VÄSTRA GÖTALANDSREGIONEN

Färgglada tyger eller hundra nyanser av brunt?

En studie av textilier från det medeltida Lödöse.

Projektägare: Lödöse museum
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LÖDÖSE MUSEUM

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Innehåll

1.0 Sammanfattning

I den här rapporten delger och diskuterar vi resultaten från färgämnesanalyser gjorda på ett urval av textila fragment ur Lödöse museums medeltida samlingar. Lödöse museum huserar en av norra Europas största samlingar av medeltida textilier. Vi vet ytterst lite om var textilierna kom ifrån och hur de såg ut under medeltiden. Vi ville öka kunskapen om detta genom att göra färgämnesanalyser på ett urval av 51 trådprover från 29 textilfragment funna på 13 olika utgrävningsplatser i det medeltida Lödöse. Identifiering av färgämne gjordes med High Performance Liquid Chromatography och photo diode array detection system (HPLC-DAD) och analyserna genomfördes av Ina Vanden Berghe och Alexia Coudray på Royal Institute for Cultural heritage (KIK-IRPA) i Bryssel, Belgien.

Dessa analyser resulterade i identifiering av fyra färgkällor; rötterna till krapp och sköldlusen kermes, som båda ger röda färgämnen. En eller flera luteolinbaserade färgväxter såsom färgreseda, ängsskära, färgginst, kamomill eller motsvarande, som används för att färga gul, och en blå vegetabilisk indigoid färgkälla, troligtvis vejde. Dock var indigoiden i samma fragment som en luteloinbaserad färgkälla, vilket innebär att just det fragmentet inte varit blått, utan grönt. En majoritet av textilierna som analyserades visade sig vara gjorda med ofärgat, men naturligt pigmenterat garn. Dessa garner varierar i flera nyanser från vitt till svart och brunt. Man har även använt ofärgat garn tillsammans med färgade garner i flera av fragmenten. Förekomst av tanniner indikerar att man i vissa fragment har använt ämnet för att fördjupa mörka färger på naturligt mörk ull.

De allra grövsta textilierna innehåller endast naturligt pigmenterat garn i olika nyanser, ibland med förekomst av tanniner, som har använts till att göra mönster och randningar i tyget. I övrigt är det både färgat och naturligt pigmenterade garn i alla olika slags textilier, allt från grövre hemtextil till finaste halslinningen med sidentråd. I de ofärgade tygerna kan det dock ha funnits färgämnen som har brutits ner över tid och inte längre syns. Dateringarna av textilierna är för vida för att kunna säga något om färgämnen över tid.

Fler analyser av fler fragment hade kunnat bredda bilden och bidragit till att kunna dra större slutsatser kring materialet. Vidare utveckling av strontiumanalyser hade varit önskvärt, så att man kunde gå vidare med att försöka få reda på varifrån ullen härstammar. Det hade kunnat visa kopplingar mellan handelsmönster, färgning och möjlig lokal produktion.

Nyckelord: Medeltid, textil, färgämnesanalys, växtfärgning

2.0 Inledning

Lödöse var under medeltiden en av Sveriges första och största städer, och under stora delar av perioden landets enda port ut mot väster. Idag är det en av de fyndrikaste medeltida platserna i Sverige. Lödöse museum huserar även norra Europas största samling av medeltida textilier. Vi vet att textilier var en mycket viktig handelsvara under medeltiden, och med tanke på att Lödöse var en av landets mest betydande exporthamnar så är det extra intressant att få veta mer om vår unika samling. Sammantaget finns idag 1700 textilfragment i Lödöse museums samlingar, som dateras till 1100–1350-talet. Det är mycket ovanligt med så tidiga dateringar i det medeltida textila materialet, och dessutom så stor mängd.

Idag har vi en ganska god idé om vilka tekniker som användes när man producerade medeltida textilier. Däremot vet vi ytterst lite om var textilierna kom ifrån och hur de såg ut under medeltiden. Vi vet att många textilier var färgade, och än idag är det möjligt att med blotta ögat urskilja mindre färgskiftningar på flera av de bevarade fragmenten. Förutom färger som brunt och beige så framträder rött ibland tydligt, och i enstaka fall även grönt. Dock förändras färgerna under påverkan av jordmånen de legat i, och även av tiden de legat under jord. Även om man kan se färgskiftningar i materialet idag, så har vi svårt att avgöra textilens ursprungliga färg, eller vad den var färgat med. Mycket tyder på att betydligt fler färger användes än vad vi idag känner till, och på samtida illustrationer framträder ofta färggranna och rikt dekorerade textilier. Kvalitet och färgning var exempelvis en viktig statusmarkör.

Genom färganalyser på utvalda textilfragment i Lödöse museums samlingar hoppades vi kunna få reda på mer om vilka färger textilierna har haft och vad man använt för att färga dem. Urvalet har varit begränsat till 51 provtrådar från 29 olika fragment av olika typ, tjocklek, struktur och färg, för att undersöka om det finns en skillnad i färg på olika typer av textilier. Analyserna har gjorts av Ina Vanden Berghe och Alexia Coudray på Royal Institute for Cultural heritage (KIK-IRPA)
i Bryssel, Belgien.

3.0 Forskningshistorik

3.1 Tidigare forskning på Lödöses textila samling

Utöver de noteringar som konserveringsavdelningen på Statens Historiska Museum har gjort (trådriktning, varp/inslag, trådtäthet och vävteknik) har delar av materialet undersökts i olika omgångar. Margareta Nockert har gått igenom de veckade textilierna som en del i ett större projekt. Resultaten är publicerade i korthet (Nockert, 1991). Andra textilier har studerats inom ramen för EU:s Raphaëlprogram – Textiles and Seafaring. I samband med projektet studerades materialet från tre medeltidsstäder och då ingick också textilierna från två grävningar i Lödöse. Resultatet publicerades i Medieval Clothing and Textiles 4. Visual Textiles: A Study of Appearance and Visual Impression in Archaeological Textiles. I samtliga fall har ovan nämnda projekt varit fokuserade på tekniska aspekter med textilproduktionen.

3.2 Färgämnesanalyser

Av de färgämnesanalyser som har gjorts på medeltida textilmaterial, så är det väldigt få som gjorts på jordfynd. De flesta av de textilier som har färganalyserats har därmed varit tyger som aldrig legat under jord, vilket nästan uteslutande är kyrkliga textilier. Det skulle därmed vara av intresse för både allmänhet och forskare att få veta mer om textilier som använts i hemmen och andra profana miljöer.

4.0 Syfte

Genom att göra färgämnesanalyser på de utvalda fragmenten hoppades vi på att få mer kunskap om ett urval av det unika textilmaterial som finns på Lödöse museum. Avsikten var framförallt att ta reda på vilka färgämnen som använts och på vilken typ av textilier de olika färgämnena använts. I förlängningen kan det ge oss en fördjupad kunskap om hantverket och om det textila modet i Lödöse under medeltiden.

Mer specifikt ville vi söka svar på följande frågeställningar:

- Vilken färg har textilen haft?
- Vad har man använt för att färga?
- Hur skiljer sig färgämnet beroende på typ av textil?
- Varierar användandet av färgämne över tid?
- Går det att säga något om vilka typer av textilier man färgade eller inte färgade?

5.0 Metod

5.1 Urval

Lödöse museum plockade ut 51 prover från 29 olika textilfragment, som hittats i 13 olika arkeologiska undersökningar i Lödöse. Mer information om textilfragmenten hittar du i bilaga 1.

Urvalet innehöll olika typer av textil som packtextil, hemtextil, dräktfragment och otolkade fragment av varierad kvalitet. Fragmenten varierade även vad gäller utseende; en del var till synes enfärgade medan andra hade tydliga randningar eller andra mönster, som till exempel olika färg i varp och inslag. Vad gäller flerfärgade textilier så är det uppenbart att man har använt sig av garn i olika färger som sedan har vävts till en textil, medan enfärgade tyger snarare bör har färgats efter att det vävts till en färdig textil. Dessa prover skickades till Ina Vanden Berghe och Alexia Coudray på Royal Institute for Cultural heritage (KIK-IRPA) i Bryssel, Belgien.

Här följer några exempel på vad som analyserades;

- en bit av en röd halsringning av ull med sideninfällning på. Det är ett ovanligt fynd, och det finns en liknande på Museum of London som är färgad med kermes.
- ett antal randiga textilier av ull med rött och brunt och beige, troligtvis dräkttextilier.
- en mycket fin (tunn) textil av ull med gåsögamönster med en hyska på baksidan, troligtvis dräkttextil.

- ett stycke kläde som består av tre ihopsydda bitar i olika färger. Synligt för ögat är rött, brunt och grönt. Kläde var en av de viktigaste handelsvarorna under medeltiden, och de allra finaste producerades i området kring Flandern.
- ett stycke krabbasnår av ull, troligtvis en grövre inredningstextil som återanvänts som en fotlapp i en sko.
- Veckade ylletyger som är mycket ovanliga i det arkeologiska materialet. Det är i Lödöse och Bergen i Norge, som man hittat ett större antal fragment av denna typ. Dessa fragment dateras till 1100–1250, och samma typ av textil står att finna på drottning Katarinas gravtumba från ca 1252.

5.2 Analyser

Identifiering av färgämne gjordes med High Performance Liquid Chromatography och photo diode array detection system (HPLC-DAD). Dataanalyser gjordes med Empower software. En detaljerad beskrivning av det analytiska protokollet är publicerat sedan innan (Vanden Berghe et al. 2009).

Förberedande till analyserna undersöktes proverna med ett stereomikroskop för att undersöka trådens uppbyggnad och färg, samt för att kunna avlägsna synbar kontaminering. Bilder från denna analys hittar du i bilaga 2.

Färgämnena utvinns från fibrerna med användning av sur extraktion med saltsyra, följt av etylacetatextraktion. Sammanfattningsvis användes dessa metoder för att på olika sätt få fram vilka färgämnen som finns i fibern. Sedan jämfördes resultaten med den samlade data av redan kända färgämnen och växter, och utifrån det, samt skriftliga källor och tidigare forskning, gjordes en tolkning av resultatet.

6.0 Resultat

Resultatet från HPLC-DAD delar in proverna i sex grupper;

6.1 Röda färgkällor – krapp och kermes

Krapp är en växt där man använder roten att färga med och ger röda toner. Krapp hittades i sju av fragmenten.

- A8
- AI954
- D81
- DN207a
- GD3228a
- NC64
- NE2834

Kermes är en lus, där honan ger en klar, röd färgsubstans. Kermes hittades i ett av fragmenten.

- C250

6.2 Gula färgkällor – luteolin

Luteolin återfinns i många färgväxter, exempelvis Färgreseda, Ängsskära, Färgginst och olika typer av kamomill. Det går inte att avgöra vilken växt som har använts. Gul luteolinbaserat färgämne har hittats i sex fragment.

- A8
- AI954
- C245c
- GD2741c
- GD3228a
- NC64

6.3 Blå färgkällor - indigotin

Indigotin finns i olika växter som exempelvis vejde eller olika växter inom indigosläktet. Det går ej att avgöra med analys vilket som har använts, men med den historiska kontexten är det troligtvis vejde i det här fallet. Indigotin har hittats i ett av fragmenten. Dock har det berörda fragmentet inte varit blått, eftersom det även fanns spår av luteolin i samma fragment. Det har alltså varit grönt.

- NC64

6.4 Tanniner/garvämnen

Tanniner är en typ av garvämne som finns i många olika växter, även färgväxter (Cardon 2007 s. 619ff). Tanniner kan också användas som betmedel, eller som ett färgämne i sig. Tillför man tanniner i ett färgbad så får man ofta en djupare, mörkare färg, och tanniner tillsammans med järn kan ge svart. Tanniner hittades i de flesta proverna, både med och utan färgämnen, dock i mycket små mängder. Det kan ha tillförts avsiktligt, men också genom kontaminering av jorden.

6.5 Övriga ämnen

Det hittades även andra ämnen som ofta förekommer i arkeologiska textilier som kan bero på nedbrytningsprodukter av färgämnen, fibrer eller omgivande material i jorden. Eftersom de detekteras i alla prover i den aktuella studien utan någon tydlig relation till den nuvarande färgen, verkar det ganska troligt att deras närvaro är relaterad till fibernedbrytning eller annat organiskt material snarare än med avsiktlig användning av färgämnen för färgningsändamål.

6.6 Ofärgade textilier/naturliga färger

9 av de 29 analyserade fragmenten visar inga spår av färgning eller tanniner, utan har en naturlig pigmentering. Det är alltså garn spunnet av mörk ull, ljus ull, och även blandad ljus och mörk ull i samma tråd. Dessa har man använt för att få mönster i textilen genom ränder eller att använda olika färg på varp och inslag.

I fyra av de tio färgade textilierna har man identifierat både färgade garner och ofärgade i samma textil, vilket innebär att man även har använt sig av naturligt pigmenterat garn för att skapa effekt tillsammans med de färgade.

Man bör dock ha i åtanke att växtbaserade färgämnen bryts ner med tiden, och kan ha försvunnit under tiden de legat i jord. Det betyder att även om analysen inte har visat på spår av färgämnen, så kan de mycket väl ha varit färgat en gång, trots allt (Brandenburgh 2010, s 55). Dessutom är det svårt att se skillnad på kemikalier från vissa färgämnen och de naturligt förkommande i jorden, som exempelvis tanninrika växter som nötter eller bark (Brandenburgh 2010, s 55).

7.0 Diskussion

7.1 Vilken färg har textilen haft?

7.1.1 Ofärgade fragment

Analysen visar att tio av fragmenten innehöll garner med spår efter färgväxter, 13 fragment innehöll tanniner (varav tre innehöll även spår av färgväxter, övriga tio endast tanniner och ofärgade pigment), och nio innehöll endast ofärgade garner utan spår av vare sig färgväxter eller tanniner. Dessa naturligt färgade garner har varierat från vitt till svart och mörkbrunt, samt nyanser däremellan som man fått fram genom att blanda mörk och ljus ull. Det är dock svårt att säga exakt vilka nyanser dessa fragment har haft från början, då de har påverkats av omliggande jord i hundratals år. Ljusa fibrer påverkas mer visuellt än mörka, vilket gör att de garner som innehåller blandad ljus och mörk ull är svårast att få en bild av hur de en gång sett ut. De som innehåller endast ljus, ofärgad ull har troligtvis varit ljusare från början, dock vet vi inte hur ljusa. Det har inte gjorts någon melatoninanalys på dessa fibrer, vilket skulle krävas för att kunna säga om det har varit vitt eller ”bara” ljusfärgat som beige eller liknande. Eftersom mörk ull påverkas visuellt mindre av omliggande jord, så kan vi i dessa fall kan få en ganska god uppfattning om hur textilen en gång har sett ut .

De ljusa trådarna består av ofärgad, ljus ull och har troligtvis varit ännu ljusare från början. Den mörka ullen innehåller tanniner men är troligtvis sig ganska lik så som den såg ut när det begav sig. Fyndnr A17.

Muntligt Marei Hacke, 2021-03-25.
Muntligt SVK och Marei Hacke, 2021-03-25.

7.1.2 Färgade fragment

De spår av färgväxter som har kunnat konstateras i analyserna ger färgerna rött, gult och blått. Dock går det inte att säga hur nyanserna sett ut från början, om det har varit mörkrött eller ljusrött till exempel. Det blå färgämnet indigotin hittades tillsammans med luteolin, alltså en gul färgkälla. Det innebär att det fragmentet har varit grönt. Det är fortfarande grönt för ögat idag. I de fall där tanniner kan ha använts som färgämne har färgen varit mörk brun eller svart.

Fragmentet längst till vänster innehåller spår av indigotin och luteolin, och har alltså varit grönt. Båda fragmenten till höger är färgade med krapp. Fyndnr NC64

7.2 Vad har man färgat med?

Man har använt sig av växter för att färga, förutom i ett av proverna då man har använt sköldlusen kermes. Troligtvis har man även i vissa fall använt sig av garvämnet tanniner för att få fram mörka färger.

7.2.1 Krapp

När det kommer till de röda växtfärgade textilierna så har man använt sig av roten till en växt som heter krapp. Krapp härstammar förmodligen från Asien och Främre orienten, och var den främsta vegetabiliska röda färgkällan i Europa under medeltid (Cardon 2007 s. 107f). Även om det inte finns arkeologiska bevis för odling av krapp under medeltid i exempelvis Nederländerna, så finns det historiska källor på att man gjort så (Brandenburgh 2010, s 54 se ref däri). Dock odlades krapp inte i Norden, därför kan man förmoda att de krappfärgade tygerna är importerade. Lokalt i Norden använde man istället andra röda färgkällor som exempelvis gulmåra (LaBerge 2018, s 7).

7.2.2 Kermes

Fragmentet som är färgat med kermes är ett spännande resultat, eftersom det var det dyrbaraste man kunde färga med under tidig medeltid (Andersson 2006, s. 202, Cardon 2007 s 608, LaBerge 2018 s 2). Kermeslusen lever i medelhavsområdet och användes till att färga med fram till 1500-talet då man började importera en annan sköldlus, kochenill, från Amerika (Wisniak 2003, s 93f, LaBerge 2018 s. 5). Kochenill innehåller cirka tio gånger mer färgämne per lus än kermes (Wisniak 2003, s 94). Detta kermesfärgade fragment är alltså importerat och inte lokalt producerat. Det har högst troligtvis varit en del av ett veckat klädesplagg och har säkerligen tillhört någon av de absolut rikaste i samhället – kanske en kunglighet? I Nordvästra Europa symboliserade kermesfärgat tyg

kungligheter (LaBerge 2018 s 54, se ref däri). Veckade tyger var ett mode som under tidig medeltid som kan ses på statyer över kyrkfolk och kungligheter i Europa. Fragmentet är dessutom hittat i det område där den tidiga kungsgården i Lödöse är lokaliserad, tillsammans med andra veckade fragment och högstatusföremål, vilket kan stärka teorin om en möjlig kunglig textil.

Det kermesfärgade fragmentet. Fyndnr C250.

Centrala portalen till katedralen i Chartres, Frankrike. 1194-1220.

Katarina Sunesdotters gravtumba i Gudhem. Förmodligen efter fransk typ. 1251-53.

Ett annat rött fragment av veckat tyg i den här analysen visade sig vara färgat med krapp, och ett par visade sig vara ofärgade men innehöll tanniner. Är det måhända ”budgetvarianter”? Samtliga veckade fragment är dock högklassiga kamgarnstyger som är väldigt fint veckade (Nockert 1991, s 49) så även om de ofärgade fragmenten skulle vara någon slags ”budgetvariant” så är det ändå ett tyg för överklassen. Det finns ytterligare ett 90-tal fragment av veckade tyger i museets samlingar och det hade varit av intresse att göra fler färgämnesanalyser på dem för att få en överblick över hur de är färgade eller inte färgade.

Färgad med krapp. Fyndnr DN207a.

Ofärgad men med spår av tanniner. Fyndnr A11.

Ofärgad men med spår av tanniner. Fyndnr CG19b.

7.2.3 Luteolin

Luteolin som ger gul färg, återfinns i många färgväxter, exempelvis färgreseda ängsskära, färgginst och olika typer av kamomill. Det går inte att avgöra vilken specifik växt som har använts.

7.2.4 Indigotin

Indigotin finns i olika växter som exempelvis vejde eller växter inom indigosläktet. Det går inte att avgöra med analys vilket som har använts, men med den historiska kontexten är det troligtvis vejde i det här fallet.

7.2.5 Tanniner

Förekomsten av tanniner är svårtolkat eftersom det inte alltid går att avgöra om de tillförts med avsikt att färga, eller om fragmentet är förorenat av omliggande jord (Vajanto 2016 s 15). Det finns spår av tanniner i majoriteten av fragmenten, dock i väldigt låga halter. En spontan tanke är att halterna borde varit högre om man medvetet hade tillfört tanniner till textilen, men riktigt så enkelt är det inte. I några av fallen skulle förekomsten säkert kunna bero på kontaminering från omliggande jord, men i flera av fragmenten förekommer det mörka trådar med tanniner tillsammans med färgade eller ofärgade ljusare trådar utan tanniner. Detta indikerar att tanniner har tillförts till de mörka trådarna på något sätt, avsiktligt eller oavsiktligt.

Tanniner finns i många växter och kan ibland fungera som betmedel för andra färgväxter. Det finns olika typer av tanniner, och den typ som hittades i den här analysen är ellaginsyra. Ellaginsyra tillsammans med järn ger en mörk/svart färg (Vajanto 2016 s. 16, se ref däri.), och det skulle kunna förklara varför de mörka fibrerna i exempelvis GD3218 innehåller tanniner, men inte de ljusa. Man kanske helt enkelt har velat färga den mörka ullen ännu mörkare. Liknande exempel har hittats i Nederländerna, se (Brandenburgh 2010, s 55f). Det förklarar dock inte varför halterna är så låga. Tanniner används också i processen att garva skinn. Kan det, åtminstone i vissa av fallen, vara så att man har tvättat den mörka ullen i ett kar som även använts till att garva skinn med? Det hade varit intressant att undersöka saken vidare för att få en tydligare bild av närvaron av tanniner i materialet.

Både de ljusa och mörka trådarna är ofärgade, men endast de mörka innehåller spår av tanniner. Fyndnr GD3218.

7.3 Hur skiljer sig färgämnet beroende på typ av textil?

I gruppen som innehöll färgade garner eller var färgat som färdigt tyg finns fragment från kläder och hemtextil, samt ett par oidentifierade fragment av medelfin kvalitet. Det verkar som att man inte ”slösar” färg på de allra grövsta garnerna som kan ha använts till packtextil, eller kanske dynor. Det känns rimligt, eftersom vi redan nämnt att färgprocessen ofta den dyraste delen av tygframställningen (Andersson 2006, s. 39).

Av samma anledning kan man tänka sig att det fina veckade fragmentet som färgats med kermes, som ju var det dyraste man kunde färga med under tidig medeltid, är ett exklusivt klädesplagg. Har man råd med en sådan lyxprodukt så vill man visa upp den.

I den grupp av fragment som innehåller endast tanniner och inget annat färgämne finner vi allt ifrån exklusivt veckat tyg till oidentifierade fragment som kan ha använts till kläder, och grövre tyg som klassas som packtextil. Dock tolkar vi ett av dem fragmenten som att det kan ha varit tyg till dynor eller liknande. Vi finner även grovt och glest vävt tyg, som troligtvis har fungerat som just packtextil.

Grovt, men tätt vävt med randning. Möjlig dyna? Fyndnr C295.

Grovt och glest vävt. Möjlig packtextil? Fyndnr NC69.

Vi finner helt enkelt alla typer av textilier i denna kategori. Flera av de tunna, finare vävda tygerna som vi trodde skulle varit färgade med växtfärger återfinns också här. De kan förvisso ha färgats med tanniner med syftet att få en mörk färg, men återigen så är det tveksamt med flera av fragmenten om tanninerna verkligen har tillförts avsiktligt. Det är också möjligt att åtminstone vissa av dessa textilier faktiskt har varit färgade med andra ämnen, men att färgämnena är nerbrutna så att de inte längre går att identifiera (Brandenburgh 2010, s 55). Underlaget för litet för att dra någon generell slutsats, och fler färgämnesanalyser på fler fragment varit därför varit önskvärt.

Tunt, fint tyg vävt i gåsöga, med hyska på baksidan. Troligt dräktfragment av mycket fin kvalitet. Har man färgat med tanniner, eller är den kontaminerad? Är den i så fall ofärgad? Fyndnr AI953.

7.4 Varierar användandet av färgämne över tid?

Eftersom de flesta textilierna har en alltför vid datering så kan vi inte säga något om huruvida färgämnena har förändrats över tid. Det är endast ett fåtal textilier som har kunnat få en någorlunda avgränsad datering, och de är för få för att kunna dra någon slutsats.

7.5 Går det att säga något om vilka typer av textilier man färgade eller inte färgade?

Utifrån resultaten i den här analysen så är det svårt att dra någon generell slutsats kring vilka tyger man färgade och inte färgade. Vi vågar tolka så långt att de garn och tyger man färgade var främst kläder och hemtextil, samtidigt som de fragment som inte var färgade också innehåller dessa kategorier. De allra grövsta tygerna innehöll tanniner, och frågan är om de är avsiktligt tillförda i en färgprocess, eller om de ”kommit dit i tvätten” eller på annat sätt. Det går därför ofta inte att avgöra om man medvetet ändrat färg på dessa tyger eller inte.
Det skulle vara av intresse att analysera fler fragment från samlingarna för att få en klarare bild av materialet.

7.6 Ofärgade/naturligt pigmenterade

När det kommer till de 9 ofärgade textilierna så återfinns flera olika kvaliteter, dock tolkar vi de flesta som kläder. Det är flera fragment med fållade kanter, ett ärmhål till en barnkjortel, och de ”känns” väldigt mycket vardagskläder, även om vi dock inte kan säga det med säkerhet. Ett spännande fragment i den här kategorin som sticker ut är en tunn spetskypert med sidentråd. Ville man ha ett exklusivt tyg så bör det ha varit färgat. Kan detta vara ett sådan fragment där färgämnet brutits ner över tid? Eller är det en felaktig slutsats att dessa exklusiva tyger ”bör” varit färgade? För att komma vidare hade det varit av intresse att titta närmare på om det finns fler fragment som är hittade i samband med det här fragmentet, och därmed har vistats i samma miljö i jorden. Då hade det kunnat vara intressant att se om det finns färgämnen kvar i dem eller inte, för att kanske kunna dra en närmare slutsats.

Fin spetskypert med sidentråd. Har den varit ofärgad från början eller har färgämnena brutits ner med tiden? Fyndnr NB154.

8.0 Nästa steg

Analysresultaten från detta projekt visade på flera spännande och överraskande resultat som gett oss vissa svar, men även fler frågeställningar;

- Förekomsten av tanniner är spännande och hade varit intressant att se närmare på. Eftersom det finns rikligt med tanniner i många växter så är det inte orimligt att tänka att dessa tyger kan vara lokalt färgade. I samband med det hade det även varit av intresse att få veta om ullen i garnet är lokalt producerat eller om den är importerad. Detta kan man förhoppningsvis göra inom en sanr framtid med hjälp av strontiumisotopanalyser.
- De veckade tygerna i analyserna visade på olika färgämnen; den dyra kermesen och den populära krappen, men även endast tanniner. Hur kommer det sig att ett så exklusivt tyg varit (möjligen) färgat med ”bara” tanniner? Är detta en lokal produktion, eller åtminstone lokalt färgat? Fler analyser av de veckade tygerna hade kunnat ge oss en överblick och förhoppningsvis en tydligare bild.
- Är det en fördom från oss i vår tid att fint vävda tyger också bör ha varit färgade för att visa på en exklusivitet? Det hade varit intressant att titta närmare på de ofärgade tygerna av fin kvalitet för att se om man kan komma vidare med det.
- Det hade varit av intresse att göra fler färgämnesanalyser på fler fragment ur våra samlingar för att få en bättre helhetsbild över materialet. Därtill är det även intresant att analysera likartade textilier från andra arkeologiska samlingar i Norden.

Att arbeta med ovanstående frågeställningar hade kunnat hjälpa oss att få en större förståelse för det medeltida samhällets textilproduktion, handelsstruktur och upprätthållande av social status.

Vi vill även tillägga att samma fragment som har analyserats i det här projektet har även provtagits för grundämnesanalys hos Riksantikvarieämbetet på Gotland som är under tolkning i skrivandets stund. Det är av intresse att

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ARCHAEOLOGICAL TEXTILES FROM THE MEDIEVAL LÖDÖSE
SHORT INTRODUCTION

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Cover image by Petter Lönngård
Lödöse museum 2020.

Old Lödöse – a long story made short

Lödöse is situated 40 kilometres from the river mouth of Göta river. During early middle ages, Lödöse was one of the first and largest cities in what later became Sweden. It was also the only port in the western part of the country, and Göta river was the main reason for a settlement here. During the early middle ages Lödöse and Göta river was the only

Today's Lödöse. Photo: Per Pettersson.

Swedish connection to the Western sea. Even the earliest archaeological evidence of the town shows signs of European trade, as coins and imported ceramics.

The medieval town of Lödöse got its name from the stream "Ljuda", known today as Gårda-stream. Ljuda, Lyda, or Löda as it is also written, means the sounding or frothing water. The name Lödöse is derived from the name of the stream and the plural form of the noun "os"- "öse" which means river mouth. Lödöse therefore means "Ljudas river mouths".

The first time Lödöse was mentioned at the end of the 10th century in the Icelandic manuscript "Njála". At that time Lödöse may have consisted of one or two farms. In the middle of the 11th century it became more of a settlement, and by the 12th century it could be described as a town. At that time they had three stone churches, one church built of wood

and a simple fort (castrum), probably built by king Knut Eriksson (1167-96). A royal mint could be found here from the middle of the 12th century.

During the 13th century one of the stone churches was replaced by a Dominican monastery. The fort gets ransacked in 1227 and a short after that a new fortress was under construction. At the end of the 13th century a leprosy hospital is mentioned in a letter.

The town area when Lödöse had it's peak around the year 1300.

Around the year 1300 Lödöse had its largest expansion with a population of about 2000 inhabitants. During the second half of the century the positive development declined because of economic depression, political unrest and the Black Death.

The town experienced several ups and downs up until the Danish occupation in 1455. In the middle of the 15th century the town faced a new development.
The northern most of the two river mouths that served as a natural water way into the town and the harbour started to silt up.
At the same time Denmark-Norway started to tax passing ships at Bohus, where Norway by prior agreement from the 13th century owned a plot of land on the east side of the river. These seemed to be the reasons why voices were raised to move the town and improve the situation of the town's residents. The decision was made in 1473 and the citizens who wanted to move and build a new town at the mouth of the river Säve were offered up to 20 years of tax relief. Today it is assumed that large parts of the central area in Lödöse were depopulated, and during the last urban period the town was concentrated around the harbour area.

In 1474 the new town changed its name from Götaholm to New Lödöse (today called "Gamlestan", which means "the old town"). At the same time the mother town changes its name to Old Lödöse.

Old Lödöse kept its town privileges until 1526 when king Gustav Eriksson Vasa withdrew both the privileges and the right to arrange markets. The reason for this was complaints from the citizens of New Lödöse, who didn't want to loose business.

Old Lödöse regained its town privileges later in the 16th century, but lost them finally in 1646.

The remaining citizens in Old Lödöse then were offered a free plot of land in the new town of Gothenburg, and between five and seven years freedom from taxes.

The area of the old town became farmland with just a few farms and Old Lödöse were almost forgotten about until the first archaeological excavation in 1905.

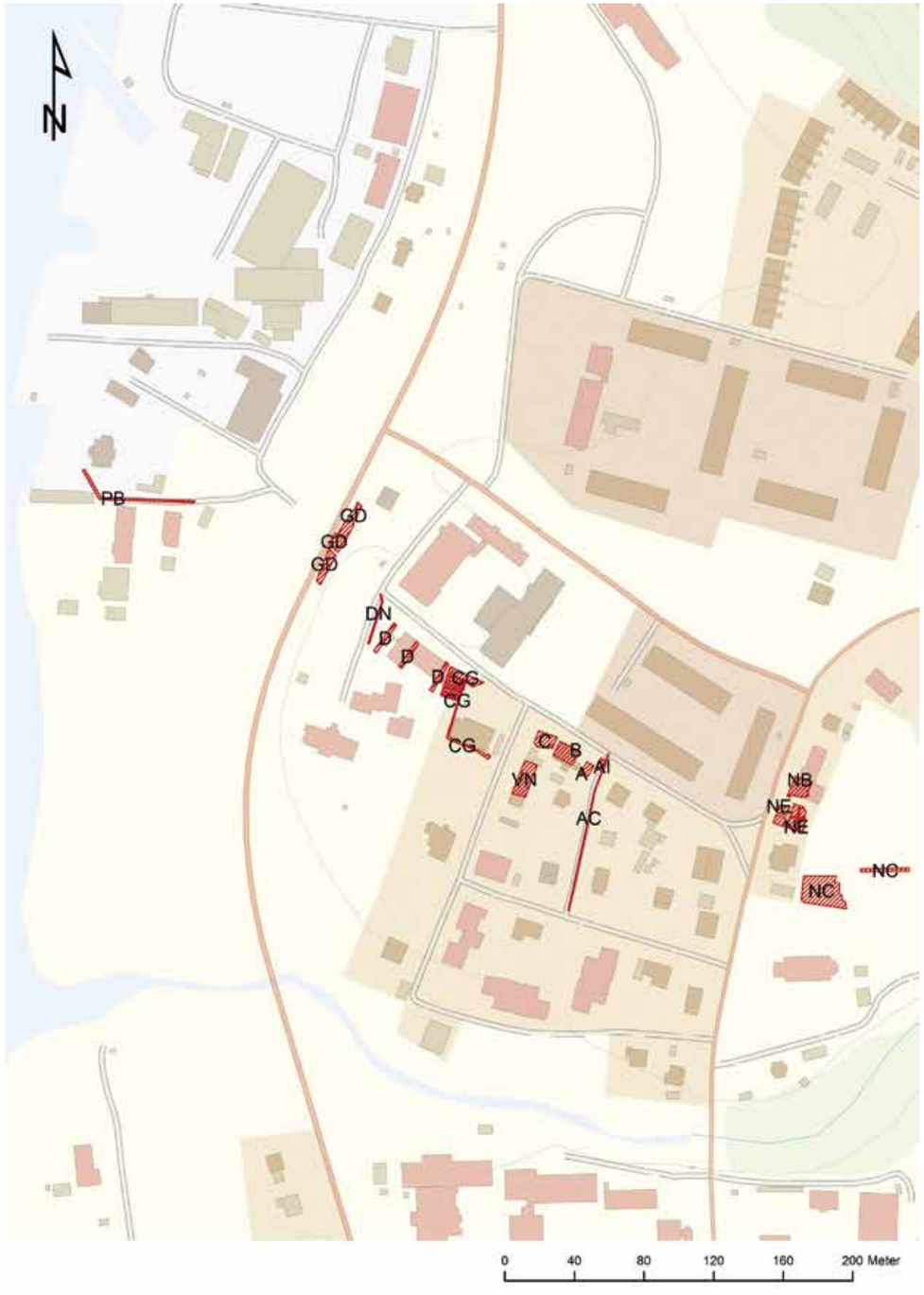
The archaeological excavations

Since Lödöse was depopulated and the construction of houses did not start until the end of the 1950's, the medieval remains have been very well preserved with deposits up to 4,5 meters thick. Until this date more than 250 archaeological excavations have been carried out and about half a million finds registered. A lot of the material is waste from different kinds of crafts were the textile craft is very well represented.
In 56 excavations, 1700 textile fragments have been found. What the textile fragments have been used for is difficult to establish on account of the small size of many of them.

The process of selecting textiles

We decided early on to get a broad representation of different types of textiles for this study. The museum's collection ranges from the finest cloth to coarse packing- and interior textiles.
During the selection process we went through the whole collection of approximately 1700 fragments. About 100 of these were considered interesting for this study. These were then sorted according to type and colour. Finally, we selected 29 fragments that now (after some anxiety) are subject to sampling.
Lena Hammarlund, craftsman and textile researcher, together with Amica Sundström, First antiquary of the textile collection at the Swedish History Museum, contributed with their knowledge in the selection process.

The textiles samples come from 13 different excavations. Below you find a short summary of the archaeological context followed by information about the samples from each excavation. Where the samples are taken on the textile fragments is shown in the numbering of the pictures.



Today's Lödöse. The excavations from which the textiles are selected are marked in red.

Excavation project A. 1962.

The cultural layer reached down to four metres under the ground surface. At 1,65-1,8 meters depth a few stones, remains of wood and planks, forming at least two houses. Between2,1-4,1 another two houses were identified.

Close to 200 finds were registered, among them around 20 textile fragments woven in twill and tabby. The finds were mainly found at a depth of 1,4-2,6 metres under the ground surface and evenly spread over the area.

Date: 12th-15th century

The selection of samples, project A.

ID: A1
Context: Level -190, Square 1
Weave: Three shaft twill
Thread count: 12x7/cm
Twist direction: z/s
Selvage: No
Colour: Yellowish brown
Length: 100 mm
Width: 150 mm
Description: Single thread, thin/average.
Number of samples: 1

ID: A8
Context: Level -160-180 cm, square 1
Weave: Tabby with stripes
Thread count: 8x8/cm
Twist direction: z/s
Selvage: No
Colour: brown, red, light brown, light brown
Length: 230 mm
Width: 110 mm
Description: Tabby weft stripes. Lightly felted on one side. Single thread. Average thickness.
Number of samples: 4

ID: A11
Context: Level -230-260, Square 1
Weave: Four shafted twill 2/2
Thread count: 11x9/cm
Twist direction: z/s
Selvage: No
Colour: brown, light brown/greyish
Length: 90 mm
Width: 80 mm
Dating:
Description: Different colours in warp and weft. Single thread, average thickness.
Number of samples: 2

ID: A17
Context: Level -210-230, Square 1
Weave: Four shafted twill 2/2
Thread count: 7x4/cm
Twist direction: z/s
Selvage: No
Colour: dark brown, light brown stripes
Length: 230 mm
Width: 180 mm
Dating:
Description: One corner of this triangular shaped fragment is sown together like a wedge. The sides in this corner has traces of folding. Fulled. Single thread, coarse.
Number of samples: 2

Excavation project AC. 1968

The excavation consisted of a 70 cm wide and 1,5-2 meters deep trench. The medieval deposits in this part of Old Lödöse are as deep as 4 meters and this excavation reached, by the look of the objects found, only to the late 13th century.

This rather certain date came from an leather underlay for striking bracteats, dated to the last quarter of the 13th century. Relatively shallow, already at ½ meter's depth there were presence of 14th century pottery, which seemed to dominate the layers down to about 150 cm under the ground surface. Approximately 10 building remnants in 4-6 layers, including a tannery.
Even though the trench was so small, a great number of finds were registered, about 1500 objects including 50 textile fragments.

Date: 13th-14th century

The selection of samples, project AC.

ID: AC269
Context: Level -130, Square 80-81
Weave: Four shafted twill 2/2
Thread count: 6x5/cm

Thread thickness: 1/mm
Twist direction: z/s
Selvage: No
Colour: brown, light brown/greyish
Length: 100 mm
Width: 50 mm
Dating:
Description: Warp and weft are in different shades. Single thread, average thickness.
Number of samples: 2

Excavation project AI. 1986.

Remnants of medieval town buildings with house remains in 16 phases in the town centre, used for dwelling and handicrafts buildings, ones with hearths and some of the older ones with wood paving.

Thickness of the deposits were 4,5 metres. Among the finds there are many different types of pottery, including very early medieval imports from Belgium (Andenne) and England.

Worth noting is that the textile fragments consisted of almost a fifth of the total quantity of finds, around 400 objects.

Date: 11th - 15th century

The selection of samples, project AI.

Id: AI953
Context: Layer 14, square H-K
Weave: Three shafted diamond twill, goose eye
Thread count: 30x22/cm
Twist direction: z/z
Selvage: No
Colour: brown
Length: 130 mm
Width: 100 mm
Dating: 1215-1235
Description: Goose eye twill in a square pattern. Different shades in warp and weft. Homogeneous structure. Slightly felted on one side. Single thread, thin.
Number of samples: 1

ID: AI954
Context: Layer 14, square H-K
Weave: embroidery threads
Twist direction: ?/s
Selvage: No
Colour: Dark brown with shifting shades. Probably four different colours.
Length: 170 mm

Width: 150 mm
Dating: 1215-1235
Description: Woolen embrodery, only the embrodery thread left.
Number of samples: 4

ID: AI1693
Context: Layer 17, square E-K
Weave: Three shafted twill
Thread count: 12x6/cm
Twist direction: z/s
Selvage: No
Colour: black
Length: 300 mm
Width: 200 mm
Dating: 1180-1215
Description: Square shaped. Many weaving errors in the weft. Homogeneous in colour and structure. Slightly felted on one side. Single thread, average thickness.
Number of samples: 1

ID: AI2517
Context: Layer 23, square E-F
Weave: Three shafted twill
Thread count: 32x18/cm
Twist direction: z/s
Selvage: No
Colour: Dark brown, blueish
Length: 80 mm
Width: 80mm
Dating: 1100-1135
Description: Homogeneous in structure, somewhat shifting in colour. Single thread, thin
Number of samples: 1

Excavation project B. 1963.

Control of a minor trial trench was made prior to the construction of a cellar. This led to an extended investigation of emerged building remains. The thickness of the deposits, 4 meters, indicates that this area is one of the oldest residential sections of the town. The lower layers contained remnants of both post-and-plank and timber buildings. A larger flat stone was assumed to belong to an adjacent paving.
The number of registered finds is 453, of which 29 are textile fragments.

Dating: 12th - 15th century.

ID: B90a
Context: Level -200, square C6
Weave: Three shafted twill
Thread count: 15x14/cm
Twist direction: z/s
Selvage: No
Colour: brown
Length: 90 mm
Width: 80 mm
Dating:
Description: Homogeneous in colour and structure. Slightly felted on one side. Single thread, thin/average thickness.
Number of samples: 1

ID: B90b
Context: Level -200, square C6
Weave: Three shafted twill
Thread count: 11x8/cm
Twist direction: z/s
Selvage: Yes
Colour: greyish-brown
Length: 100 mm
Width: 120 mm
Dating:
Description: Slightly shifting in colour and structure. Single thread, thin/average thickness.
Number of samples:1

ID: B90c
Context: Level -200, square C6
Weave:
Thread count:
Twist direction: z-?
Selvage: No
Colour: brown
Length: 50mm
Width: 170 mm
Dating:
Description: Homogeneous in colour and structure. Fulled, perhaps sheared? Single thread, average thickness.
Number of samples: 1

Excavation project C. 1963.

The top layers were identified as being stirred in conjunction with a construction of a house in 1963. Apart from that, 11 different settlement layers were identified. These are represented by hearths, timber jointed house foundations, timber framed constructions, grillages, clay floors and wattle. The deepest laying building stratum consisted of an earth layer with charcoal and wood remnants. In total 3 burn layers were found.

A little more than 2000 finds were registered and of these 163 are textile fragments.

Date: 12th-15th century.

The selection of samples, project C.

ID: C245b
Context: Level -120, square C1
Weave: Three shafted twill
Thread count:
Twist direction:
Selvage: Yes
Colour: brown with light brown stripes
Length: 225 mm
Width: 160 mm
Dating:
Description: Single thread with average thickness.
Number of samples: 2

ID: C250
Context: Level -220, square D3
Weave: Tabby?
Thread count:
Twist direction: z/s
Selvage: No
Colour: red
Length: 45 mm
Width: 25 mm
Dating:
Description: Homogeneous in colour and structure. Two fragments of fold from a pleated fabric. Single thread, thin/average thickness.
Number of samples: 1

ID: C274
Context: Level -220, square B5
Weave: Four shafted twill 2/2
Thread count: 8x5/cm

Twist direction: z/s
Selvage: Yes
Colour: brown and dark brown/black
Length: 80 mm
Width: 180 mm
Dating:
Description: Striped. Homogeneous in colour and structure. Different shades in warp and weft. Slightly napped on one side. Single thread, average thickness
Thread thickness/mm: 2/1
Number of samples: 2

ID: C291
Context: Level -200, square C1
Weave: Four shafted twill 2/2
Thread count: 8x6/cm
Twist direction: z/s
Selvage: No
Colour: golden brown
Length: 270 mm
Width: 50 mm
Dating:
Description: Homogeneous in colour. Different structure in warp and weft. Folded edge with a seam. Warp with two threads, weft with one thread? Felted on one side. Average thickness.
Number of samples: 1

Excavation project CG. 1974.

The excavation was located within the eastern part of the castle area's moat system. In the east-west trench, there were remnants of paving and building remains in wood. In the northern and western parts of the area there were predominantly stone structures with brick and mortar. In the north-eastern part of the trench was a larger building construction. About 1 - 1.5 meters deep, 2 - 4 building layers were found. In the western part, untouched bottom layers were uncovered, while the eastern part of the excavation area had significantly deeper cultural layers.

The number of finds was 49, of which 6 were textile fragments.

Date: 13th - 17th century

The selection of samples, project CG.

ID: CG19b
Context:
Weave: Three shafted twill
Thread count: 24x14/cm
Twist direction: z/s
Selvage: Yes
Colour: dark brown
Length: 140 mm
Width: 360 mm
Dating:
Description: Pleated fold approx. 1 cm. Folded hem with seam, whipstich approx 3/cm. Homogeneous colour and structure. Single thread, average thickness.
Number of samples: 1

Excavation project D. 1965.

In total, three trenches were excavated in the northeast-southwest direction, an area of approximately 95 m2. The depth of the trench was just over 2 meters, whereof the cultural deposits were 1,65 meters. Eight building constructions were found. Remains of the moat from the castle were found in all trenches. The moat was constructed in the middle of the 13th century.
Nearly 250 finds were registered, five of which are textile fragments. Particular mention should be made of an approximately 20 x 10 cm linen fragment.

Date: 13th to 17th century.

The selection of samples, project D.

ID: D81
Context: Level -250-270, square AB2
Weave: Twill
Twist direction:
Thread count:
Selvage:
Colour: Red
Length: 145 mm
Width: 40 mm
Dating:
Description: Homogeneous colour and structure. Fulled. Silk lining, silk decor. Thin/average thickness.
Number of samples: 2

Excavation project DN.1983.

Excavating for water and sewer pipe.
Background: County council was going to build a health center, and needed to connect to already existing water/sewer pipe. Medieval building remains and late medieval streets were found, dating 1100-1600s.

Building materials from a house foundation were found, heavily decomposed and lying in a layer of hard packed waste material. Since these

were untouched medieval layers, it was assumed that they were digging in the wrong place to find the connecting water/sewer pipe.
The excavation continued and uncovered decayed wood at about 100 cm under the street level. It seemed to be the remains of paving along a building. Its orientation could be established as north-northeast or nort-heast, thus at a fairly right angle to the stream.
In the continuation of the trench there were more building remains. More wooden floors and also earthen floors and stone floors, dating to the 13th century.
The number of registered finds amounts to 377, four of which were textile fragments.

Dating: 12th – 17th century

The selection of samples, project DN.

ID: DN207a
Context: Level -120-220, square 19 meter
Weave: Three shafted twill
Thread count: 20x15/cm
Twist direction: s/z
Selvage: Yes
Colour: Red
Length: 80 mm
Width: 15 mm
Dating:
Description: Hard twist in the warp, which is very finely-fibred and crinkly. Homogeneous colour and structure. Pleated. Single thread, thin/average thickness.
Number of samples: 1

Excavation project GD. 1971.

The top layers were largely destroyed by recent building- and road constructions. In intact parts, seven building layers could be interpreted. The survey contained parts of two bourgeois quarters, separated by a street in an east-west direction. In the northern block, bordering Saint Olov's cemetery to the west, parts of six buildings were examined in three to seven layers, in two parallel north-south lengths. In the southern block there were three buildings with connecting bridge foundations, an open courtyard and a drainage facility. To the south, this block borders the castle's northern moat. The best preserved building unit in older layers was a large wooden building on the south side of the street. During the second half of the 13th century, this was a timber-joint building, which had previously been built in stave work or post and plank. This building had a strikingly large concentration of finds. The east-west street, which was built in a wooden structure with transverse covering timber, could be interpreted to four different construction stages. The oldest had underlying wicker drainage, and in the latest layers there were several stone foundations, mainly in the northern parts.

There were 7743 registered finds in this excavation, 99 of which were textile fragments.

Dating: 1100th - 1500th century

The selection of samples, project GD.

ID: GD2741c
Context: Level 357-339, square T50
Weave: Three shafted twill
Thread count: 12x10/cm
Twist direction: z/s
Selvage: No
Colour: Greenish-brown
Length: 90 mm
Width: 130 mm
Dating:
Description: 'Elastic' yarn. Patchy colour, homogeneous structure. Slightly felted in places. Single thread, thin.
Number of samples: 1

ID: **GD3218**
Context: Level 348-336, Square S50
Weave: Four shafted twill 2/2
Thread count: 12x10/cm
Twist direction: z/s
Selvage: Yes
Colour: dark brown, brown, light brown
Length: 150 mm
Width: 90 mm
Dating:
Description: Homogeneous in colour and structure. Felted on one side. Single thread, average thickness.

Number of samples: 3
ID: GD3228a
Context: Level 348-336, square S52
Weave: Tabby with stripes in rep weave.
Thread count: 10/10/6/cm
Twist direction: z/s
Selvage: No
Colour: golden brown, black, red, yellow, greyish
Length: 60 mm
Width: 80 mm
Dating:
Description: Striped with four colours. Single thread, thin/average thickness.

Number of samples: 4
ID: GD3278
Context: Level 357-352, square Y48
Weave: Tabby
Thread count: 24x14/cm
Twist direction: z/z
Selvage: No
Colour: Blackbrown
Length: 110 mm
Width: 140 mm

Dating:
Description: Homogeneous in structure, patchy in colour. Single thread, thin.
Number of samples: 1

Excavation project NB. 1967.

The thickness of the cultural deposits ranged from 1,1-2 meters, and a total of six building remains were found. In the western and southwestern part of the excavation area, stones emerged which formed house foundations placed close to each other. In the northwest corner of the area a wall of wood appeared, that stretched in an east-west direction and had been built with wattle and daub. The wrecked wall was all that remained of a room. The house had been used as a bronze forge and dates back to the 1300s.
In the north-eastern part of the shaft, a coherent rock formation was found extending in a north-south direction, which may have constituted a house wall. In the northeast corner there were individual stones, interpreted to have belonged to a staircase. Additional wood structures emerged at a depth of about two meters below the ground surface, along with larger amounts of leather, leather waste and debris. In the central part of the study area building remains of wood emerged, possibly a grillage. Two floor levels were found on one with wooden boards and one made of clay. The earthen floor was found 0.8-1.0 meters below the mill and was partially burnt.
Two floor levels were found, one floor of wooden boards and one of clay. The clay floor was found 0.8-1.0 meters below the soil and was partially burnt.
Nearly 500 items were registered, 39 of which were textile fragments.

Dating 12th – 15th century

The selection of samples, project NB.

ID: NB154
Context: Level -90, square O0
Weave: Herringbone twill
Thread count: 10/10/6
Twist direction: z/z?
Selvage: No
Colour: Dark brown/black, beige
Length: 50 mm
Width: 30 mm
Dating:
Description: Silk lining. Thin.
Number of samples: 1

Excavation project NC. 1968.

The western part of the area had been excavated about 40 cm deep, when exposing seven house grounds and two hearths. According to an earlier excavation in the area, the cultural layers reaches 1,5 meters on this site.
Interpretation: craft quarter with, for example, forges.
The eastern part of the excavation area consisted of a marked slope to the east, and flat land along the overgrown stream.
In the lower part of the slope, the cultural deposits were about 2 meters deep, 2/3 of which about were formed by medieval waste. Two smaller wells were found here, as well as a wickerwork fence in a north-south direction. Irregular but coherent paving stones, possibly for bridges, occurred at different levels.
Nearly 1000 finds were registered, 24 which of were textiles of various kinds.

Dating: 13th -16th century

The selection of samples, project NC.

ID: NC64
Context: Level 425-400, square N26
Weave:
Thread count:
Twist direction:
Selvage: No
Colour: Dark red/brownish, light red/brownish, green/brownish
Length: 68 mm
Width: 45 mm
Dating:
Description: Fulled. Single thread, average.
Number of samples: 3

ID: NC69
Context: Level 500-480, square N24
Weave: Tabby
Thread count: 3x3/cm
Thread thickness/mm: 1,5
Twist direction: z/z
Selvage: No
Colour: Grey, brown
Length: 190 mm
Width: 50 mm
Dating:

Description: Different colours in warp (brown) and weft (grey). Two ply thread.
Number of samples: 2

Excavation project NE. 1971-1972, 1974.

The survey was carried out in two rounds, the winter of 1971-72, and the autumn of 1974. The thickness of the cultural deposits ranged between 1.2-2.2 meters. In total five rows with buildings were found, with large hearths which were interpreted as forges. They also found road surfacing in stone and wood, as well as drainage ditches. In the latest layers a paved street appeared and in the earliest layer a shoemaker's workshop.
Over 5800 finds were registered, 31 of which were textile fragments.
Dating: 12th -16th century

The selection of samples, project NE.

ID: NE2834
Context: Level 773-753, square H28
Weave: Overshot
Thread count: 3x3/cm
Twist direction: z/s
Selvage: No
Colour: Brown, light brown, red
Length: 275 mm
Width: 170 mm

Dating:
Description: Homogeneous in colour and structure. Single thread, average thickness.
Number of samples: 3

Excavation project PB. 1968.

A trench in east-west direction in the harbour area. Remains of six timber buildings, with narrow stone pawed alleys, in five or six phases. The deposit depth was 1,8 - 2,4 m. Timber joint buildings were identified and in the lowest deposits also traces after post and plank constructions.
In this part of the town, close to the port, there was a surprising amount of imported goods. Amongst the finds were for example enamelled glass and ceramics from the Mediterranean. The number of registered finds was 1900, 29 of which were textiles.

The selection of samples, project PB.

ID: PB47
Context: Level -200, square C1
Weave: Tabby
Twist direction:
Thread count:

Selvage:
Colour: brown
Length: 610 mm
Width: 500 mm
Dating:
Description: Striped. Single thread, coarse.
Number of samples: 2

Excavation project VN. 1960.

Motive/background: Investigation in conjunction with the construction of a new telecommunications station in the centre of Lödöse, at the upper part of Eriksgatan.
A large part of the area was already demolished (bulldozed?) when the director Zachrisson arrived, but a large part of wooden structure was documented. Among the timber was a profiled post which was collected and has been interpreted as part of a stave church. It is dated by dendrochronology to 1180-90AD. There were also four upright pillars, "carefully tailored" and with "versatile cutting" buried one meter deep. Under the layer with wood, there were about one meter of deposited layers, containing mainly wood and leather objects, and only a few ceramic shards.
The registration of the finds is not complete but 22 pieces of textile fragments have been registered.
Dating: 11th-14th century

The selection of samples, project VN.

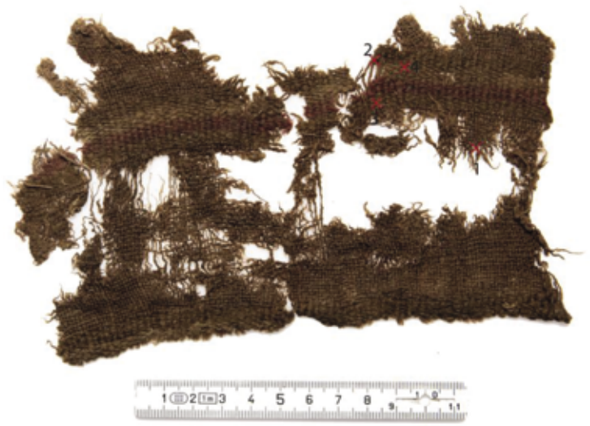
ID: VN35g
Context: Level 773-753, square H28
Weave: Three shafted twill
Thread count: 11x6/cm
Twist direction: z/s
Selvage: No
Colour: Garyish/brown
Length: 260 mm
Width: 190 mm
Dating:
Description: One armhole and half front, half back piece of the bodice. Probably from a child's dress. There is a seam in the middle of the front and back. On the front the selvage is folded and hemmed with whipstiches around the whole hem. Homogeneous in structure, shifting in colour. Single thread, average thickness.
Number of samples: 1

LÖDÖSE MUSEUM

Analysis report

Archaeological textiles from medieval Lödöse

Municipality:	Lödöse [SE]
Institution or collection:	Lödöse Museum
Type of object:	Medieval archaeological textiles



IRPA KIK
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KONINKLIJK INSTITUUT VOOR HET KUNSTPATRIMONIUM
Federaal wetenschapsbeleid
INSTITUT ROYAL DU PATRIMOINE ARTISTIQUE
Politique scientifique fédérale

Applicant:	**Lödöse Museum** Museivägen 1 463 71 Lödöse Sweden
Applicant contact person:	Liselott Ohrling liselotte.ohrling@vgregion.se
KIK-IRPA file number:	**2020.14326**
Unit(s) of the KIK-IRPA:	Department Laboratories – Textile research
Head of the unit(s):	Ina Vanden Berghe
Collaborator(s):	Alexia Coudray
Reported by :	Ina Vanden Berghe, Alexia Coudray
Report date:	25.09.2020

Refer to this report as: Vanden Berghe, I. & Coudray, A. (2020) KIK-IRPA Analysis report on the dye identification of medieval woolen textiles from the Lödöse, Sweden (DI 2020.14326, 25.09.2020)

1. Object Description

KIK-IRPA object number	-
Municipality	Lödöse [SE]
Institution	Lödöse Museum
Inventory number	
Type of object	Archaeological textiles
Description of the object	Medieval textiles from the Lödöse archaeological excavation site
Author	
Date	Medieval period
Material	-
Specification request:	

During early Middle Ages, Lödöse was one of the first and largest cities in what later became Sweden. Situated at 40 kilometers from the river mouth of Göta river, it was also the only port in the western part of the country. The Göta river was the main reason for a settlement here.
Lödöse and the Göta river were the only Swedish connection to the Western sea. Even the earliest archaeological evidence of the town shows signs of European trade, as coins and imported ceramics.

Lödöse was mentioned at the end of 10th century in the Icelandic manuscript "Njàla". At that time, Lödöse may have consisted of one or two farms. In the middle of the 11th century, it became more of a settlement and by the 12th century, it could be described as a town. In the second part of the 15th century, the town faced a new development. To improve the situation of the town's residents facing taxes, a new town was built at the mouth of the river Säve called "New Lödöse". The mother town changes its name to "Old Lödöse" at the same time.

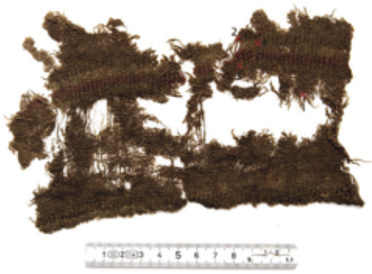
Old Lödöse was progressively depopulated.
The area of the old town became farmland with just a few farms and Old Lödöse was almost forgotten about until the first archaeological excavation in 1905.

Since Lödöse was depopulated and the construction of houses did not start until the end of the 1950's, the medieval remains have been very well preserved with deposits up to 4,5 meters thick. Since 1905, more than 250 archaeological excavations have been carried out and about half a million finds registered. A lot of materials is waste from different kinds of crafts, where the textile craft is very well represented. In 56 excavations, 1700 textile fragments have been found. What the textile fragments have been used for is difficult to establish on accounts of the small size of many of them.

2. Sample Description

After a drastic selection process, 51 samples in total were sent to the KIK/IRPA textile laboratory for the investigation of the organic dyes. The samples belong to 29 textile fragments, coming from 13 different excavations.
Information of the objects and samples (as given by the requestor), as well as object pictures, are listed in table 1, together with the KIK sample codes.

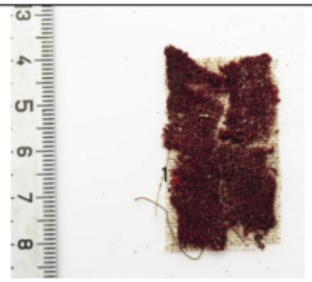
Table 1: List of the Lödöse samples: description and image(s) of the fabric, description of the samples with KIK sample codes

Object Code	Fabric: image, description and samples' locations	Sample description	KIK Sample Code
A1	 Weave: Three shaft twill Dating: 12th - 15th century	Yellowish brown	14326/01
A8	 Weave: Tabby with stripes Dating: 12th - 15th century	Brown Tabby weft stripes	14326/02
		Red Tabby weft stripes	14326/03
		Light brown Tabby weft stripes	14326/04
		Light brown Tabby weft stripes	14326/05
A11	 Weave: Four shafted twill 2/2 Different colours in warp and weft Dating: 12th - 15th century	Brown	14326/06
		Light brown/greyish	14326/07

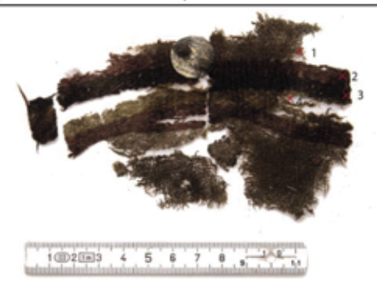
A17		Brown	14326/45
		Light brown	14326/46
AC269	 Weave: Four shafted twill 2/2 Warp and weft are in different shades Dating: 13th - 14th century	Brown	14326/08
		Light brown/greyish	14326/09
AI953	 Weave: Three shafted diamond twill, goose eye Goose eye in twill pattern. Different shades in warp and weft. Homogeneous structure. Slightly felted on one side. Dating: 1215 - 1235	Brown	14326/10

AI954	 Woollen embroidery threads Dark brown with shifting shades. Probably four different colours Only the embroidery thread left Dating: 1215 - 1235	Dark brown	14326/11
		Brown	14326/12
		Dark brown	14326/13
AI1693	 Weave: Three shafted twill Square shaped. Many weaving errors in the weft. Homogeneous in colour and structure. Slightly felted in one side Dating: 1180 - 1215	Black	14326/14
AI2517	 Weave: Three shafted twill Homogeneouos in structure, somewhat shifting in colour Dating: 1100 - 1135	Dark brown, blueish	14326/15

B90a	 Weave: Three shafted twill Homogeneous in colour and structure. Slightly felted in one side Dating: 12th - 15th century	Brown	14326/16
B90b	 Weave: Three shafted twill Slightly shifting in colour and structure Dating: 12th - 15th century	Greyish-brown	14326/17
B90c	 Homogeneous in colour and structure. Fulled, perhaps sheared? Dating: 12th - 15th century	Brown	14326/18
C245c	 Weave: Three shafted twill Brown with light brown stripes Dating: 12th – 15th century	Brown	14326/19
		Light brown	14326/20

C250	 Weave: Tabby? Homogeneous in colour and structure. Two fragments of fold from a pleated fabric Dating: 12th - 15th century	Red	14326/21
C274	 Weave: Four shafted twill 2/2 Striped. Homogeneous in colour and structure. Different shades in warp and weft. Slightly napped in one side Dating: 12th – 15th century	Dark brown/black	14326/22
		Brown	14326/23
C291	 Weave: Four shafted twill 2/2 Homogeneous in colour. Different structure in warp and weft. Folded edge with a seam. Warp with two threads, weft with one thread? Felted on one side. Dating: 12th – 15th century	Golden brown	14326/24
C295		Brown	14326/47
		Light brown	14326/48

CG19b	 Weave: Three shafted twill Pleated fold approx. 1 cm. Folded hem with a seam, whipstich approx. 3/cm. Homogeneous colour and structure Dating: 13th – 17th century	Dark brown	14326/25
D81	 Weave: Twill Homogeneous colour and structure. Fulled. Silk, lining, silk decor. Dating: 13th – 17th century	Red	14326/26
		Beige	14326/27
DN207 a	 Weave: Three shafted twill Hard twist in the warp, which is very finely-fibred and crinkly. Homogeneous colour and structure. Pleated. Dating: 12th – 17th century	Red	14326/28

GD2741c	 Weave: Three shafted twill "Elastic" yarn. Patchy colour, homogeneous structure. Slightly felted in places Dating: 11th – 15th century	Greenish-brown	14326/29
GD3218	 Dating: 11th – 15th century	Dark brown/black	14326/49
		Brown	14326/50
		Light brown	14326/51
GD3228a	 Weave: Tabby with stripes in rep weave Striped with four colours. Dating: 11th – 15th century	Brown	14326/30
		Red	14326/31
		Dark brown/black	14326/32
		Yellowish	14326/33
GD3278	 Weave: Tabby Homogeneoous in structure, patchy in colour. Dating: 11th – 15th century	Black brown	14326/34

NB154	 Weave: Herringbone twill Silk lining Dating: 12th – 15th century	Brown	14326/35
NC64	 Weave: - Fulled Dating: 13th – 16th century	Green/brownish	14326/36
		Light red/brownish	14326/37
		Dark red/brownish	14326/38
NC69	 Weave: Tabby Different colours in warp (brown) and weft (grey). Two ply thread Dating: 13th – 16th century	Grey	14326/39
		Brown	14326/40
NE2834	 Weave: Overshot Homogeneous in colour and structure Dating: 12th – 16th century	Light brown	14326/41
		Red	14326/42
		Dark brown	14326/43

VN35g	 Weave: Three shafted twill One harmhole and helf front, half back piece of the bodice. Probably from a child's dress. There is a seam in the middle of the front and back. On the front, the selvage is folded and hemmed with whipstiches around the whole hem. Homogeneous in structure, shifting in colour. Dating: 11th – 14th century	Greyish/brown	14326/44

3. Identification of the organic dyes

3.1 Analytical technique

The identification of the organic colorants is performed by High Performance Liquid Chromatography and photo diode array detection system (HPLC-DAD) with Alliance HPLC equipment (Waters, USA) and data analyses are done with Empower software, all from Waters. A detailed description of the analytical protocol was published before (Vanden Berghe et al. 2009).

Preliminary to the analysis, the samples are examined with a stereomicroscope Stemi, Zeiss, in order to examine the thread morphology and colour and to remove any visible contamination. The digital images are presented in the result table 5.

The colorants are recovered from the fibres using acidic extraction with hydrochloric acid, followed by ethyl acetate extraction[1].

3.2 Results

The HPLC-DAD analyses of each extract are listed in **Appendix**. The first two columns comprise the codes of the sample given by the requestor and the sample description, followed by the KIK sample code. The type of extract analysed and the analysis code are mentioned in the fourth and fifth columns.
The results of the chromatographic analyses are given in the following two columns. The dye composition is mentioned in column six and the wavelength(s) (nm) of integration of the mentioned compounds expressed in column seven.

[1] Extraction in 250 µL water/methanol/37% HCl (1/1/2, v/v/v) for 10 minutes at 105°C, followed by a second extraction with 500 µL of ethyl acetate - vacuum evaporation - dissolving the residue in 30/30 µL methanol/water from which 20 µL is injected. The first fourteen samples were analysed after HCl extraction, without ethyl acetate extraction.

The dye composition mentioned is expressed as relative proportions of the dye constituents after calculation of their peak area measured at the wavelength (nm) mentioned in the last column.

4. Discussion

4.1 Dyestuffs and biological sources

The results of the HPLC-DAD analyses in terms of possible dye source(s) are given in **Table 2**. Code and description of the object (fabric) are given in columns 1-2; Description and function of the thread samples in column 3 and digital microscopic images of each of the sampled yarns, in column 4. The last column gives the interpretation of the dye composition in function of the applied biological dye source(s).

- ***Red sources***

Madder
The detection of alizarin, combined with purpurin and minor amounts of nordamncanthal, munjistin, anthragallol, xanthapurpurin, rubiadin, anthrapurpurin and flavopurpurin in several of the samples is indicative for the use of the roots of a plant from the *Rubiaceae* family for red dyeing. The combination of alizarin and purpurin, suggests the use of cultivated madder (*Rubia tinctorum* L.).

Madder dyeing has been applied in the following fabrics:

- A8, the red and the ligh brown stripes, in the latter combined with a yellow dye source, from a striped tabby weave
- AI954, the brown woollen embroidery thread
- D81, the red sample from a fulled twill fabric.
- DN207a, the red sample from a twill fabric
- GD3228a, the red sample from a tabby weave with stripes in rep weave
- NC64, a fulled fabric, both in the light and dark red/brownish threads
- NE2834, the red sample

Kermes
Kermesic acid is the marker compound for dyeing with the scale insect kermes (*Kermes vermilio* Planchon), from which the female insect, small (6 to 8 mm) and sphere-shaped, gives this bright red substance.
The use of kermes for red dyeing has been identified in the fabric C250 (tabby?), in combination with tannin.

- ***Yellow source***

Luteolin and apigenin, both flavonoid dye compounds, are detected in six currently 'brown' samples. The presence of luteolin refers to the use of a yellow luteolin containing dye source. A broad range of plants are among the possible sources, such as weld (*Reseda Luteola* L.), sawwort (*Serratula tinctoria* L.), dyer's greenweed (*Genista tinctoria* L.) or types of chamomile (*Anthemis* sp.) or other local equivalents (Schweppe 1993).

A yellow luteolin-based dyeing has been applied in the following fabrics:

- A8, the light brown stripe from a striped tabby weave (found in combination with madder)
- AI954, the second dark brown embroidery thread (sample 14326/13)
- C245c, the light brown stripe from a twill weave
- GD2741c, the greenish-brown yarns from a twill, slightly felted
- GD3228a, the yellowish sample from a tabby weave with stripes in rep weave
- NC64, the green/brownish threads from a fulled weave

- ***Blue source***

The identification of indigotin is characteristic for the use of a indigoid dye source. It refers to either oriental indigo (*Indigofera* or *Polygonum* species) or woad (*Isatis tinctoria* L.). As the same dye compounds can be found after chromatographic analyses of textiles dyed with these types of plants, distinction between the sources is not possible based on the dye compound identification (Hofenk de Graaff 2004, 244-253). Considering the historical context of the finds, likely woad has been used as the blue dye source.

Indigotin was applied with a yellow source in the green fragment of fabric NC64.

- ***Tannin***

The detection of ellagic acid is an indication for the occurrence of ellagi-or gallotannins, hydrolysable tannin which can derive from a wide range of plant sources (Cardon 2007,619-635). It is found, though always in very small amount, in the majority of the samples, with or without an accompanying mordant dye.

- ***Other compounds***

In all the samples, hydroxy- and methoxy benzoic acids are present such as 4-hydroxybenzoic acid (phb), 4-methoxybenzoic acid (pmb) methyl-4-hydroxy benzoic acid (mphb) and 3,4-dihydroxybenzoic acid, also known as protocatechuic acid (pca). These compounds are generally detected in archaeological textile finds especially in humid burial context where they might refer to degradation products of dyes, fibres or surrounding material in the soil (Vanden Berghe et al. 2009).
As they are detected in all samples in the current study without any clear relation to the present colour, it seems rather likely that their presence is to be related with fibre degradation or other organic material present in the burial context rather than with the deliberate use of dyes for dyeing purposes.

4.2 Natural pigmentation

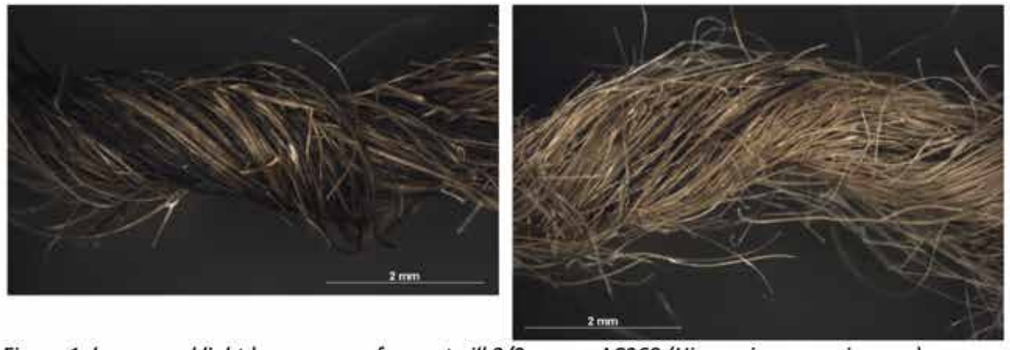
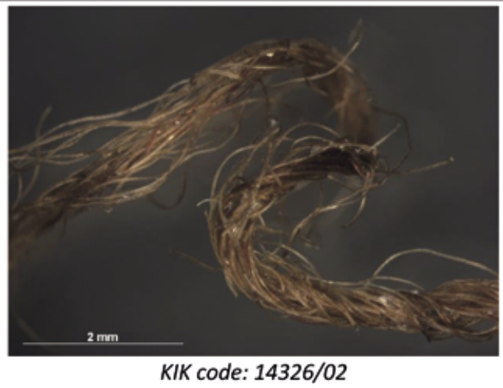


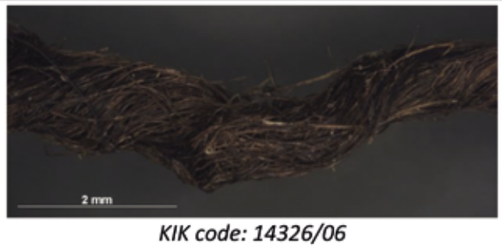
Figure 1. brown and light brown yarns from a twill 2/2 weave AC269 (Hirox microscope images)

Figure 2. brown and light brown yarns from A17 (Hirox microscope images)

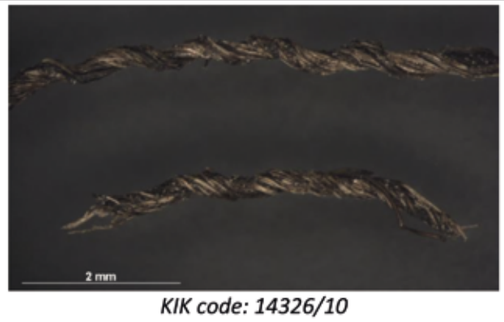
Several textile fragments don't contain any evidence for dyeing although different shades of yarns are visually distinguished. The high resolution images of the samples taken with Hirox digital microscope show that different shades of wool yarns are obtained in several of the fragments by using unpigmented or dark pigmented yarns as well yarns composed of a mixture of unpigmented and pigmented wool fibres to obtain different shades (Figures 1-2).

Table 2: List of Lödöse samples with description, pictures and HPLC-DAD results

Object code	Fabric description	Sample description	Sample Image (Stemi, Zeiss) KIK/IRPA code sample	Dye source(s)
A1	Three shaft twill	Yellowish brown	 *KIK code: 14326/01*	No dyes detected
A8	Tabby with stripes	Brown	 *KIK code: 14326/02*	*Tannin and madder ** *(likely contamination by red stripe)*
A8	Tabby with stripes	Red	 *KIK code: 14326/03*	**Madder**
		Light brown	 *KIK code: 14326/04*	**Yellow luteolin-based dye source and madder**
		Light brown	 *KIK code: 14326/05*	*Madder ** *(likely contamination by red stripe)*

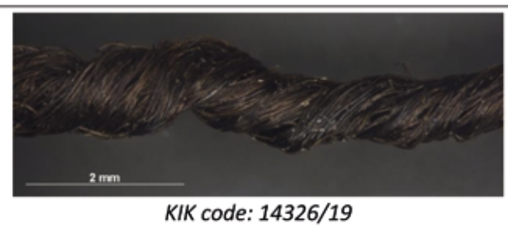
A11	Four shafted twill 2/2 Different colours in wrp and weft	Brown	 *KIK code: 14326/06*	Tannin
		Light brown/greyish	 *KIK code: 14326/07*	Tannin

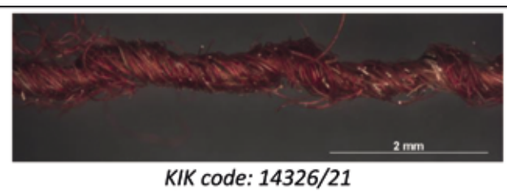
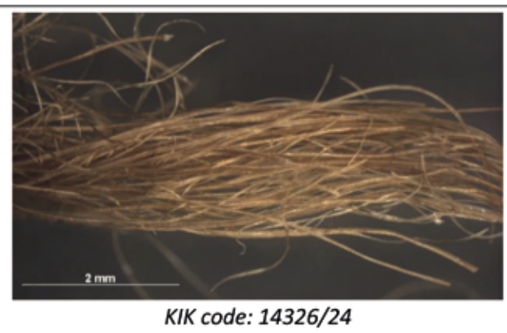
A17		Brown	 *KIK code: 14326/45*	Tannin
		Light brown	 *KIK code: 14326/46*	No dyes detected

AC269	Four shafted twill 2/2 Warp and weft are in different shades	Brown	 *KIK code: 14326/08*	No dyes detected
		Light brown/greyish	 *KIK code: 14326/09*	No dyes detected
AI953	Three shafted diamond twill Different shades in warp and weft	Brown	 *KIK code: 14326/10*	Tannin

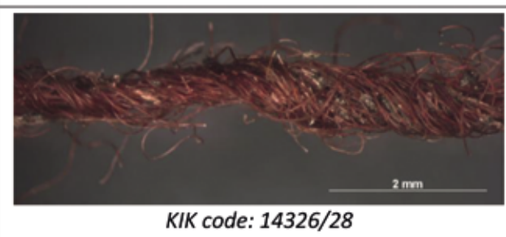
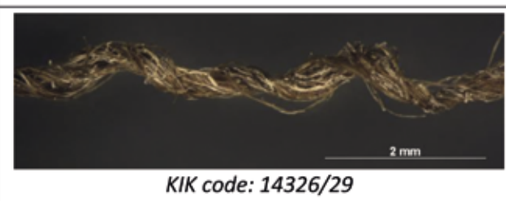
AI954	Woollen embroidery threads Dark brown with shifting shades. Probably four colours	Dark brown	 *KIK code: 14326/11*	Tannin
		Brown	 *KIK code: 14326/12*	**Madder** and tannin
		Dark brown	 *KIK code: 14326/13*	**Luteolin-based dye source** and tannin

AI1693	Three shafted twill Homogeneous in colour	Black	 *KIK code: 14326/14*	Tannin
AI2517	Three shafted twill Somewhat shifting in colour	Dark brown/bluish	 *KIK code: 14326/15*	Tannin
B90a	Three shafted twill Homogeneous in colour	Brown	 *KIK code: 14326/16*	No dyes detected

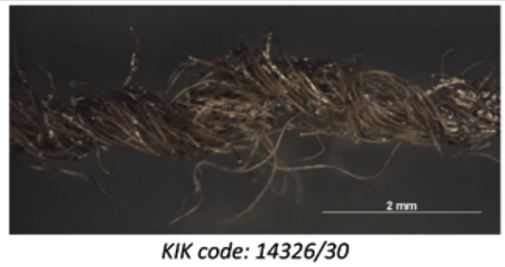
B90b	Three shafted twill Slightly shifting in colour	Greyish-brown	 *KIK code: 14326/17*	No dyes detected
B90c	Homogeneous in colour	Brown	 *KIK code: 14326/18*	No dyes detected
C245c	Three shafted twill Brown with light brown stripes	Brown	 *KIK code: 14326/19*	Tannin
		Light brown	 *KIK code: 14326/20*	**Yellow luteolin-based dye source**

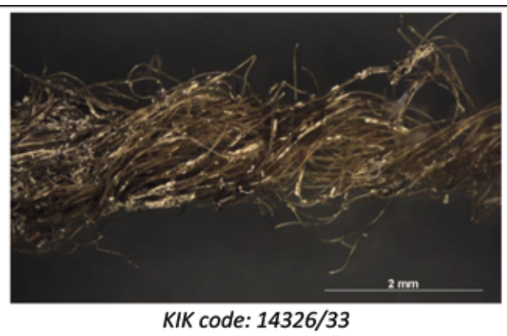
C250	Tabby? Homogeneous in colour	Red	 *KIK code: 14326/21*	**Kermes** and tannin
C274	Four shafted twill 2/2 Different shades in warp and weft	Dark brown/black	 *KIK code: 14326/22*	Tannin
		Brown	 *KIK code: 14326/23*	Tannin
C291	Four shafted twill 2/2 Homogeneous colour	Golden brown	 *KIK code: 14326/24*	No dyes detected

C295	Striped	Brown	 *KIK code: 14326/47*	Tannin
		Light brown	 *KIK code: 14326/48*	Tannin
CG19b	Three shafted twill Homogeneous colour	Dark brown	 *KIK code: 14326/25*	Tannin

D81	Twill Homogeneous colour. Fulled. Silk lining, silk decor.	Red	 *KIK code: 14326/26*	**Madder**
		Beige	 *KIK code: 14326/27*	*Traces of madder * (likely cross-contamination by red sample)*
DN207a	Three shafted twill Homogeneous colour	Red	 *KIK code: 14326/28*	**Madder**
GD2741c	Three shafted twill Patchy colours, homogeneous in structure	Greenish-brown	 *KIK code: 14326/29*	**Yellow luteolin-based dye source** and tannin

GD3218	Striped	Dark brown/black	 *KIK code: 14326/49*	Tannin
		Brown	 *KIK code: 14326/50*	Tannin
		Light brown	 *KIK code: 14326/51*	No dyes detected

GD3228a	Tabby with stripes in rep weave	Brown	 *KIK code: 14326/30*	No dyes detected
		Red	 *KIK code: 14326/31*	**Madder**
		Dark brown/black	 *KIK code: 14326/32*	*Traces of madder * (likely cross-contamination by red sample)*

GD3228a	Tabby with stripes in rep weave	Yellowish	 *KIK code: 14326/33*	**Yellow luteolin-based dye source** and madder * (possibly cross-contamination by red sample)
GD3278	Tabby Homogeneous in structure, patchy in colour	Black brown	 *KIK code: 14326/34*	No dyes detected
NB154	Herringbone twill	Brown	 *KIK code: 14326/35*	No dyes detected

NC64	Fulled fabric	Green/brownish	 *KIK code: 14326/36*	**Yellow luteolin-based dye source and blue indigoid dye source**
		Light red/brownish	 *KIK code: 14326/37*	**Madder**
		Dark red/brownish	 *KIK code: 14326/38*	**Madder** *+ traces of a yellow luteolin based and an indigoid dye source* (likely cross-contamination by green fragment)*

NC69	Tabby Different colours in warp and weft	Grey (weft)	 *KIK code: 14326/39*	Tannin
		Brown (warp)	 *KIK code: 14326/40*	Tannin

NE2834	Overshot	Light brown	 *KIK code: 14326/41*	Tannin
		Red	 *KIK code: 14326/42*	**Madder**
		Dark brown	 *KIK code: 14326/43*	Tannin *+ traces of madder * (likely cross-contamination by red sample)*

VN35g	Three shafted twill Homogeneous in structure, shifting in colour	Greyish/brown	 *KIK code: 14326/44*	No dyes detected

5. Conclusion

The dye identification of a selection of 29 textile fragments from 13 excavation sites of the Medieval Lödöse has resulted in the identification of 4 dye sources: the roots of the madder plant and the scale insect kermes, both providing red colorants, a luteolin based dye plant such as weld, sawwort, dyer's greenweed, chamomille or equivalent, used to dye yellow; and a blue vegetal indigoid dye source, likely woad. Dyes are detected in 15 of the investigated thread samples.

In total 10 of the 29 textile fragments contain yarns that have been dyed. This is the case for fragments: A8, AI954, C245c, C250, D81, DN207a, GD2741c, GD3228a, NC64 and NE2834. In the majority of the other fragments, patterns are made by the use of yarns composed of pigmented or unpigmented fibres or various mixtures of both.

Tannins are detected (by means of the presence of ellagic acid) in the majority of the samples, however always in very low amount. They seem to be systematically present in the black and dark brown yarns obtained by natural pigmented fibres but not in the clearly light brown/beige yarns such as in samples 14326/09-17-24-27-46-51.

In the following part, an overview is given of the conclusions of the study for each of the fragments.

A1 – three shafted twill weave
No evidence of dyeing. Natural pigmented fibres are used.

A8 – tabby with stripes
The fragment contains stripes made of weft yarns red dyed with madder and 'orange' wefts dyed with madder and luteolin yellow. No dyes are found in the other two light brown and brown weft yarns analysed.

A11 – four shafted twill weave 2/2
Both warp and weft yarns contain some tannins, but no evidence of dyeing has been found. The difference in hue is obtained by the use of different naturally pigmented fibres. For the darker yarns only pigmented fibres are used, while the paler yarns are made from a combination of naturally pigmented and unpigmented fibres.

A17 – fragment with stipes
There is no evidence of dyeing. For the darker threads only naturally pigmented fibres are used, while the paler threads that form the stripes are made of unpigmented fibres. Only the dark threads contain tannins.

AC269 – four shafted twill 2/2
There is no evidence of dyeing. The difference in hue between warp and weft is obtained by the use of different naturally pigmented fibres. For the lighter yarns only unpigmented fibres are used, while the darker ones are made from a combination of naturally pigmented and unpigmented fibres.

AI953 – three shafted diamond twill, goose eye
No dyes are detected. The brown yarns are made by the use of a combination of naturally pigmented and unpigmented fibres. They contain some tannins.

AI954 – woollen embroidery threads

The 'brown' embroidery thread is dyed with madder, while luteolin yellow was identified in 'dark brown' yarn. No dyes were found in the darkest sample. All yarns are likely composed of naturally pigmented fibres and contain some tannins.

AI1693 – three shafted twill weave, slightly felted on one side
No evidence of dyeing. The black yarns are made by naturally dark pigmented fibres and contain some tannins.

AI2517 – three shafted twill
No evidence of dyeing. The black yarns are made by naturally dark pigmented fibres and contain some tannins.

B90a – three shafted twill, slightly felted on one side
No evidence of dyeing. The brown yarns are made by naturally pigmented fibres.

B90b - three shafted twill
No evidence of dyeing. The pale yarns are made by unpigmented fibres.

B90c – brown fabric, fulled, perhaps sheared?
No evidence of dyeing. The brown yarns are made by naturally pigmented fibres.

C245c – three shafted twill, brown with light brown stripes
The brown yarns are made by naturally pigmented fibres and contain some tannins, while the more pale stripes are made of yarns dyed with luteolin yellow, and made of unpigmented fibres.

C250 – tabby?, two fragments of fold from a pleated fabric
The fragments have been red dyed with kermes. This is a clear indication that it concerns an important, high valuated textile. Kermes was the most precious dye source in western Europe during medieval times!

C274 – four shafted twill 2/2 with stripes
No evidence for dyeing. The dark brown/black yarns are made by naturally dark pigmented fibres, while the brown yarns are likely made of a mixture of dark and less pigmented fibres. Both yarns contain some tannins.

C291 - four shafted twill 2/2 , homogeneous colour, felted on one side
There is no evidence of dyeing. The 'golden brown' yarn is made of unpigmented fibres.

C295 – striped fabric
No evidence of dyeing. The different hue of the stripes is obtained by brown yarns, made of dark and less pigment fibres, and of light brown yarns, made of only less or unpigmented fibres. Both contain some tannins.

CG19b – three shafted twill, homogeneous colour
No evidence of dyeing. The black yarns are made by naturally dark pigmented fibres and contain some tannins.

D81 – twill weave, fulled (silk lining, silk decoration)
The red yarns are dyed with madder, while the beige yarns are undyed and made of unpigmented fibres.

DN207a – three shafted twill, homogeneous colour
The red yarns are dyed with madder.

GD2741c – three shafted twill, homogeneous structure, slightly felted in places
The greenish-brown yarns are dyed with luteolin yellow and contain some tannins.

GD3218 – twill weave with stripes
There is no evidence of dyeing. The dark brown/black and the brown yarns are made by naturally dark pigmented fibres and contain some tannins. The light brown yarns are likely made of unpigmented fibres.

GD3228a – tabby with stripes in rep weave (stripes in four colours)
The red yarns are dyed with madder and the yellowish yarns with luteolin yellow (possibly combined with madder). No dyes are found in the brown and dark brown/black yarns. The latter are both made of dark and very dark pigmented fibres.

GD3278 – tabby, homogeneous structure, patchy in colour
No dyes detected. The yarn contains traces of a dark substance on the yarn surface.

NB154 – Herringbone twill. Silk lining.
No evidence of dyeing.

NC64 – fulled fragments
The light and dark red yarns are both dyed with madder, while the green yarns are dyed with a combination of woad and luteolin yellow.

NC69 – tabby with different colour in warp and weft
There is no evidence of dyeing. The different hue between the grey weft and brown warp yarns is likely obtained by a different mixture of dark and less naturally pigmented fibres. Both yarns contain some tannins.

NE2834 – 'overshot', homogeneous in colour and structure
The red yarns are dyed with madder. No dyes are found in the light and dark brown yarns. The dark brown yarns are made by dark naturally pigmented fibres, while the lighter brown yarns is made of a mixture of dark and less naturally pigmented fibres. Both of these yarns contain some tannins.

VN35g – three shafted twill
No evidence of dyeing. The grey/brown yarn is made by of a mixture of dark and less naturally pigmented fibres.

6. References

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Hofenk de Graaff, J. (2004) The Colourful Past. Origins, Chemistry and Identification of Natural Dyestuffs, Abegg-Stiftung & Archetype Publications Ltd., Riggisberg & London.

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Appendix

Table 3: HPLC-analyses. Detected dye compounds.

Object code	Sample description	KIK/IRPA code	Extract	Analysis n°	Dye composition	λ (nm)
A1	Yellowish brown	14326/01	AcEt	01/200213/07	-	255
A8	Brown	14326/02	AcET	01/200213/08	55 purpurin, 44 alizarin, 1 ellagic acid	255
	Red	14326/03	AcEt	01/200213/09	55 alizarin, 44 purpurin, 1 nordamnacanthal, + anthragallol, + munjistin, + anthrapurpurin	255
	Light brown	14326/04	AcEt	01/200213/11	42 luteolin, 40 alizarin, 17 purpurin, 1 apigenin	255
	Light brown	14326/05	AcEt	01/200213/12	66 purpurin, 44 alizarin	255
A11	Brown	14326/06	AcEt	01/200213/13	100 ellagic acid	255
	Light brown/greyish	14326/07	AcEt	01/200213/15	100 ellagic acid	255
A17	Brown	14326/45	AcEt	01/200312/10	100 ellagic acid	255
	Light brown	14326/46	AcEt	01/200312/12	-	255

AC269	Brown	14326/08	AcEt	01/200213/16	-	255/420
	Light brown/greyish	14326/09	AcEt	01/200213/17	-	255
AI953	Brown	14326/10	AcEt	01/200227/04	100 ellagic acid	255
AI954	Dark brown	14326/11	AcEt	01/200227/05	100 ellagic acid	255
	Brown	14326/12	AcEt	01/200227/06	52 alizarin, 46 purpurin, 1 nordamnacanthal, 1 ellagic acid, + anthragallol	255
	Dark brown	14326/13		01/200227/08	53 luteolin, 47 ellagic acid	255
					63 luteolin, 25 ellagic acid, 12 apigenin	350
AI1693	Black	14326/14	AcEt	01/200227/09	Traces of ellagic acid	255
AI2517	Dark brown/bluish	14326/15	AcEt	01/200227/10	100 ellagic acid	255
B90a	Brown	14326/16	AcEt	01/200227/12	-	255
B90b	Greyish-brown	14326/17	AcEt	01/200227/13	-	255
B90c	Brown	14326/18	AcEt	01/200227/14	-	255

C245c	Brown	14326/19	AcEt	01/200304/04	100 ellagic acid	255
	Light brown	14326/20	AcEt	01/200304/05	90 luteolin, 10 apigenin	255
C250	Red	14326/21	AcEt	22/200304/06	99 kermesic acid, 1 ellagic acid	255
C274	Dark brown/black	14326/22	AcEt	22/200304/08	100 ellagic acid	255
	Brown	14326/23	AcEt	22/200304/09	100 ellagic acid	255
C291	Golden brown	14326/24	AcEt	22/200304/10	-	255
C295	Brown	14326/47	AcEt	22/200312/13	100 ellagic acid	255
	Light brown	14326/48	AcEt	22/200312/14	100 ellagic acid	255
CG19b	Dark brown	14326/25	AcEt	22/200304/12	100 ellagic acid	255
D81	Red	14326/26	AcEt	22/200304/13	58 purpurin, 37 alizarin, 4 nordamnacanthal, 1 munjistin, +anthrapurpurin, + anthragallol	255
	Beige	14326/27	AcEt	22/200304/14	70 purpurin, 30 alizarin	255
DN207a	Red	14326/28	AcEt	22/200311/04	71 purpurin, 25 alizarin, 3 nordamnacanthal, 1 munjistin, + anthragallol, + xanthopurpurin, + lawson	255

GD2741c	Greenish-brown	14326/29	AcEt	22/200311/06	92 luteolin, 4 apigenin, 4 ellagic acid	255
GD3218	Dark brown/black	14326/49	AcEt	22/200312/16	100 ellagic acid	255
	Brown	14326/50	AcEt	22/200312/17	100 ellagic acid	255
	Light brown	14326/51	AcEt	22/200312/18	-	255
GD3228a	Brown	14326/30	AcEt	22/200311/07	-	255
	Red	14326/31	AcEt	22/200311/09	64 alizarin, 30 purpurin, 5 nordamnacanthal, 1 lawson, + anthragallol, + munjistin, + rubiadin, + ellagic acid	255
	Dark brown/black	14326/32	AcEt	22/200311/10	43 purpurin, 30 nordamnacanthal, 17 alizarin, 10 ellagic acid	255
	Yellowish	14326/33	AcEt	22/200311/11	65 luteolin, 18 purpurin, 8 alizarin, 7 nordamnacanthal, 2 apigenin	255
GD3278	Black brown	14326/34	AcEt	22/200311/13	-	255
NB154	Brown	14326/35	AcEt	22/200311/14	Traces of nordamnacanthal	255

NC64	Green/brownish	14326/36	AcEt	22/200311/15	74 luteolin, 24 indigotin, 2 apigenin	255

	Light red/brownish	14326/37	AcEt	22/200311/17	80 purpurin, 18 alizarin, 1 munjistin, 1 nordamnacanthal, + anthragallol	255
	Dark red/brownish	14326/38	AcEt	22/200311/18	78 purpurin, 21 alizarin, 1 nordamnacanthal, + anthragallol, + munjistin, + anthrapurpurin, + xanthopurpurin, + rubiadin, + ellagic acid	255
					Traces of luteolin, apigenin and indigotin	350/600
NC69	Grey	14326/39	AcEt	22/200311/19	Ellagic acid	255
	Brown	14326/40	AcEt	22/200312/04	Ellagic acid	255
NE2834	Light brown	14326/41	AcEt	22/200312/05	Ellagic acid	255
	Red	14326/42	AcEt	22/200312/06	59 alizarin, 41 purpurin, + anthragallol, + rubiadin, + nordamnacanthal	255
	Dark brown	14326/43	AcEt	22/200312/08	ellagic acid, +alizarin	255
VN35g	Greyish/brown	14326/44	AcEt	22/200312/09	-	255

10.0 Bilaga 3.

Budgetöversikt

Datum	**Aktivitet**	**Kostnad (SEK)**
2020-10-01	Färgämnesanalyse	63 753,85
2020-10-08	Resa till RAÄ på Gotland	734,04
202-10-09	Boende på Gotland	4267,86
2020-10-15	Resa till RAÄ på Gotland	977,28
2020-11-01	Boende på Gotland	4267,86
2020-11-01	Avbokad resa till Gotland-	920,53
	Total kostnad	**73 080,36**