

On the DNA of the Gotlanders

A first attempt to summarise the information gathered from the Gotland project on Family Tree DNA on the past and present DNA-profiles of the Gotlanders

pissi pieluar hafpi ann sun sum hit hafpi. En hafpa cuna hit huita stierna þaun tu bygðu fyrsti agutlandi fyrstu nat sum þaun saman suafu þa droymdi hennj draumbr. So sum þrir ormar warin slungnir saman j barmj hennar Oc þytti hennj sum þair scriþin yr barmi hennar. þinna draum segþi han firi haþþa bonda sinum hann riap dravm þinna so. Alt ir baugum bundit bo land al þitta warþa oc faum þria syni aiga. þaim gaf hann namn allum o fyðum. guti al gutland aigha graipr al annar haita Oc gunfiauþ þriþi. þair scriptu siþan gutlandi i þria þriþiunga. So at graipr þann elzti laut norþasta þriþiung oc guti miþal þriþiung En gunfiauþ þann yngsti laut sunnarstaⁱ.

The above is an excerpt from the Tales of the Gutes, the saga on the discovery and early history of Gotland. While the Gotlandic saga does not make any claims on the actual creation of man and woman, it states that the island was discovered by Thjelvar. Thjelvar's son Havde and daughter in law Hvitastjerna made Gotland their home and had three sons, Gute, Graip and Gunnfjaun. While the saga very precisely informs its readers of the first persons taking up a permanent residence on the island and having offspring born there, it does not provide any direct evidence of where they came from. The three sons married women that probably came from somewhere else, or were the children of people that had moved to Gotland at a later stage since Havde and Hvitastjerna were presumably rather alone, at least at first. After a while, probably centuries as it takes time to rear children that can themselves have offspring, Gotland was said to be so overpopulated, that there was a forced exodus of about one third of the population.

So far the tale, but what do we actually know about the migration to Gotland, and where the first inhabitants came from? All our ancestors migrated there at some point in time. Human life did not begin there; it arrived there through the daughters of mitochondrial Eve and sons of Y-chromosomal Adam. The question, that we have asked ourselves in the project, is when they arrived in Gotland and where they came from, and how has that contributed to the DNA-tapestry of today's Gotland. Whoever the real life Havde and Hvitastjerna were, and where they came from, the ancient Gotlanders were not likely a very homogeneous group of people but groups of different origins that, over time, formed the population. Gotland is both rich with history and archaeology that allow us to peak into its varied history.

About 10.000 years ago, the ice age slowly released Scandinavia and Gotland from its longstanding grip. The earliest finds of human life on Gotland dates from over 9.000 years agoⁱⁱ, not too long after the withdrawal of the ice. This was in the Mesolithic age, in a hunter-gatherer society, before farming and cattle raising came into the picture. As bones have been preserved in the Gotlandic soil, remains have been tested for DNA to be able to tell the story of the people that came before us.

DNA can tell us a lot about the early history as the haplogroups can tell the story of the individual's ancestry and where they came from. According to the International Society of Genetic Genealogy (ISOGG), the definition of a haplogroup is "a genetic population group of people who share a common ancestor on the patriline or the matriline."ⁱⁱⁱ The paternal line gives us y-DNA through the Y-chromosome and the maternal line provides the mt-DNA. Through the haplogroups, we can trace our ancestry back in time to the beginning of humanity. Over time, the various haplogroups emerged from the children and grandchildren of mitochondrial Eve and Y-chromosomal Adam. Within the haplogroups, mutations occur when a new person is created as genes are not always perfectly copied from parent to child. These mutations separate or divide the main haplogroup into haplotypes (or clades and subclades). As our knowledge grows further, it can tell us with an even greater precision where our ancestors on the direct paternal and maternal line has lived and when they came to a certain place.

Below we have gathered the information available on historic DNA from Gotlandic finds^{iv} with the information available to us on the assessed age of the finds, and what haplogroup the individuals belonged to.

Individual	Sex	Date (B.C.)	Place	Mt-DNA	Y-DNA
SF9	F	7.300 to 6.988	Stora Förvar, Stora Karlsö	U4a2	N/A
SF11	M	7.023 to 7.760	Stora Förvar, Stora Karlsö	U5a1	N/D
SF12	F	7.033 to 6.757	Stora Förvar, Stora Karlsö	U4a1	N/A
SBJ	M	6.963 to 6.579	Stora Bjers, Stenkyrka	U4a1	I2-L68 (I2a1)
Ajvide 4			Ajvide, Eksta	U4	
Ajvide 5				U5a	
Ajvide 13				U4b	
Ajvide 14				H/R	
Ajvide 19				H/R	
Ajvide 29A				U5a	
Ajvide 29B				HV0	
Ajvide 36				U5	
Ajvide 52A	M	~5.000		V	HIJK-F929
Ajvide 52B				U4	
Ajvide53	F	~5.000		U4d	N/A
Ajvide58	M	4.900 - 4.600		U4d	I2a1 I-CTS772
Ajvide59	M	~5.000		U4d	I (PF3796)
Ajvide70	F	~5.000	U4d	N/A	
Fridtorp 4		~3.000	Fridtorp, Västerhejde	U5	
Fridtorp 15		~3.000		U4	
Fridtorp 22		~3.000		U4	
Fridtorp 24		~3.000		U4	
Fridtorp 27		~3.000		U5a	
Fridtorp 28		~3.000		K1a1	
Ire 3		~3.000	Ire, Hangvar	U4	
Ire 4		~3.000		U4	
Ire 5		~3.000		U4	
Ire 6B		~3.000		T2b	
Ire8	M	~3.000		U4d	I2a1b1a1-S2703 I-CTS6343
Ire 9		~3.000		K1a1	
Ansarve 3	F	3.490 – 3.110	Ansarve, Tofta	T2b8	N/A
Ansarve 5	F	3.500 – 3.130		K1a2b	N/A
Ansarve 6	M	3.090 – 2.920		J1c8a	N/D
Ansarve 7	M	3.010 – 2.890		K2b1a	N/D
Ansarve 8	M	3.340 – 3.030		J1c5	I2a1b1a1
Ansarve 9	F	2.890 – 2.630		K2b1a	N/A
Ansarve 10		2.030 – 1.890		U5b2a1a1	
Ansarve 14	M	3.330 – 2.950		J1c5	I2a1b1a1
Ansarve 16	M	2.810 – 2.580		H7d	I2a1b
Ansarve 17	M	3.330 – 2.930	HV0a	I2a1b1a1	
Visby 7B		~3.000	Visby	K1a1	
Visby 30B		~3.000		U5b1	
Visby 32		~3.000		U5a	

Some comments to the table;

- In an excavation in 1888-1893, the remains of ten individuals were found in the cave of Stora Förvar on Stora Karlsö, off the western Gotlandic coast^v. A DNA-sequencing was conducted on the remains^{vi}. The result of the test was that three individuals were of U4 or U5 in the maternal DNA. The material was not sufficient to determine the y-DNA for the male individual tested.
- In 1953, the skeletal remains of a man was found in an old burial ground at the farm Stora Bjers in Stenkyrka^{vii}. Assessed to be some 1.000 years younger than the individuals at Stora Karlsö, he too was U4 on the maternal side. His y-DNA was sequenced as I2 (L68).
- In the 1980's and later on, excavations in Ajvide in Eksta parish (Stora Karlsö is situated off the coast), individuals dating some 5.000 years BC were located. While they also had mt-haplogroup U4 and U5, other mitochondrial haplogroups including H or R, HV and V appears. The y-DNA haplogroups were I2 (now I-M438) and HIJK.
- The excavations in Ire (Hangvar parish) and Fridtorp (Västerhejde parish) as well as Visby (assessed as pitted ware cultures), dating from around 3.000 years BC mostly implied mt-DNA U4 and U5, but there is also one case of K1 and T2 in Ire, and K1 in Visby. The male

haplogroups that could be determined belonged to I2, subclade I2a1b1a1 (now P41.2/M359.2).

- In Ansarve in Tofta parish^{viii}, an excavation found individuals that were dated from around 1.900 years to 3.500 years BC. The number of haplogroups detected expanded to also include mitochondrial clades K1 and K2, T2, J,1 H7 and HV0 as well as U5. The male haplogroups that could be determined belonged to I2, subclade I2a1b1a1 (now P41.2/M359.2).

The finds paint a picture of a Mesolithic society that over time developed and expanded as new waves of settlers came. This is no different from what has been noted in Europe for these times overall. It is here in understanding the development over time that our knowledge as genealogists come into the picture. We know that populations change and evolve as people move throughout history. They may move from the place where they were born, marry people from other places and have children who in turn continue this course of the family. War, raids, famine, general turmoil, climate changes and the quest for a better life, all contribute to migration patterns. As we know that this pattern continues, it is our belief that, to get a better understanding of how the DNA-profile of the Gotlanders arose, and when haplotypes and subclades presented themselves at the island, or even perhaps originated there, it is not sufficient to only look at ancient DNA but at the DNA from more recent history as well. It is our firm belief that "traditional" family research or genealogy can vastly contribute to our knowledge and understanding of how Gotland was populated over time. We admit that there is an undeniable and definite leap in time if we consider the analysis of historic DNA to our present day genealogical research, but we must start somewhere. DNA-analysis is relatively new and, to our knowledge, there has been few, if any, attempts to link the DNA-analysis of living Gotlanders today to the historic DNA, as well as to use the genealogical research made to track the influx/immigration to Gotland.

When we examine the origins of the Gotlanders based on recent DNA from a historical perspective and try to trace and understand the possible migration routes, we cannot only look at present day Sweden but must at least look at the geographical vicinity as well. We know that the historical DNA-finds indicate mixed origins and as such, for this paper, we have defined the geographical vicinity to be Sweden and Denmark, Finland, the Baltic States, Germany and Poland. One could argue that this limitation is too restrictive as it could omit potential finds of significance. However, we would like to point out that if any major find is available that we have noted during the research work, this has been included in the paper.

In the section below we have included the known information on the haplogroups derived from the research of the project members. For reasons of privacy, they are only identified by the kit number. We will start with the mitochondrial side.

Mitochondrial DNA

The mitochondrial DNA (mt-DNA) is inherited from the mother. The mitochondria is actually the circular structure in cells that convert food into energy^{ix}. These cells also contain a small amount of DNA. The structure within the cells that contain the DNA has about 16.000 base pairs that we can use to analyse and track our maternal lineage as the DNA changes over time when it is copied from mother to child. Both the sons and daughters inherit mt-DNA from the mother, but it is only passed on through the daughters.

The mt- DNA contains three areas, HVR1, HVR2 and coding regions. HVR1 and HVR2 means hyper variable region 1 and 2. These two regions are fast changing. The coding region contains some genes and is believed to mutate at a slower pace than HVR1 and 2^x.

The current information on the haplogroups and origin of the project members with a Gotlandic maternal lineage is displayed in the table on the next side.

Haplogroup	Kit	Earliest Gotlandic maternal ancestor						Moved to Gotland Yes/No	Migrated from	
		Name	Born	Place	Dead	Place				
H		IN25333	Brita Olofsdotter					Havdhem?	No	
H	H-C16291T	422436	Johanna Elisabeth von Ojen	1684	Stockholm	1770		Visby	Yes	Stockholm
H	H1a	519100	Margareta Andersdotter	1704		1784		Stora Velinge, Buttle	No	
H	H1aj	MI19628	Margareta Hansdotter	Ca 1737		1797		Ostergårde, Tofta	No	
H	H1c2a	268440	Margareta Helena Olofsdotter	1813	Kyrkjuves, Vänge	1897		Kyrkjuves, Vänge	No	
H	H1c3	724732	Susanna Jacobsdotter	1771	Öja	1812		Alva	No	
H	H17	563541	Pernilla Hansdotter	1738	Sigtors, Havdhem	1792		Bolske, Eke	No	
H	H1o	438486	Göta Alfrida Nygren	1886	Härnösand				Yes	Ängermanland
H	H5a1j	653384	Maria Albrektsdotter	1681	Vinarve, Rone	1753		Gullgårde, Rone	No	
H	H56	480941	Anna Olivia Södergren	1862	Hallinge, Gröttingbo	1923		Stora Kruse, Alva	No	
H	H56	MI16573	Kristina Maria Ahlgren	1859	Burs				No	
H	H7a	IN15164	Sophia Petronella Carolina Landelius	1839	Stockholm	1875		Lyrungs, Lye?	Yes	Stockholm
H	H7b	715201	Esther Linnea Hall Svensson	1899	Vatseröd, Hallaröd	1974		Hemse	Yes	Skåne
H	H24a	N92308	Brita Persdotter	1667	Uggårds, Eksta	1736		Petes, Linde	No	
HV		687601	Karen	1602		1690		Myrungs, Linde	No	
I	I1a1b	682737	Gertrud Nilsdotter	ca 1650	Hamra				No	
I	I1a1b	B131715	Gertrude Jacobsdotter	1732	Siffride, Fide	1806		Rommunds, Fide	No	
I	I3a	449791	Christina Persdotter	1729	Ogges, Rone	1799		Flors, Burs	No	
I	I3a	653385	Christina Persdotter	1729	Ogges, Rone	1799		Flors, Burs	No	
J		IN23740	Anna Christensdotter	1815	Gothem	1883		Tjälder, Boge	No	
J		720607	Hanna Maria Wahlström	1879	Tofta, Uppland				Yes	Uppland
J	J1c2c2	443079	Maria Elisabeth Jonasdatter	1799	Småland			Buttle?	Yes	Småland
J	J1c5a	399100	Margareta Nilsdotter			1630		Visby	No	
T	T1a1e	474815	Brita Larsdotter	1767	Sigleifs, Rute				No	
T	T1a1e	475070	Brita Larsdotter	1767	Sigleifs, Rute				No	
T	T2	683751	Bodilla Nilsdotter	1752		1841		Klinte	No	
T	T2a1b1a1a2	698488	Matilda Christina Jonasdatter	1846	Madesjö			Tofta	Yes	Småland
T	T2b	374590	Maria Shieurman	1728	Kristine, Falun	1797		Dalhem	Yes	Dalarna
T	T2b	495172	Chatarina Persdotter	1735					No	
T	T2f1a1	553929	Johanna Eugenia Lindgren		Hölo, Södermanland			Träkucla	Yes	Södermanland
U	U1a1a2	453240	Anna Maria Ulrika Skifva Johansdotter	1841	Hallingeberg, Småland	1930		Stora Allmungs, Havdhem	Yes	Småland
U	U3a1a	425576	Margareta Henriksdotter	1683	Källunge			Probably Källunge	No	
U	U4a	651365	Anna Nilsdotter	1726		1810		Viklau	No	
U	U5a1b3a1	408766	Anna Maria Zachariasdotter Borgström	1782	Småland	1840		Ekebys, Ganthem	Yes	Småland
U	U5b1-T16189C1-T16192C1	763406	Gertrud Larsdotter	1719	Stora Hellvi, Fole	1765		Grinds, Vallstena	No	
V		468399	Ingrid Nicklasdotter	1820	Rydaholm, Jönköping	1863		Bro	Yes	Småland
V		490773	Maria Lundberg	1712		1778		Othem	No	
V		676542	Swea Ottilia Wallin	1883	Gävle				Yes	Gävle
V		B59462	Anna Olofsdotter	1728	Petsarve, Eke	1815		Hallvide, Eke	No	

Mt-DNA U

As haplogroup U is the oldest one so far located in Gotland, we will let it start our journey. While it was one of the most frequent haplogroups in Mesolithic Europe, the influx of new groups of people over time pushed it aside^{xi}. Haplogroup U is represented among the members of the Gotland project, both through those that have migrated to Gotland in more recent times, but also from those with a known Gotlandic origin. While the haplogroup is believed to have arisen in Western Asia, subclades U4 probably arose in Eastern Europe some 40.000 years ago, and may have expanded into U4a in the Baltic region^{xii}. The origin of U4b is currently attributed to North Eastern Altai in Russia^{xiii}. If researchers believe to have identified the birth places of U4, its sister U5 is a bit more shrouded in mystery. Its age varies between 35- 50.000 years, but it probably originated in Europe as it was present there before the last glacial maximum^{xiv}. U5b1 probably originated in south/central Europe^{xv}. U3 is also present, which has a Near Eastern and Caucasian origin, as well as U1^{xvi}, but both are very rare in the present day geographical vicinity^{xvii}.

In the project, we have three samples from individuals with a direct Gotlandic maternal lineage and two that has migrated to Gotland from Sweden.

Haplogroup U3, or subclades, has not been found (so far) in historic DNA. It is, as stated above, a very rare haplogroup in the geographical vicinity but it has Gotlandic representation. While the ancestor indicated in the table above, Margareta Henriksdotter, born 1684 in Källunge, has been determined to belong to U3a1a. There is a match through Family tree DNA with Butvi Olofsdotter, 1703-1764 from Vamlingbo that belongs to U3 (no mt-DNA Full Sequence test performed). This indicates an older U3-lineage in Gotland, although more evidence is needed. The match to Margareta Henriksdotter through Family Tree indicates a presence of the haplogroup in the geographical vicinity in northern and southern Sweden, Norway, Finland but also in the Baltic states and Poland. This resonates with what we know about U3 and how it is believed to have spread.

Haplogroup U4 has been found in historic DNA in Gotland, both in Stora Förvar, Stora Bjers, Ajvide and Fridtorp. There is one individual in the project with a maternal lineage through U4a with a documented ancestry back to 1726. The defining mutation for haplogroup U4a is C8818T and for U4a1 it is T152C!, A12937G, C16134T^{xviii}. The following mutations have been noted for the Gotlandic historical finds with a U4 haplogroup, where information on HVR1/HVR2-results is available^{xix}. While further analysis would be required, it is not likely, or cannot be determined, that the individuals in U4 belong to U4a.

Site and/or Individual	Sex	Date	mtDNA	Source
Ajvide [Ajv 4]		3000-2400 BC	U4 16093C 16356C	Malmstrom 2015
Fridtorp, Västerhejde, Gotland [Fri 24]		3000-2400 BC	U4 16093C 16356C	Malmstrom 2015
Ire, Hangvar, Gotland [Ire 4, 5]		3000-2400BC	U4 2 samples 16356C	Malmstrom 2015
Ajvide [Ajv 13]		2800-2000 BC	U4 A16129G T16187C C16189T T16223C G16230A C16260T T16278C C16311T T16356C	Malmstrom 2009; Brandt 2013; Malmstrom 2015
Ajvide [Ajv 52b, 66]		2800-2000 BC	U4 2 samples T16093C A16129G T16187C C16189T T16223C G16230A T16278C C16311T T16356C	Malmstrom 2009; Brandt 2013
Ajvide [Ajv 70]	M	2800-2000 BC	U4 T16093C A16129G T16187C C16189T T16223C G16230A T16278C C16311T T16356C	Malmstrom 2009; Skoglund 2012; Brandt 2013; Skoglund 2014
Ajvide [Ajv 53]	F	2800-2000 BC	U4d	Skoglund 2014
Ajvide [Ajv 58]	M	2800-2000 BC	U4d	Skoglund 2014
Fridtorp, Västerhejde, Gotland [Fri 15, 22]		2800-2000 BC	U4 2 samples A16129G T16187C C16189T T16223C G16230A T16278C C16311T T16356C	Malmstrom 2009; Brandt 2013; Malmstrom 2015
Ire, Hangvar, Gotland [Ire 8]	M	2800-2000 BC	U4d T629C A769G A825t A1018G C1224T C1226T G1315A A1811G G2174A G2182A G2185A A2758G C2885T T3594C G4104A G4153A C4189T T4312C C5211T C5974T T5999C A6047G G6075A C6181T G6755A G6993A G7146A T7256C C7412T C7427T A7521G C7974T C7978T C8351T C8375T T8468C T8655C G8701A G8860A G8998A G9192A C9540T C10088T C10213T G10398A T10664C A10688G C10810T C10873T C10915T C11332T A11337G A11467G A11914G A12308G G12372A T12705C G13105A G13276A T13506C T13650C C13860T C14620T C15049T T15693C T16093C A16129G T16187C C16189T T16223C G16230A T16278C C16311T T16356C	Malmstrom 2009; Skoglund 2012; Brandt 2013; Skoglund 2014; Malmstrom 2015
Ire, Hangvar, Gotland [Ire 3]		2800-2000 BC	U4 A16129G T16187C C16189T T16223C G16230A T16278C C16311T T16356C	Malmstrom 2009; Brandt 2013; ; Malmstrom 2015

Haplogroup U5 is readily represented in the historic DNA. In the project, U5a is represented through migration from Sweden and U5b is represented through Gotlandic maternal ancestry. The lineage from Gertrud Larsdotter from Fole has been determined as U5b1-T16189C! -T16192C!. The defining mutations for U5b are C150T, A7768G, and T14182C and for U5b1 it is A5656G^{xx}. The following mutations have been noted for the Gotlandic historical finds with a U5 haplogroup, where information on HVR1/HVR2-results is available^{xxi}.

Site and/or Individual	Sex	Date	mtDNA	Source
Visby, Gotland [Vis 30B]		3000-2400 BC	U5b1 16189C 16192 T 16270T 16362C	Malmstrom 2015
Ajvide [Ajv 54]		2800-2000 BC	U5b A16129G T16187C C16189T T16223C G16230A C16270T T16278C C16311T	Malmstrom 2009; Brandt 2013; Malmstrom 2015
Ajvide [Ajv 36]		2800-2000 BC	U5b2b1a A16129G T16187C C16189T T16223C G16230A C16270T T16278C C16311T T16362C	Malmstrom 2009; Brandt 2013; ; Malmstrom 2015
Ajvide [Ajv 5, 29]		2800-2000 BC	U5a1a'g 2 samples A16129G T16187C C16189T T16223C G16230A C16256T C16270T T16278C C16311T	Malmstrom 2009; Brandt 2013; Malmstrom 2015
Fridtorp [Fri 4]		2800-2000 BC	U5b A16129G, T16187C, C16189T, T16223C, G16230A, C16270T, T16278C, C16311T,	Malmstrom 2009; Brandt 2013; Malmstrom 2015
Fridtorp [Fri 27]		2800-2000 BC	U5a1a'g A16129G, T16187C, C16189T, T16223C, G16230A, C16256T, C16270T, T16278C, C16311T	Malmstrom 2009; Brandt 2013; Malmstrom 2015

When we review the HVR1/HVR2-mutations, we note that the specific mutations of Gertrud Larsdotter of T16189C! -T16192C! do not fully match the historical DNA, however 16189C is present in individual Visby 30B. An individual dating from some 6.000 years BC from Janislawice in Poland has been determined to belong to haplogroup U5b1 with defining mutations 16189C and 16270T^{xxii}. The ancestry of Gertrud Larsdotter may thus be very old in Gotland and the geographical vicinity. Her closest match (zero genetic distance) is a Finnish woman born in 1692. While the zero-genetic distance implies that there is no difference in HVR1, HVR2 or coding regions, it cannot be stated exactly when or where their common maternal ancestor lived^{xxiii}. Since U5b1 is likely to have originated in central/south Europe it may be that they continued up through Central and Eastern Europe and the Baltic States, but where Gertrud Larsdotter's ancestor chose the route to Gotland, and the Finnish woman's ancestor continued towards Finland is not known.

Mt-DNA HV

Haplogroup HV is an old haplogroup that arose some 24 thousand years ago in west Asia, near Caucasus. It is not a very common haplogroup today in our geographical vicinity with less than 1% in Sweden, Finland and Denmark, and some 1-3% in Poland and the Baltic states^{xxiv}. In the historic DNA we have two individuals with haplogroup HV. One is Ajvide 29B with HV0 and Ansarve 17 with HV0a. Both individuals are associated with the pitted ware-culture (Bronze Age).

In the project, there are one individual with a HV-haplogroup with a Gotlandic maternal lineage. For the individual sequenced as HV, a mt-DNA Plus has been used for that test and not a full sequence, thus we do not know the exact haplogroup. A comparison through the HV-project indicates that the individual may be placed in group HV0e due to the existence of mutation T16311C (to be considered as uncertain pending a mt-DNA Full Sequence-test). This group is associated with the corded ware culture from the Bronze Age^{xxv} and while it is not yet represented among the samples of historical DNA, it is an old haplogroup in the geographical vicinity, although it is uncertain when it arrived in Gotland. There are currently no matches through Family Tree that can shed any light on the ancestry and lineage. If this is a sign of a very rare haplotype, or a lack of tested individuals, is not possible to say.

Mt-DNA H

Haplogroup H arose some 20 thousand years ago in South East Asia, and is a mutation of HV. It is one of the most common haplogroups for individuals with a origin from that region. While most subclades are represented in our geographical vicinity, the most frequent ones are H1, H2, H3 and H5. In the samples of ancient DNA, H is however not very frequent. Ajvide 14 and 19 may be H and Ansarve 16 is H7d, but apart from those individuals, it is not present in the material tested.

The Ansarve 16-individual was of H7d. This haplogroup has also been located in the German Baalberge-culture, dating from the Neolithic age^{xxvi}. H7 is believed to have migrated into Gotland from the south of Europe with the rise of farming^{xxvii}. It is not possible to say if many individuals of that age in Gotland also carried H7d, or if this was a smaller group. No individual in the Gotland project has a H7d-haplogroup, however H7a and H7b is present through the lineage of two individuals migrating to

Gotland from mainland Sweden. While H7a has more distant matches mostly outside the geographical vicinity, H7b has an older Swedish and Nordic representation in the matches list on a closer distance.

The most common subclade to H in the project is various subclades of H1 but also H5 and H17. Haplogroup H1 is very common among women of an European decent. It has been discussed if H1 originated in present day France and/or on the Iberian Peninsula during the last ice age and then spread across Europe, developing into further sub-clades^{xxxiii}. In the project, there are two individuals with H1a and H1aj respectively that has a Gotlandic maternal lineage. Neither individual has any close Gotlandic matches and kit MI19628 with H1aj only has three matches, all on a genetic distance of 3, no one Gotlandic but British ancestry, and one that is possibly of Polish decent (no information provided).

H5 is a common find in Neolithic cultures in Europe^{xxx}. It is believed that it came to Europe with farmers from Near East, but the subclade H5a may have originated in Europe^{xxx}. H5 is not present in the historical DNA however in the project it appears to have an older representation in Gotland through Maria Albrektsdotter, born in Rone in 1681. While there are matches through Family Tree, there are no apparent close Gotlandic matches.

H17 appears to have originated in Europe^{xxxi}. It is a smaller subclade and it is not yet fully investigated. One member with a maternal lineage in Gotland belongs to this subclade. The matches on zero distance are difficult to investigate due to the lack of family trees; however appear to be more British and/or German.

H24 is a haplogroup that are found in the Swedish funnel beaker culture, and in other parts of the geographical vicinity including Denmark, Finland, Germany and Poland as well on the the British isles and Spain^{xxxii}. One of the members, sequenced as H24a, has a long matriline on Gotland. It has been traced back to 1667 when Brita Persdotter was born in Uggårds in Eksta parish. Her closest matches all appear to be of a British decent. The funnel beaker culture (Stone Age culture) was present in Gotland^{xxxiii}. It is tantalising to think that Brita's ancestors may have been in Gotland for a few thousand years. While there is no historical find in Gotland with H24, the Gökhem 7-individual from Västergötland in mainland Sweden has been sequenced as H24, thus placing it in the geographical vicinity.

H56 is believed to have originated after the last ice age and is today more frequent in Northern Europe^{xxxiv}. Two members with a maternal lineage in Gotland belongs to this subclade. While both have a Gotlandic lineage, the two members appear at a genetic distance of three, implying that three mutations are not shared. The closer genetic matches appear to have a British and/or German origin. It is difficult to determine exactly how this should be interpreted, however it indicates that the shared maternal ancestor is distant. It could indicate separate migrations to Gotland of the H56 lineage, arriving at different times, while having the same distant maternal ancestor. It could however also indicate migration from Gotland to other countries. Further research and samples of H56 with a Gotlandic lineage would be needed to be able to fully answer this question.

In Europe, individuals from Mesolithic Europe have been sequenced as H1, H2, H3, H7, H10, H11a, H16, H20 and H89^{xxxv}. Still, there are to date few historical finds in Gotland sequenced as H. In comparison, individuals with haplogroup H have been found to a greater extent in Sweden, but also in other parts of the geographical vicinity. This includes the following finds (please note that none of the find is Gotlandic)^{xxxvi}:

Site and/or Individual		mtDNA
Res20	Resmo, Öland	H/R
Gok7	Gökhem, Västergötland	H24
Gok2	Gökhem, Västergötland	H
Gok4	Gökhem, Västergötland	H
GE44 (KOP32)	Köpingsvik, Öland	H1f
RISE00	Sope, Estonia	H5a1
RISE42	Marbjerg, Denmark	H2c1
RISE145	Polwica, Poland	H6a1b
RISE71	Falshoj, Denmark	H3b
RISE562	Landau an der Isar, Germany	H2a1e
RISE559	Augsburg, Germany	H

This contrasts with the lack of haplogroup H-sequenced Gotlandic individuals. In further contrast to this, haplogroup H is quite common among the members in the project with a Gotlandic female ancestor of more recent history. While we have argued that the number of samples tested does not represent a statistical section of the population, based on the information available, a more frequent representation of other subclades of H could be a later introduction to the Gotlandic DNA- tapestry than in the rest of Europe.

Mt-DNA I

Haplogroup I, while now relatively rare in the geographical vicinity, was more frequent foremost in Denmark during the Iron Age (around 1.200 BC to 550 AD) and the Viking age (793–1066 AD). While competition from other groups probably caused it to reduce, it is still found in Europe^{xxxvii}. Where this leaves Gotland, due to its specific location and well known trade routes, is not clear. No individual sequenced as mtDNA I, have been noted in Palaeolithic, Mesolithic or Neolithic Europe, but is was first noted in Catalonia some 3.500 to 3.000 years BC, before starting to appear at a more regular basis during the early Bronze Age^{xxxviii}. This implies a later migration to Gotland

While haplogroup I is not represented on the maternal side of the historic DNA that has been analysed, it is present among the members of the projects. Three individual with a maternal lineage have been sequenced as I. Two belong to subclade I1a1b and the third one to I3a. The two individuals in subclade I1a1b have a 0-genetic distance according to Family Tree. While this indicates a shared maternal ancestor, it is not possible to determine exactly when she may have lived. The other matches on a 0-genetic distance are predominantly of a French lineage. Matches on a genetic distance of 1 appear mostly to be of British origin, but there is also an Icelandic match and on a 2-genetic distance, women of a Swedish lineage appear.

There are two individuals that have I3a that has indicated the same ancestor, Christina Persdotter born in 1729 in Rone parish. What we noted during the research is that these two individuals, who have a shared ancestor, is at a genetic distance of 2 to each other. This indicates that the mtDNA has two mutations that has originated in Gotland. A comparison indicates that there are two mutations in HVR2, 573.3C and 573.4C that is present in 653385 but not in 449791. As the maternal lineage for 653385 is Gotlandic, we can say that these two mutations originated in Gotland. The individuals with I3a have few other matches. The other individuals designated as matches by Family Tree, appear to be of a British, German or Russian/Eastern European descent with no apparent Gotlandic lineage.

It may be that women of haplogroup I migrated to Gotland and Denmark in a higher frequency than to the rest of the geographical vicinity, however this would not be possible to determine without further tests of the Gotlandic population. Further tested individuals with a Gotlandic maternal lineage would be needed to determine when the mutations originated and if haplogroup I is more common in Gotland.

Mt-DNA J

Haplogroup J arose some 45.000 years ago, probably in the Middle East^{xxxix}. It is quite evenly spread in the geographical vicinity at some 5-10% assessed coverage. While it has been assumed it spread from Southern Europe after the ice started to withdraw, scientists are also discussing if J took refuge in the Near East during the last glacial maximum and spread to Europe from there^{xl}. The subclade J1c is fairly common today among the individuals with an origin in Europe and the geographical vicinity. Exactly from where it came is debated but it is present in finds of historic DNA in Gotland and the geographical vicinity^{xli}.

Based on the samples available from historical DNA, women of a J-lineage lived in historic Gotland. Two are classified as J after a mtDNA Plus. An attempt to analyse the subclades was not possible. Of the finds noted, two individuals have been sequenced as belonging to J1c2c2 and J1c5. In the project, haplotype J1c2c2 is present through migration from Sweden. The Gotlandic maternal lineage present in J1c5, traced to Margareta Nilsson, dead in 1630 in Visby, has close matches predominantly in Norway, southern Sweden and Eastern Europe. There is however no match as early dated as Margareta Nilsson. The defining mutation for J1c5 is T12453C and A15113G for J1c5a^{xlii}, however we have not found information on the Ansarve 8 individual to be able to investigate if it can be placed in a further subclade to J1c5.

Mt-DNA T

Haplogroup T originated some 29.000 years ago, most likely in the east Mediterranean area/Near East. It has two main subclades, T1 and T2, which were formed in the end of the ice age^{xliii}. Haplotype T, both T1 and T2, occurs in some 10% of the women with a maternal lineage in the geographical vicinity^{xliv}. In historical finds, the haplotype has been noted in the Yamna culture^{xlv}. Human remains from the late Mesolithic area have been sequenced as T (assumed T1a and sequenced T2b), implying it could be an old haplogroup in the geographical vicinity^{xlvi}. T is also present in the finds of historical DNA from Gotland through the subclade T2b8 through the Ansarve 3 individual.

In the project, two members with a maternal Gotlandic lineage belong to T1a1e through the same ancestor, Brita Larsdotter born in 1767 in Sigeleifs in Rute parish. Both members have an 0 genetic distance, indicating that no mutation has occurred. There are few other matches. These are of a predominantly southern Swedish descent. The third individual with a maternal lineage in Gotland belong to T2. Bodilla Nilsdotter, dead in 1841 in Klinte is the earliest identified maternal ancestor for this line. There are no matches for Bodilla Nilsdotter's maternal lineage through Family Tree.

Two members have been sequenced as T2b, of which one line has migrated to Gotland from the province of Dalarna and one has a maternal lineage to Gotland from Catharina Persdotter, born in 1735. It is interesting to see that the T2b-lineage that has migrated to Gotland has many matches, both Swedish and other ones; however the lineage of Catharina Persdotter has only 10 matches. The closest match (0 genetic distances) is to Catarina Jacobsdotter and her daughter Helena Larsdotter, born in 1760 in Ala, Rute parish. This indicates that the T2b-lineage has an old Gotlandic branch. The 1 genetic distance matches are predominantly from Finland and the 3 distance genetic matches from Germany, Sweden and Norway. There is however no match to the other T2b from Dalarna. While they had a common ancestor in their maternal lineages, it is not recent.

Mt-DNA V

Haplogroup V probably originated in the west Mediterranean region, possibly the Iberian peninsula, around 14 thousand years ago. It spread from there across Europe and today it exists in pockets. One of these pockets is Scandinavia where it is especially linked to the Saamis. Apart from there, it is also present in Basque, as well as in Western and North Africa^{xlvii}. In historical finds in the geographical vicinity, the haplotype has been noted in Neolithic finds in Germany dating some 5000 years BC. The finds were determined to belong to the Linear Pottery-culture^{xlviii}. In the historical Gotlandic finds haplogroup V was noted in the Ajvide 36 individual.

In the project, there are 4 individuals who has haplogroup V, of which two has a Gotlandic maternal lineage. The first one with the earliest maternal ancestor being Maria Lundberg, dead in Othem in 1778, does not have any 0 genetic distance matches on Family Tree. The 1 genetic distance matches are predominantly of a Norwegian descent and then of an apparent descent from the British Isles. The other lineage through Anna Olofsdotter from Eke, predominantly has matches with an apparent eastern European lineage, while there are fewer matches of a Swedish lineage. The members with a Gotlandic descent do not appear in each other's match lists through Family Tree. This indicates that the common ancestor lived a long time ago or immigration of haplogroup V in various waves to Gotland.

Mt-DNA W

Haplogroup W is a rare haplotype and does not always get the attention it deserves. It originated up to 37.000 years ago in northern India or north-western Pakistan^{xlix}. While there are no known historical finds from Gotland that has been sequenced as W, we would expect it to be located in Gotland as it is associated with early European history.

In the project, we have one individual sequenced as W5. This line can be traced to Anna Christina Enquist, 1773-1880, living in Stockholm. There is to date no documented lineage of her ancestry, a brick wall for her great great great grandson. While it has not yet been established that the origins of Anna Christina can be traced to Gotland, the extensive research made to solve the mystery of her unknown ancestry, has led to a presumed maternal lineage with women with a Gotlandic origin and a possible Gotlandic mutation in the clade HVR1. Through the research, her 4 times grandson has

located lineage where women of a Gotlandic origin appear to be relatives of women in Prussia and Estonia. Through a comparison of the mt-DNA, she appears to have Gotlandic lineages back to three Gotlandic female lineages that are traced back to the beginning of the 18th century. We want to underline that this is a theory in the search of an unknown branch of the family tree, but it is nevertheless a very interesting story that we will continue to follow from the project. However, at least three women with a documented W5 mtDNA-haplotype could indicate that W5 is more common in Gotland. This could however only be determined through further testing.

Mt-DNA K

In the project, there are no participants with haplotype K. In the historic samples we have two individuals, Ansarve 9 and Visby 7B with K2b1a and K1a1 respectively. Haplogroup K has been noted in early European farmers dated some 5.300-5.000 BC, and used to be more frequent than the current extent of some 10% of women with a European lineageⁱ. While the haplogroup arose in West Asia some 20-38.000 years ago, it is now believed that K2b1 originated in Eastern Europe during the Mesolithic age and spread from there. In contrast to that, the subclade K1a originated in the Near East and spread with farming practices. The subclade of the Visby 7B individual has been found in north western Anatolia in today's Turkeyⁱⁱ. The absence of the maternal lineage K in the project implies that we have not yet had the chance to study the presence of this haplotype in Gotland and see what subclades are represented, either through migration or through older Gotlandic lineages.

Y-DNA

The Y-chromosome is passed from father to son. Through the testing of sections of the chromosome, which contain DNA, geneticists can determine the haplogroup, and thus the origin of the patrilineⁱⁱⁱ. These sections are called "markers" and it is possible to test from 12 up to 500 (or now 700 through Family Tree). The markers are also called Short Tandem Repeats (STR). This consists of so called nucleotides, which occurs in a row on the DNA-strandⁱⁱⁱⁱ. Through analysing the STR, geneticists can determine if two, or more, men are related.

In the table below we have included the known information on the haplogroups derived from the research of the project members. We have chosen to also include the old denominations in the table for reasons of clarity. As well as the main haplogroup, we have also included information on haplotypes that the members have been sequenced in, when available.

Haplogrupp		Kit	Earliest Gotlandic paternal ancestor					Moved to Gotland	Migrated from	
				Name	Born	Place	Dead	Place		Yes/No
G	G-M201		680955	Olof Willartzsson	1655	Linde	1716	Petes, Linde	No	
I1	I-M253	BY54261	438212	Nils Peter Samuelsson Appelquist	1831	Stocknäs, Södra Solberga, Småland	1915	Atheime, Buttie	Yes	Småland
I1	I-M253	P109	318523	Lars Jacobsson	1692		1765	Käbbe, Eksta	No	
I1	I-M253	I-BY35249	IN57497	Johan Hagetorn	1648		1712	Stånga	No	
I1	I-M253	Y7925	611605	Per Bjers		Sannolikt Bjers, Endre	1694	Bjers, Endre	No	
I1	I-M253	BY48212	647217	Carl Magnus Andersson	1843	Tjuvhult, Ryssby	1922	Autsarve, Rone	Yes	Småland
I1	I-M253	S12289	438486	Per	ca 1490	Pilungs, Måsterby			No	
I1	I-M253		268440	Otto Bernhard Karlsson	1891	Husgöl, Sillhövda, Blekinge	1974	Endre	Yes	Blekinge
I1	I-M253		399100	Gustav Oskar Thorell	1851	Kävlebo, Ätvid, Östergötland	1938	Kvie, Martebo	Yes	Östergötland
I1	I-M253		510363	John Axel Nyman	1890	Maria Magdalena, Stockholm	1918	Suderbys, Västerhejde	Yes	Stockholm
I1	I-M253		651365	Sigfrid Larsson	före 1594		efter 1651	Otemars, Othem	No	
I1	I-M253		BP11977	Oskar Vilhelm Pettersson	1858	Allmungs grund, Havdhem	1921	Stora Kruse, Alva	No	
I1	I-M253		IN24573	Nils Nygren	1811	Hellvi	1840	Hellvi	No	
I1	I-M253		MI19607	Erik August Karlsson	1877	Askaremåla, Ryssby	1958	Romakloster	Yes	Småland
I1	I-M253		MI19627	Olof Petter Klintberg	1842	Malms, Hellvi	1926	Hellvi	No	
I1	I-M253		IN45874	Nils Temmesson	1733	Norrgårde, Hellvi	1804	Norrgårde, Hellvi	No	
I1	I-M253		239089	Johan Magnusson Falck	1740	Visby	1821	Anderse, Fide	No	
I1	I-M253		N38225	Lauritz Hansson	ca 1600			Simunde, Vamlingbo	No	
I2	P215	I-M223 - Y20046	438175	Hans Larsson	1701	Bara, Ethelhem	1749	Ollajvs, Alskog	No	
N	N-M231		519100	Hans Sandström	1800		1861	Gammelgarn	No	
R1a	R-M198		653384	Anders Pehrsson	1628		1696	Stora Gläves, Burs	No	
R1a	R-M198		761306	Nils Larsson	1656	Färö	1731	Färö	No	
R1a	R-M198		IN18736	Oskar Melcher Söderberg	1876	Stockholm			Yes	Stockholm
R1a	R-M198		IN46582	Thomas Andersson	1673		1746	Alands, Burs	No	
R1a	R-M512		408766	Victor Vilhelm Björkander	1863	Gnsvärd, Tofta	1935	Visby	No	
R1a	R-M458	R-YP263	338076	Tomas Mårtensson			1732	Runne, Sanda	No	
R1b	R-M269		651793	Nicklas Hugo Larsson		Lunde	1974	Stockholm	No	
R1b	R-M269		666671	Christian Wilhelm Philip Schartau	1772	Mellanköpinge, Kyrkököpinge			Yes	Skåne
R1b	R-M269		IN25333	Karl-Axel Karlsson	1903	Stöde, Sundsvall	1976	Smis, Linde	Yes	Sundsvall
R1b	R-M269		IN26214	Jacob Jacobsson			1771	Linhatte, Vall	No	
R1b	R-M269	R-CTS5533	579206	Per Olofsson	1782	Bara, Hörsne		Lilla Hulte, Endre?	No	

Y-DNA I

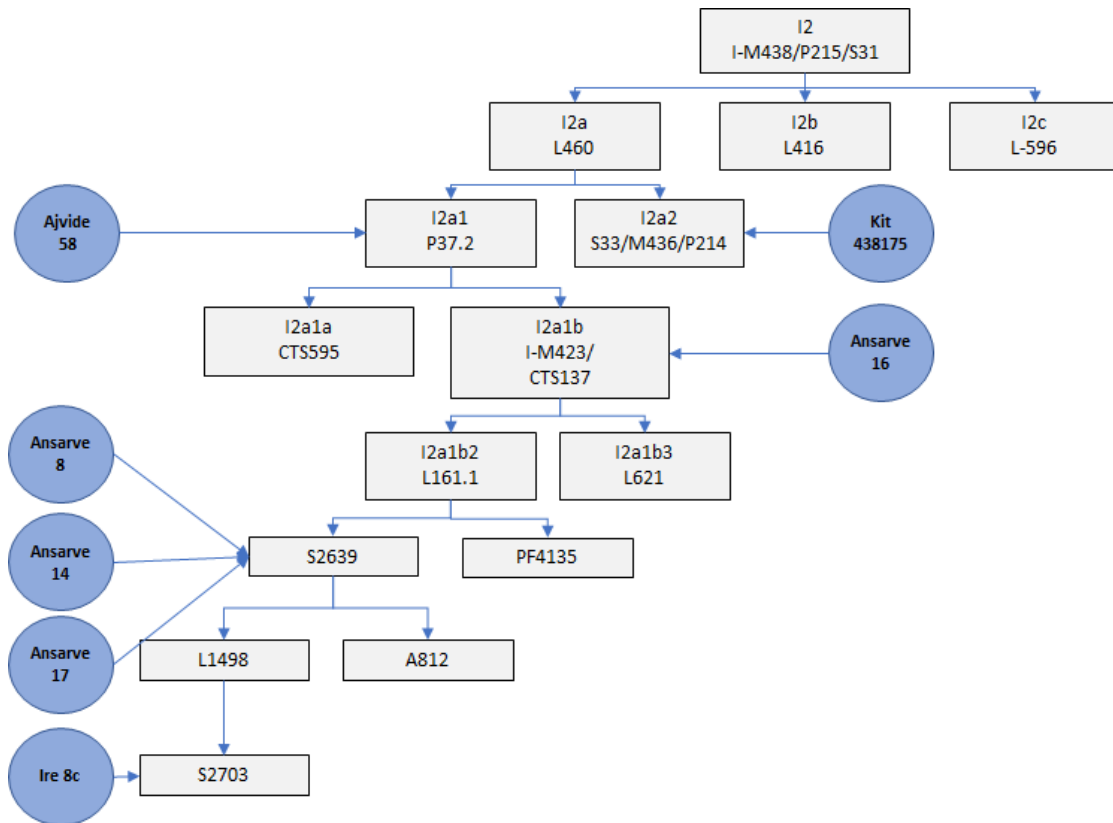
Haplogroup I probably arose in Europe some 45.000 years ago, in what is now northern France or Germany. It is one of the most frequent male haplogroups in parts of the geographical vicinity with some 35-40% in Sweden, Denmark and Finland, most in I-M253 (or I1), but at lower numbers in the other parts of the geographical vicinity^{liv}. It is estimated to have originated in northern France/Germany some 40-50,000 years ago. Haplogroup I has undergone a great expansion and split into two main haplogroups, I1 and I2. Exactly when the split occurred is debated, but probably around 30,000 years ago. I2 originated probably in Western Europe although that has not yet been finally determined^{lv}. I1 (I-M253) probably originated in northern Germany, close to the salt mines in Halle-Saale^{lvi}.

In the project, we have mostly I1, now known as I-M253 and further subclades. In the historical DNA, we do not have any representative for I1 but for I2, so let us begin with that one.

Haplogroup I2 (I-M438) was the main male haplogroup in Mesolithic Europe until some 6.000 years B.C^{lvii}. There are not many individuals in the historical Gotlandic finds for whom it has been possible to determine the haplogroup, but all of them for whom this has been accomplished, have been sequenced as I2 (I-M438). If we go back to historic days, I2 was a frequent male haplogroup until I1 (I-M253) for some reason pushed it to the side. In the historic DNA, some 6 individuals have been sequenced as I2 and further subclades. The man in Stora Bjers and Ajvide 58 were sequenced as I2 subclade I2a1 (I-M438 subclade I-P237.2+ or I-L68). Further analysis undertaken by other geneticists indicates that the Ajvide 58-individual could be placed as I-CTS772 (PF3631). This subclade indicates ancestry from Eastern Europe, where it is the main male haplogroup^{lviii}. Ajvide 59, that lived perhaps not exactly the same time as Ajvide 58, but at least rather near in time, has been sequenced as I-PF3796 by other geneticists. I-PF3796 is a subclade to haplogroup I (I-M170) and is thus not placed in either I2 (I-M438) or I1 (I-M253)

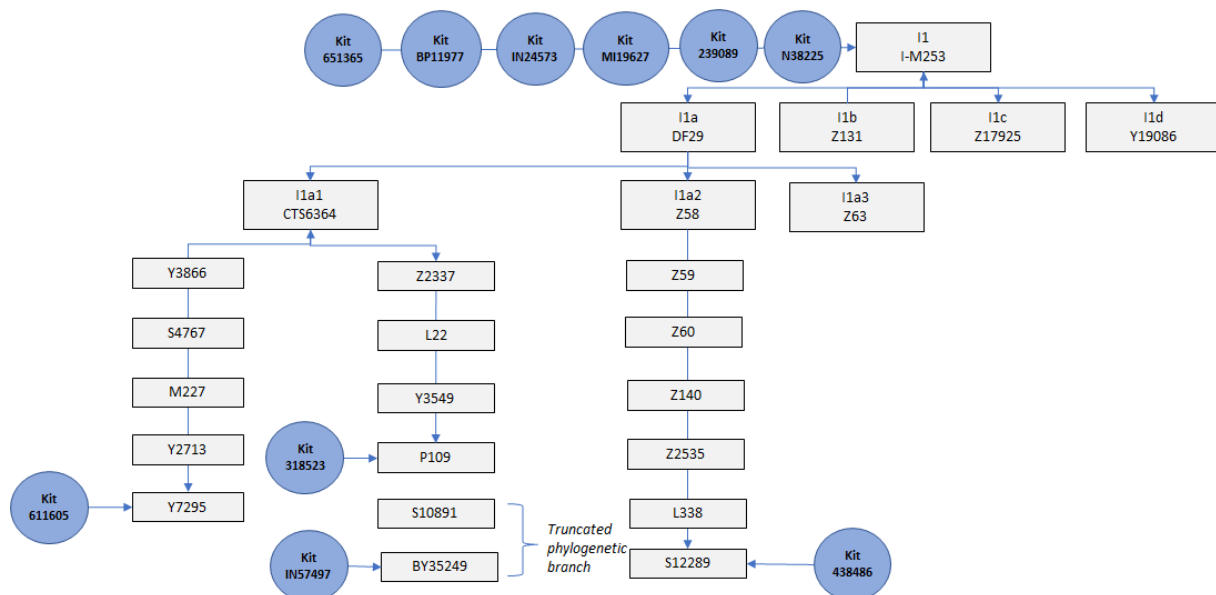
The Ire8-male has been sequenced as I2a1b1a1 (S2703). The I2a1b1a1/S2703 subclade was found on the British Isles including Ireland, but also in Sweden, Germany and Poland and arose somewhere between Neolithic and the Bronze Age^{lix}. The same haplotype I2a1b1a1/S2703 has been established in Ansarve14 and 16, while Ansarve 18 has been sequenced as far as I2a1b (now I-M423). In the geographical vicinity, the Motala 12-man and the Loschbour-man has also been sequenced as I2 (I2a or L-460)

In the project, there is one tested individual that has been sequenced as I2 (P215). Through a BigY-test, he has been further sequenced into the subclade I2a through to I - M223 and Y20046 (full phylogenetic branch not shown in the image below). The family tree in this case goes back to 1701, indicating a longer presence of the lineage in Gotland. I-M223 (what was I2a2), originated some 13-21.000 years ago^{lx}. If we compare the I2-males in historic DNA and kit 438175, we note that while they had a common ancestor, he lived more than 20.000 years ago. The Gotlandic finds that has been possible to sequence are all in one haplotype I2a1 or goes through to I2a1b and further subclades^{lxi}.



I2 was pushed to the side by I1 probably sometime during the Bronze Age^{lxii}, and is now estimated to include less than 1% to some 5% of the males in the geographical vicinity^{lxiii}. It would be interesting to see if there is a greater representation of I2 in Gotland or not. Only further testing could determine this.

If we look at I1 (I-M253), it is not represented in the Gotlandic historical finds. The earliest find of I1 in historical DNA in the geographical vicinity is from Bronze Age Germany and Hungary. Some 16 individuals in the project belong to I1, and further subclades. Of these, 10 have a Gotlandic paternal lineage going back in time. Of these 10 individuals, two have been tested belong to the subclade I-P109, of which one has been placed in I-BY35349 through a Big Y-test one to Y-7925 and one to S12289. Those are the ones we can look at more closely in a phylogenetic tree^{lxiv} as they have done further analysis.



Through the phylogenetic tree, we note that three of four the kits belong to subclades of I1a1, or CTS6364. But despite that, the common ancestor is some 6.000 years away.

The kits 318523 and IN57497 both belong to P109 through the L22 subclade and kit IN57497 has been placed in BY35249. L22 is estimated to be around 4.000 years old and includes a large part of the male population with a Scandinavian descent. The age indicates it could have originated during the Battle-Axe culture (from around 2.900 BC)^{lxv}. While there are indications that the Battle Axe-culture was not adopted in Gotland^{lxvi}, this does not prevent that members of P109 migrated to Gotland. P109 is today most frequent in southern Scandinavia and descendants of Danish Vikings^{lxvii}. However, despite belonging to the same subclade, the two kits have a genetic distance of 2 only at Y12-level. This indicates that their common ancestor lived a very long time ago. Kit 318523 appear to have closer links to other kits only sequenced as I-M253. The same applies for kit IN57497. It appears that Gotlandic P109-members are not necessarily closely linked, which may indicate separate migration to Gotland or very long presence of the haplotype, leading to diverse groups being developed.

Kit 611605 is sequenced through I-M227 through to SNP Y7925. While a subclade of I-M253, it does not belong to the Scandinavian cluster L22. I-M227 is found at lower rates in Scandinavia but are also found in the Baltic countries and Eastern Europe. It has been suggested that this is attributed to the Vikings that travelled eastward and other earlier migration from Scandinavia^{lxviii}. It would be interesting to see if further test of men of a Gotlandic paternal lineage would reveal further persons belonging to this haplotype, especially with regards to the tradition that Gotlanders travelled eastwards in those times, earlier as well as later.

In the project, most members sequenced as I1 (I-M253) has not done further testing and can as such not be placed in a further subclade. When we compare the project members to each other through the genetic distance-reports available through Family Tree, using the Y37-marker level, we note that there are members that would probably be sequenced in the L22-subclade as well as I-M227, based on the calculated genetic difference. When we used the further sequenced members as comparison, as well as for members currently in the I-M253 clade, we note that it spans from a 0 genetic distance, indicating a common ancestor in the time span of 500-1.000 years, as well as a higher genetic distance that places the common paternal ancestor further back in time. For more comparisons and research, we hope that more project members do further tests so that we can better trace and understand their ancestry. Overall, when the haplotype I-M253 first set foot on Gotland is not possible to say, may it be Bronze Age or later in history. However, there have most likely been many waves of immigration to Gotland of bearer of that particular haplogroup.

When we investigate the genetic distance between these men to determine if there is a common ancestor in Gotland, and if I-M253 has continued to evolve in Gotland, we noted that, while all men belonging to I-M253 has common ancestry, this common ancestor lived further back than perhaps expected. Through the analysis performed, the ancestors of the men in I-M253 and subclades, also for the individuals with a long history of Gotlandic paternal lineage, seem to indicate a migration to Gotland of males that, while belonging to I-M253, was of a separate direct paternal lineage. Many of the tested individuals have not tested for further subclades, which could shine more light on this matter.

Y-DNA G

The G-haplogroup is thought to have originated in Western Asia some 26.000 years ago. While the descendants have spread across the world, it is a rare haplogroup in our geographical vicinity. G is thought to have come with the Middle Eastern farmers some 6.000 years ago, the populations that spread farming practices to Europe. Its most famous member is Ötzi the iceman, who was sequenced as G-L91 (formerly G2a2b)^{lxix}. In Sweden, the haplogroup is perhaps most known for those researching into the Bure-family where Johan Bure's claims on his heritage were proven to be rather accurate by modern DNA-technology. The "Bure-mutation" Z30729 is also a subclade to G2 and Bure relatives carry either GY30009 (Burträsk), G-Y40024 (Burman), G-Y93397 (Kusmark) and G-Y16788 (Falmark)^{lxx}. These are downstream clades of G2a2b (G-L91) etc. This implies that Ötzi and the Bure family actually have a common ancestor, albeit thousands of years ago.

While rare in the geographical vicinity, there are 5 project members with G as their paternal lineage. The one sequenced member that has stated a Gotlandic paternal lineage is only sequenced as G (G-M201). While only a few matches at a genetic distance of 4, the matches for the G-M201-kit is predominantly of a Grecian and Eastern European descent. There are furthermore no matches between kit 680955 and the other members sequenced as G, even at a y-DNA 12-marker level. That the other members has not stated a heritage renders the analysis more difficult, however if they are of a Gotlandic descent this implies that G-haplogroup carriers have migrated at different times to Gotland. There are further members sequenced as G-M201 that has not stated a heritage. As there are matches between some of the individuals there may be some connections. Further testing would however be required to determinate the subclade to understand how and when they came to Gotland and if any paternal lineage from the first migration of farmers are still present in the island.

Y-DNA N

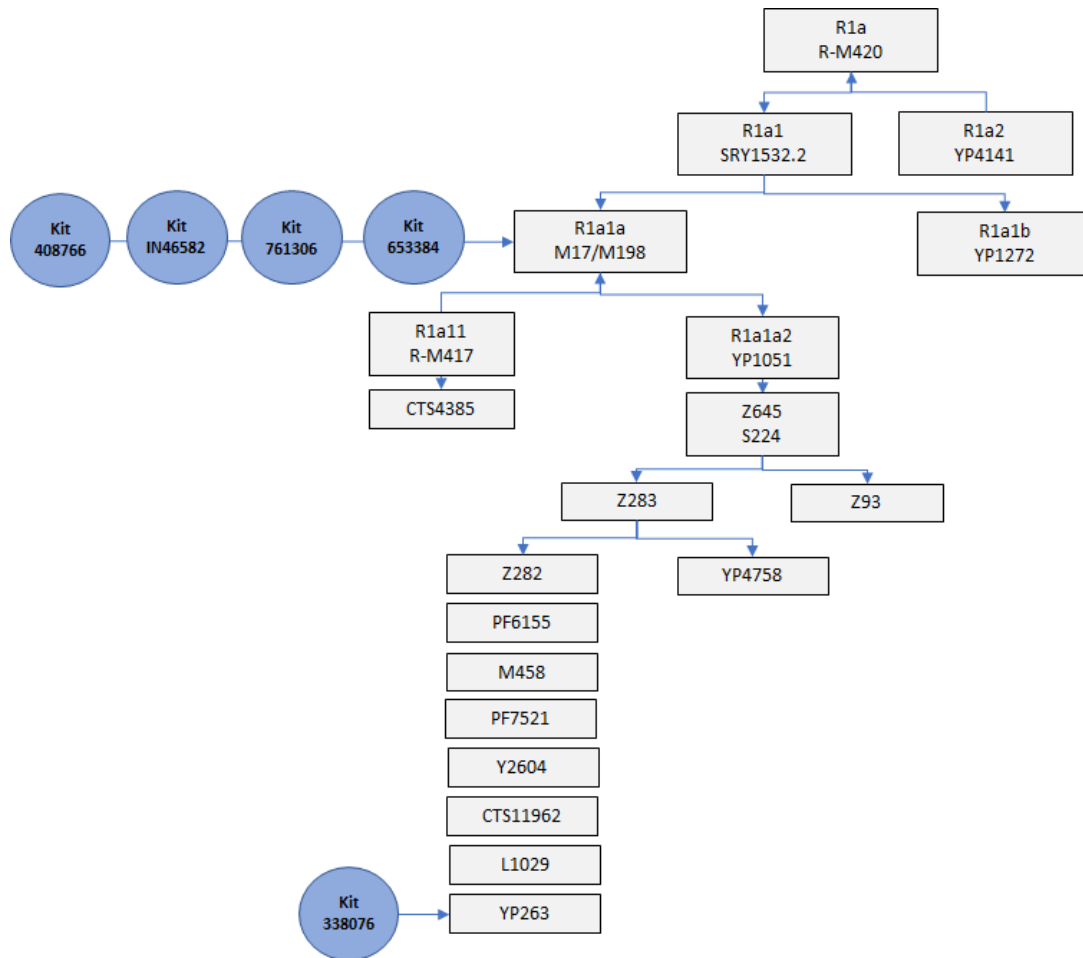
Haplogroup N, while fairly common in Sweden at an estimated 7% of the male population, it is more frequent in other parts of the geographical vicinity including Finland, the Baltic States and Poland. It probably originated some 20-30.000 years ago in Eurasia^{lxxi} and came to Gotland from east. In the project, we have one member belonging to N (N-M231). The matches at Family Tree, while fairly distant at a genetic difference of 6 or 7 at y-DNA 67 markers, indicate mainly Finnish connections. Any migration to Gotland of N may have come both from Finland, the Baltic States and/or Poland.

Y-DNA R

Besides I, the other major haplogroup in the geographical vicinity is R. R originated some 27.000 years ago in central or South Asia^{lxxii}. This haplogroup divides into R1a (now R-M420) and R1b (now R-M343). In the Gotlandic historical finds, there are no known finds sequenced as R. If we look in the geographical vicinity, the RISE 98 from Lilla Beddinge in Sweden was sequenced as R-M405^{lxxiii}, implying he was of R1b, a Proto-Germanic branch^{lxxiv}.

According to Karin Bojs and Peter Sjölund in "The Swedes and their fathers", the men of R brought not only their paternal lineage, but also the Swedish words for wheel, ox and so on, words in use to this day^{lxxv}. It is tantalising to think that the men of R also could have affected the Guthnic language. But let us return to the DNA. Based on the results of the project members, R is the other major haplogroup in Gotland, besides I1. We have both carriers of R1a and R 1b. It was to be expected that these would be frequent haplogroups besides I-M253.

If we first look at R1a, or R-M420, six project members are sequenced as R-M420. Of these, five has a Gotlandic patriline. The place of the haplogroups in the phylogenetic tree^{lxxvi} is as follows:

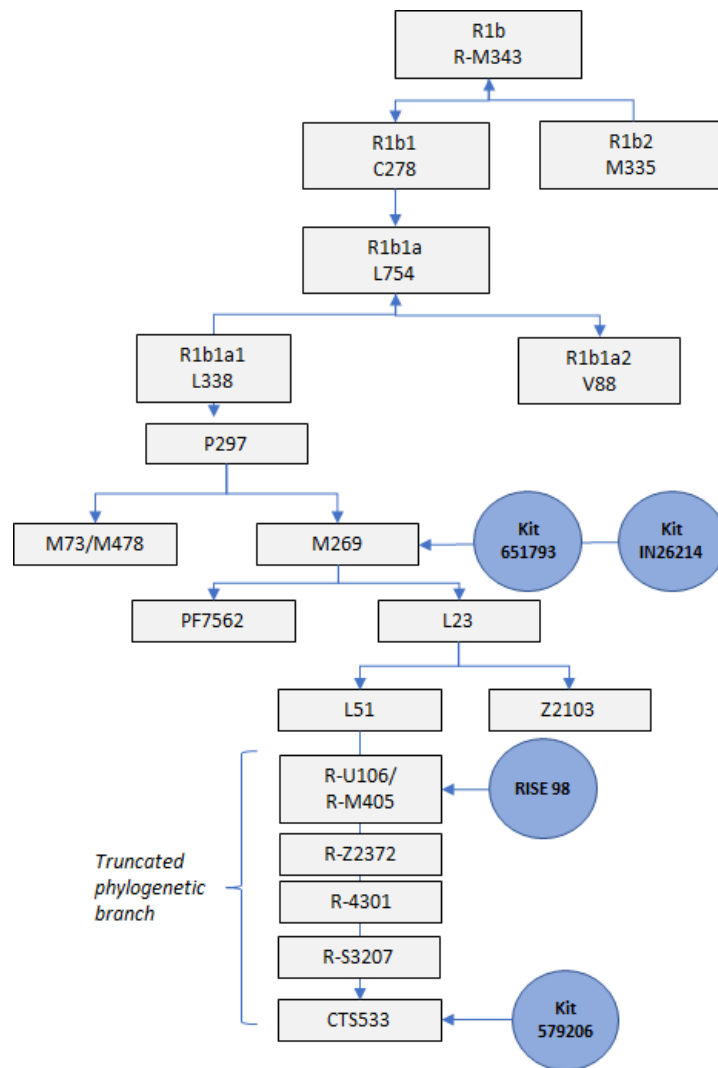


Four has been sequenced at R-M198 (nowadays also labelled as R-M512). This haplotype is associated with Mesolithic north-east Europe^{lxvii}. Further analysis of their y-DNA would place them into further subclades and could shed light on the migration of their patriline to Gotland.

One member has been sequenced as R-M458 - YP263. R-M458 is considered as mainly a Slavic subclade with representation in Poland, Czech Republic, Slovakia, Ukraine and northwest Russia. It is separate from the Scandinavian subclade Z284, but belongs to the Z283 subclade. This is more considered as a Central and Eastern European subclade. R-M458 is not a common haplotype in Scandinavia, but is more frequent in other parts of the geographical vicinity, foremost Poland^{lxviii}. It is a very interesting sequencing. It indicates a migration of R1a to Gotland not through Scandinavia but directly from Central and Eastern Europe. The matches on a Y37-level includes mostly individuals with an apparent Eastern European descent, but also some Swedish matches.

When comparing the members to each other through the Family Tree genetic distance report at a Y-37 level, there does not appear to be any close relationship within 0-1 genetic distance (indicating a relationship within 500-1.000 years). There is however a genetic distance of 2 and upwards between some project members, indicating that there are a common ancestor, albeit perhaps from 2.000 years ago and upwards. The genetic matches with other individuals than those in the project vary. Some members have few close matches while some have more. The matches are predominantly of a Scandinavian (mostly Swedish) but also Eastern European descent. This can indicate that the earlier R1a- individuals migrated into Gotland from Germany/Eastern Europe rather than from Scandinavia.

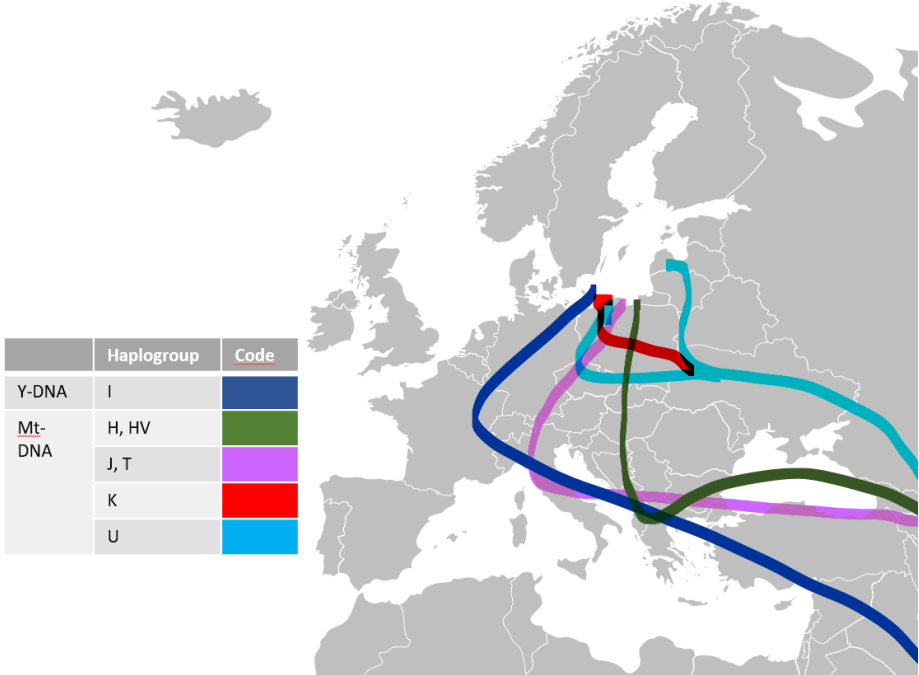
If we look at group R1b, or R-M343, five project members are placed in this haplogroup. Of them, three has a Gotlandic paternal lineage. All these three sequenced belong to the R-M269 subclade^{lxix}.



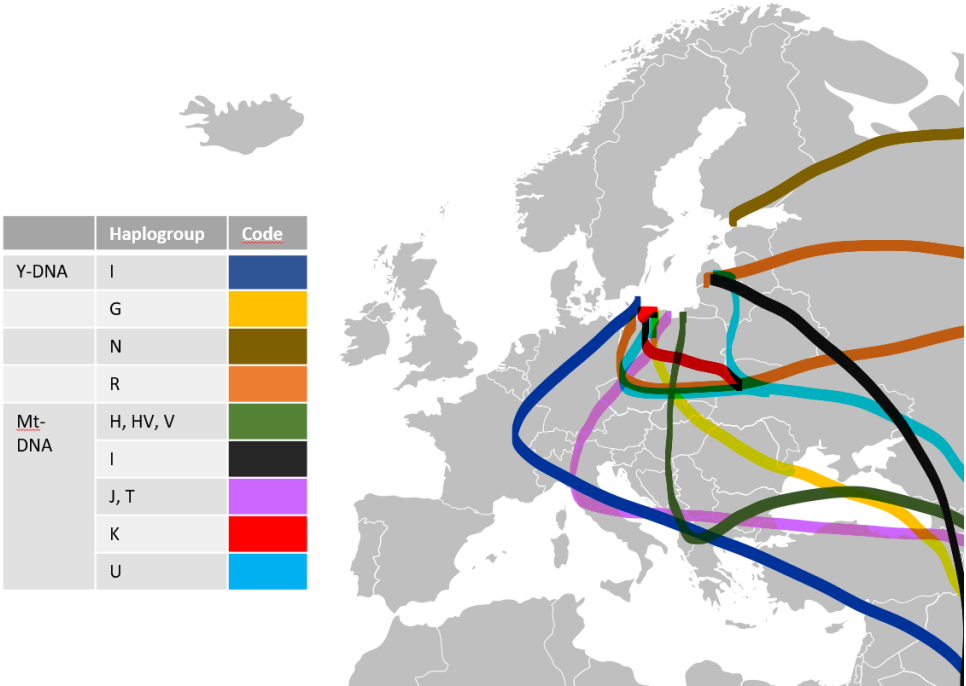
One member has done a Y-Full and has been sequenced in the CTS5533 subclade. This goes through R-U106. This is called a Proto-Germanic haplogroup as it was spread from Northwest Germany in around 1.700 BC. This is the same branch as the RISE 98-man. The CTS5533 goes through subclade S4301. This implies that the lineage can be traced to the Iron Age, some 500 BC to 1.050 AD years ago. Its further subclade is S3207, associated with Scandinavia and Scotland, to where it could have spread with the Vikings^{loxx}. It is interesting to see the RISE 98-man on the same branch as kit no 579206 and when this branch could have come to Gotland, if the ancestors of RISE 98 and kit no 579206 parted ways before one went to Gotland and the other to Sweden, or if the migration took place from Sweden to Gotland. Further research would be needed to answer that question.

When comparing the members in R1b to each other through the Family Tree genetic distance report, there are no close genetic relationships, the earliest ones starting at a genetic distance of 3 at the Y12-marker level. There are also no close genetic relationships with other in Family Tree-database. The same applies for the other kits with a Gotlandic patriline. This could indicate a migration to Gotland in waves over time of R1b-carriers

If we map the historical DNA's route to Gotland, based on the routes as indicated through current research it could look something like this^{lxxxix}



If we add to the map the informative we have on the migration routes of the more recent haplogroups to add to the picture, it could look something like this



Conclusion

While new discoveries and ideas are likely to emerge as one of the results of the fruitful, but relatively new, companionship of archaeology and DNA-analysis, so far, the available evidence from points to various waves of immigration over the time in history. The earliest settlers probably arrived in Gotland shortly after the ice melted, and the island became habitable. There is no reason why the first settlers on Gotland would not match those of Europe and the geographical vicinity, represented by the finds at Stora Karlsö. The earliest mt-DNA finds are limited to U4 and U5. The presence of I2 in itself may indicate immigration to Gotland both from Western Europe (I2) as well as from the east, as haplogroup U originated in Western Asia^{lxxxii}. From historical evidence, we know that haplogroup U was more common in Europe under the Mesolithic period before other groups of people made their way into the area. Groups consisting of individuals already of mixed haplogroup and geographical decent could have migrated to Gotland as established groups, or met on Gotland. In finds dated to Mesolithic Europe, men of I2 have been found with women of U, such as U4 and U5^{lxxxiii}. Based on the European finds, we can conclude that the most likely scenario is (smaller) groups of people of I2-male and U4/5 female lineage that settled on Gotland. Perhaps they still have direct descendants living in Gotland, but so far no one has been proven to be a direct relative to these first settlers. After this, waves followed of further settlements on Gotland from other groups of people. Some probably came in groups, while other may have come individually. There has probably been immigration to Gotland direct from Neolithic Germany, from Finland, the Baltics, from present day Poland, Denmark and Sweden. Immigration continued and while we do not have any evidence as of now, it is easy to imagine the impact left by the ancient trading routes, the Hansa, the Danish and subsequent Swedish conquest on the Gotlandic DNA-tapestry.

Even though the material available only consists of some 43 individuals, this seems to match the pattern revealed in the table above where the maternal lineage, and thus the mitochondrial DNA, expands to other haplogroups as well. There is however not as many male haplogroups represented in the historical DNA. It could be interpreted as if the female population was more genetically diverse through the representation of more haplogroups, however we need to keep in mind that not all remains thought to be males have been possible to determine which y-DNA haplogroup and subclades they belong to and, if this would have been possible, it might have given another picture. When reading in the literature, we have also noted that the current view of the scientists is that, while the old male haplogroups disappeared upon arrival of new groups, the female older groups remained to a larger extent. This may also be why there is an apparent larger diversity of female haplogroups in the project. But while we do not aspire to be professional geneticists, it is however our opinion that the current DNA-material available is not sufficient to draw a conclusion if the groups tested are statistically representative for the early Gotlandic population or not, especially not for the male population. We hope that further testing of human remains located through archaeological excavations will help to answer that question.

There is also a theory that would at least to some extent explain the larger diversity in the female haplogroups. Scientists in Germany investigating Bronze Age communities realised that, while they found families buried together, the grown daughters were missing. It appears that the daughters that reached adulthood travelled far to marry, leaving the childhood home for good^{lxxxiv}. Perhaps the daughters travelled to Gotland as well and, again perhaps, this custom was more widespread in early Europe and not limited to today's Germany, leading to a spread in the female haplogroups while the male groups did not relocate in the same systematic manner. Only more research can answer this question.

It is known that the Scandinavians, from the Bronze Age and onwards, but foremost during the Viking Era, traded with slaves and used them as a workforce. Probably the female slaves had offspring since doubtless they were sexually used by their owners. During the Viking Age, Gotland was a wealthy farmer society, and thus could afford to keep slaves. These enslaved women were brought in from various parts of Europe, and this could also give part of the explanation to why there are more female than male haplogroups.

We had assumed that there would be more matches noted between individuals with the same haplogroup than we have noted. So far, few closer relationships have been noted. We want to stress that no conclusion can be reached, as the available tests are too few to be relied upon. If we want to speculate, this could be an indication that the current Gotlanders are not so related to each other as can perhaps be assumed based on that Gotland is not a large island and the population, now and in

historic times, is limited in numbers. It may be that the Gotlanders are not so related or it may be that the lineage with Gotlandic origin is old and that the common ancestors lived many generations back, perhaps not even on Gotland but in the geographical vicinity or elsewhere. It can also be that the genetic relationships are limited to some families that have not yet been tested. This can only be answered through further individuals being tested. We will also consider this in our project to create a Gotlandic family tree that will provide an important part of the puzzle as this is something that will require further research. This paper is intended to be updated and new insights given when the material available allow for this.

This was our first paper from us in the Gotland project. We want to underline that no one of us are professional geneticists or scientists. We are genealogists that are exploring DNA-analysis as a mean to find out more about our families' history, to put more flesh on the bones and to hopefully give an input to the further Gotlandic family research and historical finds. We will continue to monitor and update the information and monitor the developments in the research. It is easy to try to want to explore everything at once and try to push further, like when you are searching to find your ancestors just one more generation back (and then just one more). We hope that we will be able to update this paper going forward as more people submit tests, and also more finds of human remains are tested to bridge the gap in time between the historic and more recent that now undeniably exists. We also have other ambitions that we hope to realise through DNA-research. But this time we will end here. Thank you for spending some time with us and for being a member of the project. We hope to see you soon again through the Gotland project.

For the Gotland project

Madeleine Endre
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