

# THE GENETICS OF CRIMEAN KARAITES

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## Abstract

The ancestral origins of the Turkic-speaking Crimean Karaites have at times been contentious with several competing theories. This study uses genetic science to help clarify to what extent, if any, these people are related to other Karaite communities and/or to Rabbinical Jews who had ancestors who lived in ancient Israel. The main alternative theory contends that they may descend from the Turkic-speaking Khazars who converted to Judaism prior to the documented establishment of any Karaite communities north of the Black Sea. The data set used to make genetic comparisons between populations contains hundreds of thousands of samples from around the world. Some of the samples come from people whose ancestors lived on the Crimean peninsula (including, but not limited to, Crimean Tatars, Crimean Rabbinical Jews, and Crimean Armenians) while others came from members of ethnic groups (Karachays, Uygurs, Kazakhs, Chuvashes, Ossetians, and many others) who inhabit the North Caucasus, the Volga River region, and Central Asia, some of whom may have had a genetic affinity with the Khazars. 33 Crimean Karaite uniparental lineages (19 Y-DNA and 14 mtDNA), two Lithuanian Karaite Y-DNA lineages, and one Western Ukrainian Karaite mtDNA lineage are compared to the other data. By and large, the results show that Crimean Karaites are often closely related to other Jews, both Karaite and Rabbinical, but have little affinity with other Turkic-speaking peoples or with non-Jewish peoples who inhabit lands that were once part of Khazaria.

**Keywords:** Karaites, DNA, admixture, ancestry, Crimea, Russia, Ukraine, Lithuania, Jewish diaspora

## Özet

Türkçe konuşan Kırım Karaylarının kökeni meselesi zaman zaman tartışan kuramlarla tartışmalı bir hal almıştır. Bu çalışma işbu cemaatin eğer varsa diğer Karay cemaatleriyle ve/veya ataları eski İsrail'de yaşamış olan Rabbani Yahudilerle ne derece ilişkili olduklarını açığa kavuşturmak için genetik bilimini kullanmaktadır. En önemli karşı kurum bunların herhangi bir Karay cemaatinin Karadeniz'in kuzeyinde

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kayıtlara geçmiş varlığından çok önce Museviliğe geçmiş olan Türkçe konuşan Hazarlardan inmiş olabileceğini öngörmektedir. Nüfuslar arasında genetik karşılaştırma yapmada kullanılan veri kümesi tüm dünyadan yüzbinleri içeren bir örnekleme temsil etmektedir. Numunelerin bazıları ataları Kırım yarımadasında yaşamış kimselerden gelmekte iken (Kırım Tatarları, Kırım Rabbani Yahudileri ve Kırım Ermenileri dâhil, ama bundan ibaret değil), diğerleri Kuzey Kafkaslarda, İdil havzasında ve Orta Asya'da yaşayan, bazılarının Hazarlarla genetik ilişkisi mümkün etnik topluluklardan (Karaçaylar, Uygurlar, Kazaklar, Çuvaşlar, Osetler vd.) inmektedir. 33 tek atalı Kırım Karay (19 Y-DNA ve 14 mtDNA), iki Litvanya Karay Y-DNA ve bir Batı Ukrayna mtDNA sülalesi diğer veriyle karşılaştırılmıştır. Genel olarak Kırım Karaylarının Karay ve Rabbani diğer Musevilerle yakın akraba olduğu, fakat bir zamanlar Hazar devletinin bulunduğu bölgelerde yaşayan Musevi olmayan Türkler veya diğer halklarla daha az ilişkilerinin olduğu görülmüştür.

**Anahtar Kelimeler:** Karaylar, DNA, etnik karışma, ecdat kökleri, Kırım, Rusya, Ukrayna, Litvanya, Yahudi diasporası.

For more than seven centuries, people who professed the Karaite variety of Judaism have lived on the Crimean peninsula north of the Black Sea in multiple cities and towns. There is no evidence that any Karaites lived there during the period of the Khazar Kingdom (7th-11th centuries), whose rulers were of Central Asian Turkic origin but practiced the Rabbinical variety of Judaism. The first definite mention of Crimean Karaites was made by Aaron ben Joseph of Byzantium in *Sefer ha-Mivhar* in 1294 in connection with a 1278 Karaite-Rabbinical debate in the city of Sulkhata (Eski Kırım) (Akhiezer 2011: 753). At the time, the Crimea was ruled by the Golden Horde. Many of the Karaites from Sulkhata later moved to Chufut-Kale (Qırq Yer). When the Crimean Khanate and Ottoman Empire were in control between the 15th-18th centuries, Karaites also lived in Bakhcheserai, Yevpatoria, Mangup, Sudak, and Kaffa (Kefe), among other places. Karaites continued to live in the region after the Russian Empire took control in 1783 with residency in Simferopol, Kerch, and other cities.

It is documented that many ancestors of the Crimean Karaites had previously lived in Constantinople during Byzantine rule and Istanbul during Ottoman rule. (Shapira 2003: 1-3) Some Karaites also moved in the opposite direction, from the Crimea to Istanbul, up until the late 19th century. (Shapira 2003: 4; Kefeli 2005: 3,5) As a result of their two-way migrations, many Karaites in both communities share the same surnames, such as Kohen, Levi, Ormeli, Kefeli, Bolek, Teriyaki, Sinani, and Köycü. (Kefeli 2005: 6) As in most cultures, Karaite surnames are passed from father to son rather than from mother to son. Karaite Judaism (unlike modern Rabbinical Judaism) also uses the paternal line of descent to determine whether a person's religious status is automatically Jewish or non-Jewish. Kohen and Levi are names with special significance in Judaism since they are also used as titles.

Kohens are believed to be descended from priests who served in the Jewish temple in Jerusalem in ancient times. Levi is the name of an ancient Israelite tribe whose members once served as assistant priests in the temple.

Traditionally, Crimean Karaites viewed themselves as descendants of the Jews of ancient Israel. This idea conformed to their religious beliefs since the Jewish Bible (Torah) and Jewish liturgy proclaim living Jews to be Israelites both spiritually and physically. Mordehay Kazas, a Crimean Karaite writer of the early 19th century, accepted a literal interpretation of the Torah by declaring, "I come from Jews; I am a descendant of Jacob, son of Isaac, who is a son of Abraham. They call my motherland Israel. My language is *leshon ha-kodesh* [= "the holy tongue", meaning Hebrew]." (A. Kefeli 2004: 19)

The Crimean Karaite language is a variety of the Crimean Tatar language and distinct from the Kipchak dialect called Karaim that was spoken by Karaites in Lithuania and Poland. (Shapira 2007: 58) Greek was formerly spoken by Karaites in both Mangup and Constantinople. (Shapira 2007: 55) The theory that the Crimean Karaites and other Karaites of eastern Europe are not Israelites but instead are descended from Turkic-speaking Khazars was invented in the 1920s and 1930s by S. Markovich Shapshal, the chief rabbi of the Karaites in Troki, Lithuania. (Shapira 2007: 45-46; Altınkaynak 2004: 13-23.) The Nazi adoption of Shapshal's theory saved most of the Crimean Karaites from being murdered during World War II. After World War II, many Karaites in eastern Europe remained followers of the Khazar theory of their origins despite its artificial and undocumented nature. Some Crimean Karaites who wanted to distance themselves from Rabbinical Jews (Ashkenazi Jews, Sephardi Jews, and Mizrahi Jews) were especially enthusiastic about it. The Karaite Ananiasz Zajączkowski was among the writers who tried to add scholarly credibility to the theory. (Zajączkowski 2005: 123-133.)

The purpose of my genetic study was to use modern science as an objective tool to attempt to definitively answer the question of Crimean Karaite origins. I organized the study using the services of Family Tree DNA in Houston, Texas, U.S.A.,<sup>1</sup> which has a large pool of genetic samples of Jews and non-Jews from around the world including Karaites from Egypt, Azerbaijan, Lithuania, and Galician Ukraine and Rabbinical Jewish populations including Ashkenazi Jews from central and eastern Europe, Sephardi Jews whose ancestors lived in Spain and Portugal, and Mizrahi Jews from regions including West Asia, North Africa, and the Caucasus. This made it possible to find out whether any Crimean Karaites match other Karaite Jews and/or

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<sup>1</sup> The geneticists at the Arizona Research Laboratories of the University of Arizona in Tucson, Arizona, U.S.A. processed the samples. Leon Kull, Adam J. Levin, Rebekah Adele Canada, Bennett Greenspan, Debra Katz, and Abraham Kefeli assisted with multiple other aspects of my project including gathering samples, funding tests, and analyzing the results.

Rabbinical Jews and to see if Crimean Karaites have any unique lineages that are not shared by other Jews.

Some of the Crimean Karaites in the study were living on the Crimean peninsula at the time they participated while others lived abroad, including in the United States and Israel. All participants were asked to supply basic details on their paternal and maternal lines of ancestry including their ancestors' ethno-religious identifications and geographic origins. The study only includes one person per extended family so as to avoid intentionally testing the same lineage twice.

A total of 25 individuals (21 men and 4 women) from unbroken, long-term Crimean Karaite family lineages participated. Since some of the men were children of mixed marriages between a Karaite and a non-Karaite,<sup>2</sup> I was only able to analyze those lineages that reflected their Karaite heritage, with the further restriction that modern Karaite ancestors from outside of the Crimea did not count. 8 of the men had both a Crimean Karaite mother and a Crimean Karaite father, while 11 of the men had only a Crimean Karaite father, and 2 of the men had only a Crimean Karaite mother. Another limitation was that women could only be genetically tested on their maternal lines even if their fathers were also Karaites. The Y chromosome (Y-DNA) is exclusively transmitted from father to son and never from father to daughter. Mitochondrial DNA (mtDNA), however, can be transmitted from mother to son as well as from mother to daughter. The inclusion of mtDNA in the study enabled the women to participate. Altogether, the study consists of 19 Y-DNA samples and 14 mtDNA samples from individuals with deep roots in the Crimean Karaite community whose ancestral lines had not been interrupted by recent migrations in or out of the community.

As discussed above, Crimean Karaites usually bestow children with their father's surname, such that each surname typically represents a different pathway going back multiple generations in the direct paternal line. A goal was to genetically test the Y-DNA of as many surnames as possible. Of those whose paternal lines have deep roots in the Crimean Karaite community, male representatives of the following surnames participated in the

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<sup>2</sup> Vladimir Matveyev, "Breakaway sect from Judaism shrinking in numbers in Ukraine", released by the Jewish Telegraphic Agency on September 29, 2005, reported that Crimean Karaites have been frequently intermarrying with Rabbinical Jews as well as with non-Jews in recent decades and that some of these Karaites are not religiously observant. Karaites in eastern Europe had seldomly married Rabbinical Jews before then, although there were already some mixed Karaite-Rabbinite marriages under the rule of the Russian Empire (see Mikhail Kizilov, *The Karaites of Galicia: An Ethnoreligious Minority Among the Ashkenazim, the Turks, and the Slavs, 1772-1945*, Brill, Leiden 2009, pp. 219-221) and examples are known from history where marriage contracts contained special clauses to accommodate Karaite-Rabbanite marriages (see Moshe Gammer, "The Karaites of Crimea during the Crimean War: A French Report", *Turkish-Jewish Encounters: Studies on Turkish-Jewish Relations through the Ages*, Haarlem, SOTA 2001, p. 71).

study: Arabadji, Avyaz, Babadjan, Balakai, Balyq, Feruz (two members who are not known relatives and did not match each other genetically either), Gammal, Gumush, Hadji, Kapon, Kefeli, Kogen, Levy, Mangubi, Oksyuz, Qrym, Shakai, and Teriyaki.

On a small scale the study was able to test if Levites and Kohens from Karaite populations genetically match Levites and Kohens from Rabbinical populations by sampling the Y-DNA of one Crimean Karaite Levite and one Crimean Karaite Kohen.

The study also sampled the Y-DNA of a Karaite man whose ancestors in this line joined the Crimean Karaite community but had not lived in Europe before 1881. In this article, this sample's code name is N01. His paternal grandfather was born in the Crimea but his paternal great-grandfather was born in the city of Khotan in East Turkistan (the present-day Xinjiang Uygur Region in northwest China). This great-grandfather and his wife had already been practicing Karaite Judaism prior to their immigration to the Crimea. Since their son was a Karaite Jew living in the Crimea who married a woman from a deeply-rooted Crimean Karaite family, N01 is a bonafide Crimean Karaite, however his Y-DNA isn't informative of the origins of the Crimean Karaite community.

All of this study's Y-DNA samples have been tested at least up to the 37-marker level. Some have been further upgraded to the 67-marker level, enabling even more precise relative-matching.

Scientists have determined that the Y-DNA haplogroup family J originated in the northern part of West Asia. Branches of J later reached other lands including Europe and South Asia. The haplogroups J1 and J2 are subclades of J. J1 is especially frequent in places like eastern Turkey, southern Iraq, Yemen, Qatar, Saudi Arabia, and Jordan. J2 is especially frequent in Turkey, Armenia, Azerbaijan, Iraq, and Lebanon. Three participating Crimean Karaites were found to belong to J1. Six others belong to J2.

Sample K05's Y-DNA belongs to J1 (J-M267). At the 25-marker level he is one step mutation from an Ashkenazi from Romania, an Ashkenazi from Belarus, and a man from Ukraine and two step mutations from an Ashkenazi from Moldova. At the 12-marker level he is one step mutation from an Ashkenazi from Poland as well as from an Ashkenazi Kohen from Belarus and other men mostly from Europe.

Sample K10's Y-DNA belongs to J1 (J-M267). He identifies as a Kohen and, consistent with this, his surname is Kogen. He exactly matches an Ashkenazi Kohen from Belarus whose surname is Kagan at the 12-marker level but does not match him at the 25-marker level. His one step mutation matches at the 12-marker level are overwhelmingly Ashkenazim and Sephardim, including some Ashkenazi Kohens and Ashkenazi Levites. His only match listed at the 25-marker level is a man with roots from Ukraine whose

ethnic identity isn't specified, and this match is at a genetic distance of two step mutations.

Sample K21's Y-DNA belongs to J1 (J-M267). At the 12-marker level he is one step mutation from Ashkenazim (including but not limited to Kohens), Sephardim (including those from Syria, Spain, Lebanon, and Italy, and some of these Sephardim are Kohens), a Mizrahi from the portion of Kurdistan in Iran, and two Mizrahim from Afghanistan, along with men from countries like Armenia, Greece, Morocco, Saudi Arabia, Yemen, and Scotland among others. At the 25-marker level he is two step mutations from an Ashkenazi from Russia.

Sample K03's Y-DNA belongs to J1 (J-M267). At the time of this writing, he does not match any other man in Family Tree DNA's Y-DNA database.

Sample K20's Y-DNA belongs to J2 (J-M67). At the 37-marker level he is an exact match with two men from Chechnya in the Russian Federation who share an ethnically Chechen surname, one step mutation from a man from Ingushetia in the Russian Federation whose surname is ethnically Ingush, two step mutations from a man from Ingushetia, three step mutations from a man from Ingushetia, and four step mutations from three men with ancestry from Chechnya and one man with ancestry from Ingushetia. Based on the 37-marker data, the Y-DNA TiP Report indicates that the probability that sample K20 shares a common ancestor with his two closest Chechen matches is about 83% going back 4 generations, about 97% going back 8 generations, and nearly 100% going back 12 generations (rounding to the nearest whole percents). The report's probabilities between him and his closest Ingush match are about 89% going back 8 generations, about 98% going back 12 generations, and nearly 100% going back 20 generations (rounding to the nearest whole percents). At the 25-marker level he is an exact match with a man from Georgia, one step mutation from a man from Armenia, and two step mutations from a man from Georgia. He is an exact match with a man from Slovenia at the 12-marker level. At the same level he is one step mutation away from three Sephardim (from England, the Netherlands, and Greece) as well as an Ashkenazi from Germany and an Ashkenazi from Moldova but he also matches dozens of other people from countries like Iran, Lebanon, Saudi Arabia, Italy, Spain, and England.

Sample K24's Y-DNA belongs to J2 (J-M172). He is an exact match with an Ashkenazi from Russia at the 12-marker level.

Sample K15's Y-DNA belongs to J2 (J-M172). He is an exact match with an Ashkenazi from Russia at the 12-marker level. At the 37-marker level he is one step mutation from a man from Ukraine.

Sample K02's Y-DNA belongs to J2 (J-M172). He is two step mutations from another Crimean Karaite in this study (sample K01) at the 37-marker level. He is four step mutations from a Frenchman at the 37-marker level. At the 25-marker level he is two step mutations from an Italian. He matches all

12 markers with a Syrian Arab. He is one step mutation from two Saudi Arabians, an Armenian, a man from Turkey, four Englishmen, and two Hungarians, among others, at the 12-marker level.

Sample K01's Y-DNA belongs to J2 (J-M172). He is two step mutations from this study's sample K02, as stated above. He is four step mutations from a confirmed Frenchman as well as from a man with the same surname as the confirmed Frenchman but with one less letter. At the 12-marker level he is one step mutation from a Syrian Arab and a British man.

Sample K27's Y-DNA belongs to J2 (J-M172). At the time of this writing, he does not match any other man in the Y-DNA database.

The Y-DNA haplogroup family E is also common in West Asia as well as in Africa. Its branch E1b1b developed in northeastern Africa and E1b1b's descendant branches settled mainly in West Asia, North Africa, and Europe. Four participants with solidly confirmed Crimean Karaite ancestry were found to belong to E1b1b1 or a descendant of it.

Sample K16's Y-DNA belongs to E1b1b1 (E-L117). He is one step mutation from a man from France and an Italian from Sicily and two step mutations from one man each from Spain and the United Kingdom at the 25-marker level. At the 12-marker level he is an exact match with two Ashkenazim from Poland, an Ashkenazi from Russia, two Ashkenazim from Ukraine, two other people from Russia, two others from Poland, one other from Ukraine, eleven from Germany, one from the Netherlands, one from Italy, one from Cyprus, five from the United Kingdom (two of whom are specified as England and one as Scotland), and one from Switzerland.

Sample K19's Y-DNA belongs to E1b1b1 (E-L795). At the 37-marker level he is three step mutations from a Karaite from Egypt and according to the Y-DNA TiP Report the probability that they share an ancestor within 20 generations is about 96% and within 24 generations nearly 99% (rounding to the nearest whole percents). At the 12-marker level he exactly matches a different Karaite from Egypt as well as an Ashkenazi from Belarus and a man from the United Arab Emirates plus a man from Bulgaria and ten men from Switzerland. At the 25-marker level he is two step mutations from a man from Jordan and a man from Germany.

Sample K14's Y-DNA belongs to E1b1b1 (E-M78). His exact matches at the 12-marker level include an Ashkenazi from Germany as well as men from many other countries including one from Armenia, one from Austria, one from Hungary, two from Italy, two from Poland, and two from the Czech Republic, among others. At the 25-marker level he is two step mutations from two men from Germany and one man from England as well as a man with a surname that stems from English and German origins and a man with Arabic first and last names who did not list his country of paternal origin.

Sample K09's Y-DNA belongs to E1b1b1a1c (E-V22). At the 12-marker level he is one step mutation from a Mizrahi from Iraq, a Saudi Arabian, an Albanian, and one man from Belgium.

The Y-DNA haplogroup family G is believed to originate from the northern part of West Asia or the Caucasus Mountains region. It later spread to such regions as Central Asia and Western Europe. Three participating Crimean Karaites were found to belong to three different branches of this family.

Sample K06's Y-DNA belongs to G2a (G-P15). He is three step mutations from another Crimean Karaite in this study (sample K18) at the 37-marker level and exactly matches him at the 25-marker level. At the 25-marker level he is two step mutations from sample K12, another Crimean Karaite.

Sample K18's Y-DNA belongs to G (G-P15). He is three step mutations away from Crimean Karaite sample K06 at the 37-marker level, as stated above, and they are an exact match at the 25-marker level. At the 25-marker level he is two step mutations from Crimean Karaite sample K12. He is a distantly related to a Georgian who matches him at the 12-marker level with 1 step mutation.

Sample K12's Y-DNA belongs to G2a3b1 (G-P303). At the 25-marker level he is two step mutations from Crimean Karaite samples K06 and K18 as well as one Ashkenazi from Hungary, one Ashkenazi from Germany, one man from the Russian Federation, and one man from Slovakia.

The Y-DNA haplogroup family L is found in populations in South Asia, West Asia, and Europe. It is believed to have originated somewhere in or near South-Central Asia. The branch called L2a is mainly found in Europe. One participating Crimean Karaite was found to belong to this branch.

Sample K04's Y-DNA belongs to L2a (L-M349). He identifies as a Levite and, consistent with this, has the surname Levy. At the 25-marker level he is two step mutations from an Egyptian Karaite, two Ashkenazim from Moldova, and one Ashkenazi from Russia. Based on the 25-marker data, the Y-DNA TiP Report indicates that the probability that sample K04 shares a common ancestor with one of the Moldovan Ashkenazim is about 90% within 24 generations and about 83% within 20 generations and the same probabilities hold for his relationship to the other Moldovan Ashkenazi, whereas his relationship to the Egyptian Karaite is about 89% within 24 generations and about 80% within 20 generations (rounding to the nearest whole percents). At the 12-marker level he is an exact match with a Sephardi from Turkey and one step mutation from a different Sephardi from Turkey plus some other men.

The Y-DNA haplogroup family R includes the widespread branches R1a and R1b. Branches of R1b are especially common in western Europe, with R1b1a2 being the most prevalent branch there. West Asia may be the place

of origin for R1b. One participating Crimean Karaite was found to belong to a descendant of R1b.

Sample K26's Y-DNA belongs to R1b1a2 (R-M269). At the time of this writing, he does not match any other man in the Y-DNA database.

As for N01, the atypical Crimean Karaite with recent immigrant heritage in his paternal line, his Y-DNA belongs to haplogroup Q1b1a (Q-L245), which has also been found among Iranians, Iraqi Arabs, Saudi Arabs, Syrian Arabs, Armenians, and Christian Assyrians, making it a sign of West Asian origin.<sup>3</sup> At the 67-marker level he is two step mutations from three Ashkenazim from Ukraine. The Y-DNA TiP Report between sample N01 and one of the Ukrainian Ashkenazim who are two step mutations away from an exact match with him at the 67-marker level shows that the probability that they shared a common ancestor within the last 12 generations is about 96%, within the last 16 generations about 99%, and within the last 24 generations bordering on 100% likelihood. At the 67-marker level, he is three step mutations from two Ashkenazim from Ukraine and an Ashkenazi from Austria. At the same level, he is four step mutations from an Ashkenazi from Lithuania, five step mutations from an Ashkenazi from Poland and an Ashkenazi from Russia, six step mutations from an Ashkenazi from Poland, and seven step mutations from three Ashkenazim from Ukraine and one man from Poland. His close matches at the 12-marker, 25-marker, and 37-marker levels include mostly Ashkenazim. He is a distantly related to an Armenian from Turkey who matches him at the 12-marker level with 1 step mutation.

All mtDNA samples in this study were tested at both the low resolution hypervariable region 1 (HVR1) and the intermediate resolution hypervariable region 2 (HVR2) levels. Three of the samples were also tested up to the complete Coding Region level but only one of them found matches there.

The mtDNA haplogroup family I is present among ethnic groups of Europe, West Asia, and South Asia. As an example, the Slavic-speaking Lemko Rusyns of Slovakia, Poland, and Ukraine have it in a high frequency. Geneticists have reasons to believe that haplogroup I originated in West Asia. Two participating Crimean Karaites were found to belong to this family.

Sample K22's mtDNA belongs to I. Her HVR1 matches include a Sephardi from Algeria, three Sephardim from Morocco,<sup>4</sup> one Bedouin from

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<sup>3</sup> Evidence suggests that the ancestral haplogroup of Q1b1a, Q (Q-M242), arose in Siberia. Q1b1a is one of the most westerly of Q's subclades. Q1b1a's direct parent in the tree of subclades, Q1b (Q-M378), is found in modern times among the Uygurs of northwest China, the Hazaras of Afghanistan, and the Sindhi people of Pakistan.

<sup>4</sup> K22 matches nine out of the ten control regions within haplogroup I that were reported for particular Moroccan Jews in Table S1 in the following published study: Doron M. Behar, et al., "Counting the Founders: The Matrilineal Genetic Ancestry of the Jewish Diaspora", *PLoS ONE* 3:4 (April 30, 2008), e2062.

Israel, and one Lebanese, but also non-Jewish people from Europe: one from Belarus, one from Poland, one from Hungary, one from the Czech Republic, one from Austria, three from France, three from Germany, four from Ireland, two from Portugal, and seven from the United Kingdom (two of whom are specified as England and three as Scotland). At the HVR1+HVR2 level she matches two people from Portugal, one person from Spain, and one Crimean Karaite (sample K13). The matches from Portugal and Spain might be descendants of Sephardi Jews who converted to Christianity.

Sample K13's mtDNA belongs to I. His HVR1 and HVR2 matches are the same ones that sample K22 has and, as stated above, samples K13 and K22 match each other at the HVR1+HVR2 level.

The mtDNA haplogroup family H is very commonly encountered among the peoples of Europe, though it is also found, albeit in lesser frequencies, in the northern regions of West Asia, the southern portions of the Caucasus region, and North Africa. Haplogroup H9 is a branch of H that's also found among some ethnic groups in Europe and West Asia but only in low frequencies. H is by far the most common mtDNA family in this study. Ten participating Crimean Karaites were found to belong to this family, one of whom belongs to its subclade H9a.

Sample K05's mtDNA belongs to H. His matches at the HVR1 level include one Ashkenazi from Ukraine and one Georgian Jew who falls into the broad category of Mizrahim.<sup>5</sup> His matches at the HVR1+HVR2 level include a Crimean Karaite (sample K02), one person from Belarus with a Jewish middle name and an Ashkenazic last name whose maternal line is probably Ashkenazic as well but did not explicitly state this, one person from Lithuania who did not state an maternal ethnicity but has a surname found among Ashkenazim and Germans which suggests Ashkenazic maternal heritage, and one Azerbaijani.

Sample K02's mtDNA belongs to H. His HVR1 and HVR2 matches are the same ones that sample K05 has and, as stated above, samples K02 and K05 match each other at the HVR1+HVR2 level.

Sample K03's mtDNA belongs to H9a. Most of his matches at the HVR1 level are Europeans but he also matches six people from Lebanon, one from Syria, and one from Turkey. His matches on HVR1+HVR2 all come from European countries: a Crimean Karaite (sample K25), three people from England, one from France, one from Germany, two from Greece, one from Hungary, four from Italy (including one from Sicily), two from the Netherlands, one from Poland, one from Scotland, one from Slovakia, one from Switzerland, and two from Ukraine. His closest match on his full genomic

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<sup>5</sup> K05's control regions within haplogroup H are identical to those of some Georgian Jews listed in Table S1 in: Behar, et al., "Counting the Founders: The Matrilineal Genetic Ancestry of the Jewish Diaspora".

sequence (CR level) in the entire database is a person from England who matches him at the genetic distance of -2. Two people from Germany, one from Greece, and one from the United Kingdom match him at the genetic distance of -3.

Sample K25's mtDNA belongs to H. Her HVR1 and HVR2 matches are the same ones that sample K03 has and, as stated above, samples K25 and K03 match each other at the HVR1+HVR2 level.

Sample K26's mtDNA belongs to H. He has numerous HVR1+HVR2 matches including two Ashkenazim from Austria, an Ashkenazi from Hungary, an Ashkenazi from Lithuania, an Ashkenazi from Poland, two Ashkenazim from Russia, and five Ashkenazim from Ukraine, but also many non-Jews from Greece, Poland, Sweden, Germany, and other countries.

Sample K18's mtDNA belongs to H. He has abundant HVR1 matches including one Sephardi from Bulgaria, one Ashkenazi from the Netherlands, and numerous non-Jews from European countries such as seven Italians. His HVR1+HVR2 matches include one person from the Czech Republic, one from England, four from Germany, one from Italy, and one from Ukraine as well as another Crimean Karaite in this study (sample K12). In conjunction with data reported above, this means samples K18 and K12 match both maternally and paternally.

Sample K12's mtDNA belongs to H. He has the very same HVR1+HVR2 matches that sample K18 does.

Sample K23's mtDNA belongs to H. Her HVR1+HVR2 matches are one person from England, three from Germany, and one from Ukraine. At the HVR1 level she matches numerous people including a Sephardi from Bulgaria, an Ashkenazi from the Netherlands, and others without a Jewish designation.

Sample K11's mtDNA belongs to H. He has numerous HVR1+HVR2 matches including an Ashkenazi from France, an Ashkenazi from Poland, two Ashkenazim from Ukraine, two Ashkenazim from Hungary, three Sephardim from Morocco, two Druze from Israel, and a Palestinian Arab from Israel, but also many non-Jews from Europe such as many dozens of people from Ireland and Germany.

Sample K16's mtDNA belongs to H. At the time of this writing, he does not match any other person in the mtDNA database.

The mtDNA haplogroup family N is present mostly in populations outside of Africa including many peoples of Europe, Asia, Australia, and the Americas. The subclade N1c is common among populations in West Asia,

especially northern Saudi Arabia and Turkey. N1c is occasionally found in Ashkenazim.<sup>6</sup>

Sample K17's mtDNA belongs to N1c. At the time of this writing, she does not match any other person in the mtDNA database.

The mtDNA haplogroup family T is fairly well distributed in Europe and West Asia, especially the Baltic region. Geneticists believe it originated in or near Syria or Turkey. The subclade T1 is most commonly found in Udmurts of modern-day Russia, Iraqis, Kurds, Armenians, Balkan peoples, and other peoples of Europe and the south Caucasus.

Sample K24's mtDNA belongs to T1. At the time of this writing, he does not match any other person in the mtDNA database.

The overall results of the study are not unexpected considering the documented Jewish roots of the Crimean Karaite community.

Samples K04 and K19 provided evidence that Crimean Karaites are sometimes genetically related to practitioners of their sect in distant lands, in their case Egyptian Karaites, a group whose members never denied their Israelite ancestry. If I had been able to test Turkish Karaites I am sure some of them would have likewise matched Crimean Karaites.

Relationships were also discovered with their Rabbinical coreligionists. Many Crimean Karaites were found to be genetically related to Ashkenazi Jews. Seventeen of them (samples K02, K04, K05, K10, K11, K12, K14, K15, K16, K18, K19, K20, K21, K23, K24, K26, N01) match Ashkenazim. Some of them match them paternally, others maternally. Within the group of paternal matches, the Crimean Karaite Kohen matches an Ashkenazi Kohen. In the search for indicators of the Israelite ancestry of Crimean Karaites it would be considered more relevant when they match Ashkenazim by Y-DNA as opposed to mtDNA since the mtDNA lineages of Ashkenazim show substantial European admixture and even traces of South Chinese, North Asian, and North African ancestries in some families whereas the Y-DNA of Ashkenazim is much more frequently of West Asian origin, including Levantine ancestry held in common with peoples like the Samaritans, Syrians, Lebanese, and Druze.<sup>7</sup>

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<sup>6</sup> N1c is one of three haplogroups called "others" in tables in the "Supplementary Figures" section of: Marta D. Costa, et al., "A substantial prehistoric European ancestry amongst Ashkenazi maternal lineages", *Nature Communications* 4 (October 8, 2013), article number 2543.

<sup>7</sup> Costa, et al., "A substantial prehistoric European ancestry amongst Ashkenazi maternal lineages"; Steven M. Bray, et al., "Signatures of founder effects, admixture, and selection in the Ashkenazi Jewish population", *Proceedings of the National Academy of Sciences of the United States of America* 107:37 (September 14, 2010), pp. 16222-16227. The extent to which women from ancient Italy genetically contributed to the Ashkenazi population is currently the subject of debate between geneticists, with some, including Doron Behar and Karl Skorecki, disagreeing with Costa's team's ethnic assignments for some haplogroups.

Sample K04 illustrates this point by virtue of being a fairly close match to Ashkenazi Jews as well as an Egyptian Karaite, and at the same time having Turkish Sephardi Jews among his more distant matches.

Sample K04 was not alone; samples K10, K11, K12, K13, K18, K20, K21, K22, and K23 also match Sephardi Jews, yielding a total of ten Crimean Karaites who match them.

One of the Crimean Karaites (sample K09) matches an Iraqi Jew. Another (sample K21) matches a Kurdish Jew. One (sample K21) matches Afghan Jews. Two different participants (samples K02 and K05) match Georgian Jews. Many of these relationships, however, are distant.

Moving for the moment beyond the Jewish world, relationships were found with members of multiple West Asian ethnic groups who do not practice Judaism. Ten Crimean Karaites (samples K01, K02, K03, K09, K11, K19, K20, K21, K22, K25) match non-Jewish Arabs, while still another Crimean Karaite (sample K14) matches a person with a fully Arabic name who is likely to be a non-Jewish Arab. Two Crimean Karaites (samples K13 and K22) match Bedouin Arabs. Sample K11 also matches Druze. Five participants (samples K02, K14, K20, K21, N01) match Armenians. Four (samples K02, K03, K20, and K25) match people from Turkey who are presumably Anatolian Turks as they did not give themselves a special ethnic minority designation like Kurd or Armenian.

While samples K01, K03, and K25 match some Eastern Mediterranean and West Asian peoples, they do not currently match any Rabbinical Jews in the database. It is therefore possible that none of their ancestors in these lineages lived in ancient Israel but instead had joined the Karaites through religious conversions. K03 and K25 maternally match Europeans more closely than any of their West Asian matches. Meanwhile, K02 doesn't match a Rabbinical Jew paternally, only maternally. K02's Y-DNA is close to K01's. The common paternal ancestor of K02 and K01 could have been either West Asian or European.

West Asian ancestry should be assumed for samples K17 and K27, who have no matches from people of any ethnic group in the database, on the basis of the geographic distributions of their haplogroups.

By contrast, sample K26's Y-DNA haplogroup is not a signature of West Asian ancestry. His haplogroup is present among peoples of western Europe and found at a high frequency among the Bashkirs, an ethnic group whose members live in the Bashkortostan and Perm regions of the Russian Federation.

K20's results suggest that he is of Caucasus origin in his paternal lineage. Although he matches Rabbinical Jews and non-Jewish West Asian peoples, those relationships are much more distant than his relationships with Caucasus peoples. His earliest Karaite ancestor in this line was probably a non-Israelite who converted to Karaite Judaism.

It is difficult to assess whether or not the samples whose mtDNA haplogroups belong to H and I obtained those lineages from recent West Asian ancestry since their matches sometimes simultaneously include members of Rabbinical Jewish groups, non-Jewish West Asian peoples, and non-Jewish European peoples, consistent with the widespread distribution of their haplogroups. One could speculate that European women might have been the maternal line ancestors of these Karaites, especially samples K03 and K25 who do not match any Jews in the database and have non-Jewish Europeans as their closest matches, but it is equally possible that the common ancestors some of the other samples share with Ashkenazim, Sephardim, and/or Mizrahim were ancient Israelite Jews. Samples like K18 and K23 who match Sephardim and Ashkenazim maternally but have closer matches with non-Jewish Europeans probably did not share a common convert ancestor with their Rabbinical Jewish matches.

Sample K17's mtDNA haplogroup, N1c, is particularly suggestive of West Asian roots and presents what may be the strongest case for Israelite ancestry among the study's Karaite maternal lineages.

The genetic evidence points to a substantial West Asian origin for the Crimean Karaites. This evidence is consistent with the traditional belief that Crimean Karaites descend from the ancient Israelites, who were related to the peoples of the Levant, Arabia, Mesopotamia, and Asia Minor. However, it is also known that all Rabbinical Jewish populations in the world have admixed with non-Israelite peoples, and this phenomenon also happened with Crimean Karaites, as revealed for example by one of the present study's samples whose close relations are Vainakh-speaking ethnic groups of the north Caucasus, the Ingush and Chechens.<sup>8</sup>

Crimean Karaites may also descend from non-Jewish ethnic groups who originated in places like western Europe, the Byzantine Empire, and non-Byzantine Asia. This might be the case for example with the participant whose closest match is English.

As no genetic matches were found between Crimean Karaites and peoples of Central Asia or North Asia or Turkic-speaking peoples of the north Caucasus or the Volga-Ural region, the results revealed in the present article confirm what Shapira wrote that "there is no relationship between the Khazars and the Karaites of Eastern Europe and the Crimea". (Shapira 2007: 64) Nor were haplogroups found in common between Crimean Karaites and those other groups, with the exception of one sample's haplogroup that is common among Turkic-speaking Bashkirs but far from exclusive to

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<sup>8</sup> Unlike Crimean Karaites, Ashkenazim lack genetic elements from the north Caucasus even while they have some from the south Caucasus; see the "Supplementary Figures" section of: Costa, et al., "A substantial prehistoric European ancestry amongst Ashkenazi maternal lineages".

them and there is no reason to believe that the Karaite received his haplogroup from a Bashkir rather than a more westerly European ancestor.

The study also failed to find any genetic link between Crimean Karaites and their Crimean Tatar neighbors despite centuries of cultural exchange between the two groups.

The Crimean Karaites can be called members of the people of Israel with full confidence.

An incomplete look at the genetics of other Karaite communities of eastern Europe will serve as a postscript. In historical times, some Crimean Karaites departed northward to resettle in Lithuania, Poland, and western Ukraine, including the region of Poland and Ukraine that was called Galicia in the days of the Austrian Empire. As a result, historians already knew that these Karaites share part of their ancestry with Crimean Karaites and, beyond them, with other Jews.

I paid for the testing of one Lithuanian Karaite man, while a second Lithuanian Karaite man who tested independently communicated his results to me. A Galician (Halych) Karaite woman from western Ukraine was tested by National Geographic's Genographic Project and I was given full access to her data.

The first Lithuanian Karaite (sample K07) belongs to the Y-DNA haplogroup G2a (G-P15). At the 12-marker level he is one step mutation from two Englishmen, two men from Italy, one man from Poland, one man from Ukraine, and one man from Germany.

The second Lithuanian Karaite's paternal grandfather identified as a Kohen. The grandson was tested to belong to the Y-DNA haplogroup J1c3d (L147.1) and is negative on the single nucleotide polymorphism (SNP) called Z644. This haplogroup is also possessed by many Rabbinical Kohens and this fact correlates with the match I found between a Crimean Karaite and an Ashkenazi Kohen and once again confirms the frequent Israelite roots of East European Karaites.

The Galician Karaite (sample K28, kit number N3232 in the publicly-accessible *Mitochondrial (mtDNA) DNA Haplogroup H & HV Project* at Family Tree DNA) belongs to the mtDNA haplogroup HV-T16311C!. HV is the ancestor of haplogroup H. She has numerous HVR1+HVR2 matches including a Sephardi from Bulgaria, seven people from Ireland, dozens from Germany, one from Croatia, one from Belgium, one from Austria, one from Ukraine, and two from Scotland, among others.

None of these Lithuanian or Galician Karaites genetically match any of the Crimean Karaites in my study, but sample K07's haplogroup is the same one that Crimean Karaite sample K06 has.

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