

Bronze Age wool: provenance and dye investigations of Danish textiles

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Recent analysis of the wool textiles from the famous Egtved oak coffin burial in Denmark indicated that the wool had been obtained from beyond Denmark. Was this an isolated case, or evidence of a large scale wool trade in the Danish Bronze Age? To investigate the broader pattern of wool provenance, textile manufacturing and trade practices, strontium isotope and organic dye analyses were conducted on textiles from a variety of selected burial contexts. Strontium isotope analysis revealed at least 75% of the Bronze Age wool samples originated outside present day Denmark. Results also showed no evidence for the use of organic dyes, thereby supporting the hypothesis that no dyestuffs were used in Nordic Bronze Age textile production. These results challenge extant interpretations of Scandinavian Bronze Age textile provenance, and demonstrate the complexity of exchange networks in wool textiles during this period.

Keywords: Denmark; Bronze Age; strontium isotopes; wool; dye; trade; textiles

Table S1. Organic dye analyses performed by HPLC-DAD of Bronze Age wool textiles recovered in Denmark.

Archaeological site	Period	Type of burial	Museum number	Textile description	Fibre description	Colours of textile	Biological source
<i>Inhumation graves</i>							
Egtved	EBA	oak coffin burial	B11834	blouse	weft	brown and black	–
Egtved	EBA	oak coffin burial	B11834	blouse	warp	brown and black	tannin
Egtved	EBA	oak coffin burial	B11836	corded skirt	weft	brown and black	tannin
Egtved	EBA	oak coffin burial	B11836	corded skirt	warp	brown and black	tannin
Egtved	EBA	oak coffin burial	B11836	corded skirt	light thread	brown and black	tannin
Egtved	EBA	oak coffin burial	B11835	belt	warp	brown and black	tannin
Egtved	EBA	oak coffin burial	B11835	belt	weft	brown and black	–
Egtved	EBA	oak coffin burial	B11849	cord	weft	brown and black	tannin
Egtved	EBA	oak coffin burial	B11849	cord	warp	brown and black	tannin
Egtved	EBA	oak coffin burial	B11838	foot wrap	warp	brown and black	tannin
Egtved	EBA	oak coffin burial	B11838	foot wrap	weft	brown and black	tannin
Egtved	EBA	oak coffin burial	B11839	foot wrap	warp	brown and black	tannin
Egtved	EBA	oak coffin burial	B11839	foot wrap	weft	brown and black	tannin
Egtved	EBA	oak coffin burial	B11847	cord and hair	cord	brown and black	tannin
Egtved	EBA	oak coffin burial	B11837	cord	cord	brown and black	tannin
Egtved	EBA	oak coffin burial	B11833	blanket	light weft	brown and black	tannin
Egtved	EBA	oak coffin burial	B11833	blanket	dark weft	brown and black	–
Egtved	EBA	oak coffin burial	B11833	blanket	warp	brown and black	tannin
Trindhøj	EBA	oak coffin burial	B19910	wrap-around garment	warp	brown and black	tannin
Trindhøj	EBA	oak coffin burial	B19910	wrap-around garment	weft	brown and black	tannin
Trindhøj	EBA	oak coffin burial	B19912	blanket	weft	brown and black	tannin
Trindhøj	EBA	oak coffin burial	B19912	blanket	warp	brown and black	tannin
Trindhøj	EBA	oak coffin burial	B19913	foot wrap	warp	brown and black	tannin

Archaeological site	Period	Type of burial	Museum number	Textile description	Fibre description	Colours of textile	Biological source
Trindhøj	EBA	oak coffin burial	B19913	foot wrap	weft	brown and black	tannin
Trindhøj	EBA	oak coffin burial	B19915	simple cap	s-spun, light thread	brown and black	tannin
Trindhøj	EBA	oak coffin burial	B19915	simple cap	z-spun, dark thread	brown and black	tannin
Trindhøj	EBA	oak coffin burial	B19912	blanket	fringe	brown and black	tannin
Trindhøj	EBA	oak coffin burial	B19914	piled cap	sewing thread	brown and black	tannin
Trindhøj	EBA	oak coffin burial	B19910	belt	warp	brown and black	tannin
Trindhøj	EBA	oak coffin burial	B19910	belt	weft	brown and black	tannin
Trindhøj	EBA	oak coffin burial	B19909	cloak	warp	brown and black	tannin
Trindhøj	EBA	oak coffin burial	B19909	cloak	weft	brown and black	tannin
Trindhøj	EBA	oak coffin burial	B19909	cloak	threads from pile	brown and black	
Borum Eshøj—A	EBA	oak coffin burial	B1397	cloak	warp	brown and black	tannin
Borum Eshøj—A	EBA	oak coffin burial	B1397	cloak	weft	brown and black	tannin
Borum Eshøj—A	EBA	oak coffin burial	B1399	kilt	warp	brown and black	—
Borum Eshøj—A	EBA	oak coffin burial	B1399	kilt	weft	brown and black	—
Borum Eshøj—A	EBA	oak coffin burial	B1399	kilt	sewing thread	brown and black	—
Borum Eshøj—A	EBA	oak coffin burial	B1400	belt	cord	brown and black	tannin
Borum Eshøj—A	EBA	oak coffin burial	B1400	foot wrap	warp	brown and black	tannin
Borum Eshøj—A	EBA	oak coffin burial	B1402	foot wrap	weft	brown and black	—
Borum Eshøj—C	EBA	oak coffin burial	B679	sprang cap	thread	brown and black	tannin
Borum Eshøj—C	EBA	oak coffin burial	B680	blouse	warp	brown and black	—
Borum Eshøj—C	EBA	oak coffin burial	B680	blouse	weft	brown and black	tannin
Borum Eshøj—C	EBA	oak coffin burial	B680	blouse	sewing thread	brown and black	tannin
Borum Eshøj—C	EBA	oak coffin burial	B682	striped belt	dark warp	brown and black	—

Archaeological site	Period	Type of burial	Museum number	Textile description	Fibre description	Colours of textile	Biological source
Borum Eshøj—C	EBA	oak coffin burial	B682	striped belt	light warp	brown and black	tannin
Borum Eshøj—C	EBA	oak coffin burial	B682	striped belt	weft	brown and black	—
Borum Eshøj—C	EBA	oak coffin burial	B681	wrap-around dress	warp	brown and black	tannin
Borum Eshøj—C	EBA	oak coffin burial	B681	wrap-around dress	weft	brown and black	tannin
Borum Eshøj—C	EBA	oak coffin burial	B681	wrap-around dress	dark warp selvedge	brown and black	tannin
Borum Eshøj—C	EBA	oak coffin burial	B684	foot wrap	warp	brown and black	—
Borum Eshøj—C	EBA	oak coffin burial	B684	foot wrap	weft	brown and black	tannin
Borum Eshøj—C	EBA	oak coffin burial	B684	foot wrap	sewing thread	brown and black	tannin
Borum Eshøj—C	EBA	oak coffin burial	B683	plain belt	warp	brown and black	—
Borum Eshøj—C	EBA	oak coffin burial	B683	plain belt	weft	brown and black	—
Borum Eshøj—C	EBA	oak coffin burial	B686	net	twined thread	brown and black	—
Borum Eshøj—C	EBA	oak coffin burial	B686	net	spun thread	brown and black	—
Borum Eshøj—C	EBA	oak coffin burial	B685(2)	foot wrap	warp	brown and black	tannin
Borum Eshøj—C	EBA	oak coffin burial	B685(2)	foot wrap	weft	brown and black	tannin
Melhøj	EBA	stone cist in mound	B12382A/1	—	—	black + copper	—
Melhøj	EBA	stone cist in mound	B12382A/2	—	—	black + copper	—
Melhøj	EBA	stone cist in mound	B12382B/1	—	—	black + copper	—
Melhøj	EBA	stone cist in mound	B12382B/2	—	—	black + copper	—
Melhøj	EBA	stone cist in mound	B12382C/1	—	z-spun	black + copper	—
Melhøj	EBA	stone cist in mound	B12382C/2	—	s-spun	black + copper	—
Melhøj	EBA	stone cist in mound	B12382C/3	—	sewing	black + copper	—
Melhøj	EBA	stone cist in mound	B12382D/1	—	—	black + copper	—

Archaeological site	Period	Type of burial	Museum number	Textile description	Fibre description	Colours of textile	Biological source
<i>Cremations</i>							
Hvidegaard	EBA	stone cist in mound	9220E/1	–	–	red and brown	–
Hvidegaard	EBA	stone cist in mound	9220E/2	–	–	red and brown	–
Lusehøj	LBA	bronze urn, in mound	26436	–	warp	brown	–
Lusehøj	LBA	bronze urn, in mound	26436	–	weft	brown	–
Haastrup	LBA	clay urn, stone cist in mound	OBM/FS8838 1	–	light	red and brown	–
Haastrup	LBA	clay urn, stone cist in mound	OBM/FS8838 1	–	dark	red and brown	–
Haastrup	LBA	clay urn, stone cist in mound	OBM/FS8838 2/1	–	s-spun	red and brown	–
Haastrup	LBA	clay urn, stone cist in mound	OBM/FS8838 2/2	–	z-spun	red and brown	–
Haastrup	LBA	clay urn, stone cist in mound	OBM/FS8838 2/3	–	s-spun	red and brown	–
Haastrup	LBA	clay urn, stone cist in mound	OBM/FS8838 2/4	–	z-spun	red and brown	–
<i>Hoard</i>							
Vester Doense	LBA	bog hoard	B3416/1	–	–	reddish brown	–
Vester Doense	LBA	bog hoard	B3416/2	–	–	reddish brown	–

Table S2. Strontium isotope results from textiles finds from the Danish Iron Age collected from previous studies (non-local values are indicated in bold).

Sample description	Context	$^{87}\text{Sr}/^{86}\text{Sr}$	2 SE (abs)	Reference
NM D 1310 A dark yarn	Krøgens Mølle—female bog body	0.71030	0.00007	Frei 2014
NM D 1310 A light yarn	Krøgens Mølle—female bog body	0.71195	0.00003	Frei 2014
NM D 1310 D	Krøgens Mølle—female bog body	0.71013	0.00005	Frei 2014
NM D 1310 J	Krøgens Mølle—female bog body	0.70878	0.00005	Frei 2014
HEM 3231 x 83 warp	Hammerum—female grave	0.70933	0.00002	Frei 2011
HEM 3231 x 83 weft	Hammerum—female grave	0.70981	0.00006	Frei 2011
HEM 3231 x 83 warp from red thread A	Hammerum—female grave	0.70905	0.00006	Frei 2011
HEM 3231 x 83 warp from red thread B	Hammerum—female grave	0.70903	0.00004	Frei 2011
HEM 3231 x 83 warp from red thread C	Hammerum—female grave	0.70975	0.00005	Frei 2011
HEM 3231 x 83 warp from red thread D	Hammerum—female grave	0.70916	0.00007	Frei 2011
NM 3706 weft	Haraldskær—female bog body	0.70946	0.00002	Frei <i>et al.</i> 2015
NM 3706 warp	Haraldskær—female bog body	0.70993	0.00003	Frei <i>et al.</i> 2015
NM 3707 C1	Haraldskær—female bog body	0.70924	0.00002	Frei <i>et al.</i> 2009a
NM 3707 C2	Haraldskær—female bog body	0.71283	0.00006	Frei <i>et al.</i> 2015
NM C 37143 sprang cap	Haraldskær—female bog body	0.70839	0.00009	Frei <i>et al.</i> 2015
NM C 37143 cord	Haraldskær—female bog body	0.70921	0.00003	Frei <i>et al.</i> 2015`
NM 7325 a	Corselitze—female bog body	0.71002	0.00001	Frei <i>et al.</i> 2009a
NM C 3474	Huldremose I—female bog body	0.71002	0.00003	Frei <i>et al.</i> 2009b

Sample description	Context	$^{87}\text{Sr}/^{86}\text{Sr}$	2 SE (abs)	Reference
NM D 3505 warp I	Huldremose II—single textile deposit	0.70857	0.00007	Frei <i>et al.</i> 2009b
NM D 3505 warp II	Huldremose II—single textile deposit	0.71454	0.00010	Frei <i>et al.</i> 2009b
NM D 3505 warp III	Huldremose II—single textile deposit	0.71443	0.00006	Frei <i>et al.</i> 2009b
NM D 3505 warp IV	Huldremose II—single textile deposit	0.71140	0.00004	Frei <i>et al.</i> 2009b
NM D 3505 warp V	Huldremose II—single textile deposit	0.70909	0.00004	Frei <i>et al.</i> 2009b
NM D 3505 weft I	Huldremose II—single textile deposit	0.71331	0.00006	Frei <i>et al.</i> 2009b
NM D 3505 weft II	Huldremose II—single textile deposit	0.70958	0.00005	Frei <i>et al.</i> 2009b
NM D 3505 weft III	Huldremose II—single textile deposit	0.72037	0.00004	Frei <i>et al.</i> 2009b
NM D 3505 weft IV	Huldremose II—single textile deposit	0.70819	0.00003	Frei <i>et al.</i> 2009b
NM D 3505 weft V	Huldremose II—single textile deposit	0.70908	0.00004	Frei <i>et al.</i> 2009b
NM D 3505	Huldremose II—single textile deposit	0.70931	0.00004	Frei <i>et al.</i> 2009b

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