not necessarily correspond to changes in population structure. For instance, new ideas can spread through trade or diffusion.

However, new DNA evidence has demonstrated that major migrations and population movements have taken place throughout prehistory: not merely a single human expansion from an ancestral homeland, but several complex migrations and back-migrations (both large and small), probably with numerous sidetracks and roundabouts along the way.

In particular, recent studies of ancient burials have provided new evidence of complex intercultural relationships dating to the Neolithic Period and Bronze Age, when (in agreement with Gimbutas’ “Old European and Kurgan” model) multiple populations lived side by side. Remarkably, autosomal DNA and mtDNA evidence from Neolithic Farming cultures has shown that some of the earliest residents of Central and Northern Europe were genetically related to present day Mediterranean populations. However, other Late Neolithic and Bronze Age cultures of Central Europe had mtDNA profiles more similar to present day populations of Eastern Europe and the Caucasus Mountains.

Other recent studies have assessed modern European populations for patterns of segment sharing that provide time signatures for ancient mixture between populations between 2,300 BCE and the medieval period. Notably, this segment sharing analysis has provided evidence for substantial periods of contact among European populations (due to expansions, trade, or migrations).

Although patterns vary locally, results indicate a long period of contact between many European populations throughout the 1st millennium BCE (around the time of the Late Urnfield and Hallstatt C cultures) and a second brief period of increased sharing in the late 1st millennium BCE (around the time of the Roman Republic and La Tène culture). Finally, results consistently show a substantial local sharing within Eastern Europe during the Migration Period, in which the polyethnic barbarian confederations (such as the Ostrogoths) relocated and Slavic cultures repopulated Central and Eastern Europe in the wake of the Hunnic invasions.

In summary, a comparison of archaeological and ancient DNA evidence for population movements that shaped the ancient genetic landscape of Central Europe is included in Table 1.

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9 It should be emphasized that although the population structure in Europe and other parts of the world is primarily geographical, the present day territories associated with each region might or might not fully correspond to the ancient ranges of related ancestral populations in earlier periods. For instance, ancient DNA evidence demonstrates that ancestral “Mediterraneans” of the TRB culture lived in the Baltic Sea island of Gotland. See http://www.sciencemag.org/content/336/6080/466.abstract. For this reason, a better label for this far-traveling ancestral population might be Gimbutas’ term “Old Europeans.”


<table>
<thead>
<tr>
<th>Time Period</th>
<th>Archaeological Patterns in Central Europe</th>
<th>Genetic Evidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Copper Age -</td>
<td>Conflict and mixture between &quot;Old European&quot; Farmers and &quot;Kurgan&quot; Pastoralist cultures. Coexistence of</td>
<td><strong>MtDNA</strong>&lt;sup&gt;12&lt;/sup&gt;: Dichotomy of Farmer (Rössen, etc.) and &quot;Kurganized&quot; (Únětice, Corded, etc.) mtDNA. Farmers similar to modern Mediterranean. Some Kurgan similar to modern Eastern Europe and Caucasus. However, other culturally &quot;Kurganized&quot; populations retained Mediterranean like mtDNA (Baalberge; Salzmünde).</td>
</tr>
<tr>
<td>Bronze Age</td>
<td>dual populations in places (such as Baden culture). Exodus of several waves of mixed &quot;Kurganized&quot; cultures</td>
<td></td>
</tr>
<tr>
<td></td>
<td>into Central Europe (such as the &quot;Lengyel Exodus&quot;).</td>
<td></td>
</tr>
<tr>
<td>Copper Age -</td>
<td>Bell Beaker culture.</td>
<td><strong>MtDNA</strong>: Possibly Iberian origin (haplogroup H), but maternal profile among present day populations was similar to Northern and Western Europeans.&lt;sup&gt;14&lt;/sup&gt;</td>
</tr>
<tr>
<td>Bronze Age</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Later Bronze Age</td>
<td>Urnfield Culture. Integration of multiple European zones with nexus in Central Europe.</td>
<td><strong>MtDNA</strong>: Similar to present day Western Europeans.&lt;sup&gt;15&lt;/sup&gt;</td>
</tr>
<tr>
<td>Iron Age (Earlier)</td>
<td>Hallstatt Culture.</td>
<td><strong>IBD (segment sharing)</strong>&lt;sup&gt;16&lt;/sup&gt;: Segment sharing between many European populations. Long wave lasting throughout 1st millennium BCE.</td>
</tr>
<tr>
<td>Iron Age (Later)</td>
<td>La Tène Culture.</td>
<td><strong>IBD (segment sharing)</strong>: Short spike of segment sharing at end of 1st millennium BCE.</td>
</tr>
<tr>
<td>Early Medieval</td>
<td>Migration Period.</td>
<td><strong>IBD (segment sharing)</strong>: Widespread segment sharing in Eastern Europe. Less segment sharing in Mediterranean Europe.</td>
</tr>
</tbody>
</table>

**Table 1**: Comparison of cultural changes attested in the archaeological record and new ancient DNA evidence and segment sharing analysis for several time periods of European prehistory.

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<sup>12</sup> For ancient mtDNA, see "Ancient DNA Reveals Key Stages in the Formation of Central European Mitochondrial Genetic Diversity" by Brandt et. al at [http://www.sciencemag.org/content/342/6155/257.short](http://www.sciencemag.org/content/342/6155/257.short).

<sup>13</sup> For ancient autosomal DNA, see "Origins and Genetic Legacy of Neolithic Farmers and Hunter-Gatherers in Europe" by Skoglund et. al at [http://www.sciencemag.org/content/336/6080/466.abstract](http://www.sciencemag.org/content/336/6080/466.abstract) and "Reconstructing the Human Past using Ancient and Modern Genomes" by P. Skoglund at [http://uu.diva-portal.org/smash/get/diva2:645462/FULLTEXT01.pdf](http://uu.diva-portal.org/smash/get/diva2:645462/FULLTEXT01.pdf).

<sup>14</sup> See [http://www.sciencemag.org/content/suppl/2013/10/6/342.6155.257.DC1/Brandt.SM.pdf](http://www.sciencemag.org/content/suppl/2013/10/6/342.6155.257.DC1/Brandt.SM.pdf), p. 58, 68.


Non-Local Genetic Components in Central Europe (STR)

To assess the influence of population movements attested in the archaeological record and compare with new ancient DNA evidence and segment sharing analysis, non-local genetic contributions in Central Europe were identified based on autosomal STR data. Results are summarized in Table 2 and illustrated in Figure 2.

Discussion: Results in Table 2 express a variety of non-local genetic components in Central Europe. Basque percentages are generally low, but largest in the Germanic sub-region (3.8%) and Polish sub-region (2.2%). Notably, both of these regions are located fairly distant from present day Basque cultures of the Pyrenees Mountains. However, it is possible that early Vasconic cultures (including ancient Basques and Aquitanians) lived in a larger area of Atlantic Europe, possibly including nearby areas of France that later became predominantly Celtic and Romance (French) speaking.

Spanish percentages are largest in the Belgic (24.3%) and Polish (13.4%) sub-regions. As with Basque percentages, these results suggest possible relationships between the Iberian Peninsula and relatively distant parts of Central Europe (such as Poland). This might reflect shared ancestry from populations that once lived in more central locations (later expanding into Spain and Poland), as well as


Figure 2: Non-local genetic components in sub-regions and populations of Central Europe. These percentages exclude local Belgic, Germanic, Polish, and Balkan components.
early population expansions and contacts that connected regions that in more recent history have been perceived as remote or culturally unrelated. Based on segment sharing analysis, this might have included contacts near the end of the Urnfield period and during the Hallstatt C culture.¹⁸

The distribution of Portuguese percentages is somewhat different from the preceding components. Top sub-regions where this component is expressed at the highest levels in Central Europe include Balkan (8.1%) and Belgic (6.1%). In contrast to the Spanish and Basque sub-regions, Portugal was associated with several predominantly Celtic cultures (such as the Gallaeci) during the classical period and participated in the preceding Atlantic Bronze Age.¹⁹

<table>
<thead>
<tr>
<th>Europa Sub-Region or Population</th>
<th>Basque</th>
<th>Spanish</th>
<th>Portuguese</th>
<th>Italian</th>
<th>Celtic</th>
<th>Norse</th>
<th>Finnic</th>
<th>Russian</th>
<th>Slovakian</th>
<th>Thracian</th>
<th>Thracian</th>
<th>Greek</th>
<th>Arabian</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>Polish</td>
<td>2.2%</td>
<td>13.4%</td>
<td>0.0%</td>
<td>0.0%</td>
<td>4.8%</td>
<td>0.0%</td>
<td>76.7%</td>
<td>1.5%</td>
<td>1.3%</td>
<td>0.0%</td>
<td>0.0%</td>
<td>0.0%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>*Hungary</td>
<td>1.5%</td>
<td>2.3%</td>
<td>0.0%</td>
<td>3.8%</td>
<td>0.0%</td>
<td>19.0%</td>
<td>0.0%</td>
<td>36.8%</td>
<td>0.0%</td>
<td>23.5%</td>
<td>9.6%</td>
<td>3.3%</td>
<td>0.2%</td>
<td></td>
</tr>
<tr>
<td>Balkan</td>
<td>1.3%</td>
<td>0.0%</td>
<td>8.1%</td>
<td>1.7%</td>
<td>0.0%</td>
<td>2.0%</td>
<td>1.2%</td>
<td>28.7%</td>
<td>10.9%</td>
<td>34.3%</td>
<td>11.8%</td>
<td>0.0%</td>
<td>0.0%</td>
<td></td>
</tr>
<tr>
<td>Germanic</td>
<td>3.8%</td>
<td>9.0%</td>
<td>0.5%</td>
<td>18.2%</td>
<td>5.9%</td>
<td>29.5%</td>
<td>0.0%</td>
<td>24.2%</td>
<td>0.0%</td>
<td>8.9%</td>
<td>0.0%</td>
<td>0.0%</td>
<td>0.0%</td>
<td></td>
</tr>
<tr>
<td>Belgic</td>
<td>0.0%</td>
<td>24.3%</td>
<td>6.1%</td>
<td>25.0%</td>
<td>16.2%</td>
<td>26.6%</td>
<td>0.0%</td>
<td>0.0%</td>
<td>0.0%</td>
<td>0.0%</td>
<td>0.0%</td>
<td>1.8%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 2: Non-local genetic components in Central European sub-regions and populations (marked with an asterix). These percentages exclude local Belgic, Germanic, Polish, and Balkan components.

Italian percentages are largest in the Belgic (25.0%) and Germanic (18.2%) sub-regions and smallest in the Polish (0.0%) and Balkan (1.7%) sub-regions. Unlike the Iberian Peninsula related percentages described below, these Italian percentages follow a more geographical distribution (oriented towards the north and west of Italy). This suggests that Italian related contacts might have taken place at a time when the geographical distribution of affected European populations was more similar to today’s countries.

Specifically, these contacts might have taken place during the Urnfield and Hallstatt C periods, in which contacts between Italy and Central Europe stimulated the development of the Villanovan culture (of Urnfield inspiration and possibly related to early Etruscans) and Canegrate, and Golasecca cultures (possibly related to early Celtic speaking cultures). Italian components in Hungary (3.8%) and the Balkan sub-region (Western Balkans; 1.7%) might in part reflect Bronze and Iron Age contacts between the Este culture of northeastern Italy (possibly related to the Adriatic Veneti involved in trade near the Amber Road).²⁰

Celtic percentages are largest for the Beltic (16.2%) and Germanic (5.9%) sub-regions, but not expressed for the Polish, Hungarian, or Balkan sub-regions. This suggests that contacts with British Isles (Celtic) populations are relatively limited in Central Europe and might have specifically involved expansions of Celtic-speaking cultures (such as Iron Age Hallstatt C and La Tène expansions).

¹⁸ For instance, see http://www.eve.ucdavis.edu/~pralph/ibd/boxplotted-inversions.pdf, p. 58.
¹⁹ The Latin poet Avienus noted an ancient account that the area of Ophiussa (near Lisbon) had been inhabited by Ostrimni (perhaps Istrians from the Upper Danube), possibly related to Hallstatt C or La Tène migrations.
²⁰ The Veneti might have been involved in importing steppe-Urartian horse breeds from the Pannonian Sigynians (possibly related to Iron Age Scythians). See Europe Before History by Kristiansen and Larsson, pp. 226-227.
In contrast, **Norse percentages** are expressed for all studied sub-regions and populations of Central Europe. Norse components are largest in the Germanic (29.5%) and Belgic (26.6%) sub-regions and smallest in the Balkan (2.0%) and Polish (4.8%) sub-regions. However, a substantial Norse percentage (19.0%) is found in present day Hungarians.

This suggests that, although Scandinavian trade with Italy was largely cut off by the Hallstatt C expansions, Scandinavian related populations have played a role in shaping the genetic structure of Central Europe, either in Germanic speaking contexts (probably related the Jastorf culture) or in more ancient links with the south (such as the TRB culture, genetically related to present day Cypriots, Greeks, and other Mediterraneans).

A small **Finnic percentage** (1.2%) is expressed only for the Balkan sub-region. This might reflect contacts with Uralic speaking cultures, but the overall absence of this component in Central Europe suggests that these links were mediated through other Eastern European sub-regions.

Substantial **Russian percentages** are expressed for most studied regions and populations. These are largest for the Polish sub-region (76.7%) and Hungary (36.8%) but absent in the Belgic sub-region (0.0%). Intermediate percentages are expressed for the Balkan (28.7%) and Germanic (24.2%) sub-regions. These Russian percentages might reflect in part the long-term pattern of expanding “Kurganized” cultures since the Copper Age and Bronze Age, as well as later expansions of Slavic speaking cultures (and possibly other polyethnic tribal confederations, such as the Ostrogoths) during the Migration Period.

**Scythian percentages** are expressed for just two sub-regions, Balkan (10.9%) and Polish (1.5%). Notably, the higher percentage in the Balkan sub-region might reflect the role of the Balkan Peninsula as a recipient for migrations from near the Black Sea during the many waves of steppe expansions (such as the Hunnic invasion led by Attila).

**Thracian (Romanian and Moldovan related) percentages** are largest in the Balkan (Western Balkan) sub-region (34.3%) and Hungary (23.5%). This might reflect longstanding local contacts within the Balkan Peninsula that date to the Copper Age settlements of the CBMP, as well as the periods of wider contacts between European sub-regions mentioned earlier in this article.

**Greek components** are expressed for the Balkan sub-region (11.8%) and Hungary (9.6%), but not for other studied parts of Central Europe. This suggests that direct contacts with Greece were primarily a local phenomenon in the Balkan Peninsula.

Finally, a small **Arabian component** (3.3%) is expressed for Hungary. This is the only substantial non-European component expressed for Hungarian populations and might in part reflect traces of the Migration Period Avar and other steppe confederations that eventually led to the establishment of the early Magyar state in Central Europe.

However, this component is notably Middle Eastern (Arabian) related rather than Siberian or North Asian related. This suggests that the transmission of a Uralic language to Hungary did not necessarily involve a substantial influx of populations related to present day North Asians. Instead, one possibility is that Magyar migrations in Europe might have involved links with population centers related to present day Middle Eastern populations (such as Iron Age Central Asians).

**In summary**, results attest a variety of inter-regional links in Central European sub-regions and populations. This reflects the longstanding role of Central Europe as a recipient of population expansions, in which long-distance trade patterns with neighboring populations intersected and multiple cultural streams were integrated at the heart of the European continent.

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DNA Tribes® Announcements for December 2013

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DNA Tribes® is pleased to introduce our new 22 Marker Kit and 26 Marker Kit tests using enhanced STR technologies at great prices. These new STR testing options replace 15, 21, and 27 Marker Kit lab tests. However, updates incorporating new populations and world region definitions for 15, 21, and 27 Marker Kit results are available.

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**New DNA Tribes® 22 Marker Kits** test the following autosomal STR markers:

- Amelogenin, CSF1PO, D13S317, D16S539, D18S51, D21S11, D3S1358, D5S818, D7S820, D8S1179, FGA, Penta D, Penta E, TH01, TPOX, vWA, D19S433, D2S1338, D10S1248, D12S391, D1S1656, D22S1045, and D2S441.

**New DNA Tribes® 26 Marker Kits** test the following autosomal STR markers:

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¹³ 26 Marker Kit test all markers previously included in 27 Marker Kits, with the exception of SE33, at a substantially lower test cost.
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*DNA Tribes*® *SNP* reports ([http://dnatribes.com/snp.html](http://dnatribes.com/snp.html)) include:

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  - Continent, Region, Native Population, and Global Population Percentages.

- **Multi-Dimensional Scaling (MDS) Graphs**
  - Continent, Region, Native population, and Global Population.

- **Total Similarity**
  - Compare your Genotype to over 280 Populations in our SNP Database.

<table>
<thead>
<tr>
<th>Population</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yoruba Nigeria</td>
<td>26.9%</td>
</tr>
<tr>
<td>Bambara West Africa</td>
<td>9.6%</td>
</tr>
<tr>
<td>Igbo Nigeria</td>
<td>6.7%</td>
</tr>
<tr>
<td>Kaba Chad</td>
<td>5.2%</td>
</tr>
<tr>
<td>Fang Cameroon</td>
<td>5.1%</td>
</tr>
<tr>
<td>Bantu South Africa</td>
<td>5.0%</td>
</tr>
<tr>
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