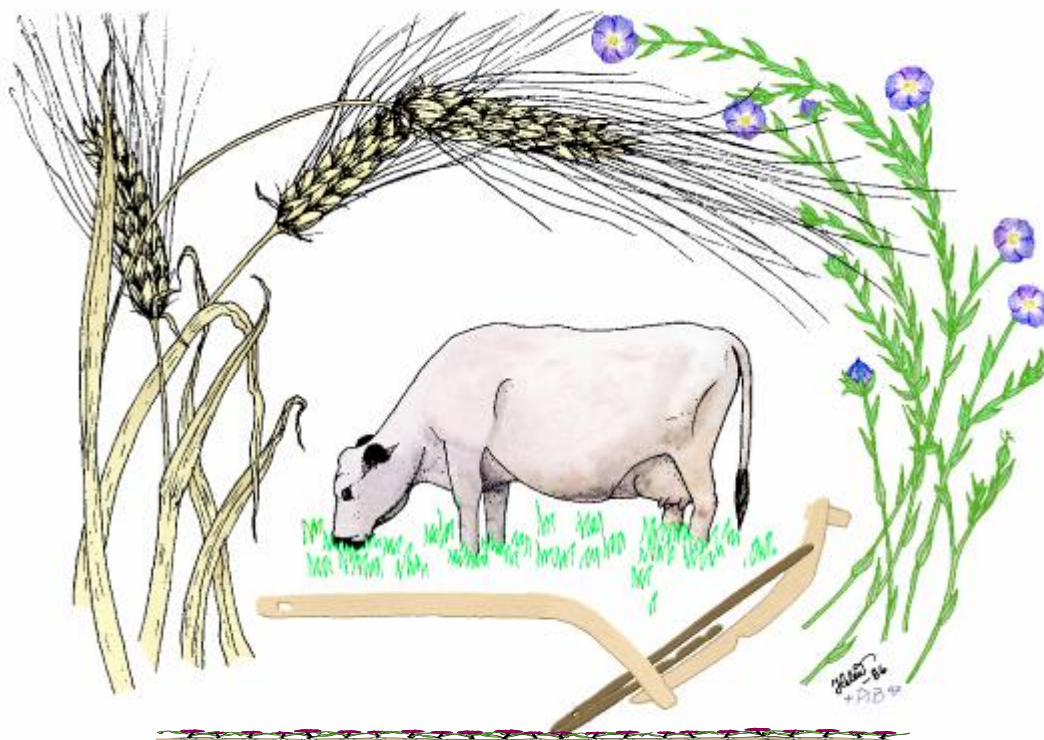


MILJÖARKEOLOGISKA LABORATORIET

RAPPORT nr. 2015-010



**Environmental archaeological analysis of
samples from site Hestehag 47/2, Aust-Agder,
Arendal kommune, Norway.**

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INSTITUTIONEN FÖR IDÉ OCH SAMHÄLLSTUDIER



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By

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1 Introduction

This study deals the site, site Hestehag 47/2, Aust-Agder, Arendal kommune, Norway., were a number of bulk soil samples and pollen samples have been collected in connection to a grave mound and its surroundings. The main purpose of the study was to identify different layer formation and possible charred material in relation to the grave and cultivation contexts.

Geographic site information (background maps) and excavation result compiled in this report has been given by Jessica Leigh McGraw, University Oslo.

Samuel Ericsson and Sofi Östman have conducted the soil chemical and archaeobotanical analysis of the material. Jan-Erik Wallin has dealt with the pollen analysis and related report.

2 Material and methods

2.1 Material

4 bulk samples and 8 samples for pollen analysis was collected and submitted to MAL.

2.2 Analytical methods

Bulk soil chemical and physical properties:

Prior to all analysis samples are dried at 30°C. Samples are then passed through a 1.25 mm sieve and any presence of matters of cultural significance is noted (such as bone, charred matters and ceramics etc).

The chemical methods employed here are the same as those used in the Swedish soil chemical studies following the methodological approach of Engelmark and Linderholm (1996 and 2008). The parameters analysed are explained in the table matrix below.

Abbreviation	Method	Description
MS	Magnetic Susceptibility	Magnetic susceptibility measured on 10g of soil, with a Bartington MS3 system with an MS2B probe (Dearing 1994). Data are reported as SI-units per ten grams of soil, (corresponding to X_{lf} , $10^{-8} \text{ m}^3 \text{ kg}^{-1}$) (Thompson & Oldfield 1986).
MS550	Magnetic Susceptibility after burning at 550°C	Magnetic susceptibility after 550° C ignition (units as above)
LOI(%)	Loss On Ignition	Soil organic matter, determined by loss on ignition at 550° C, in percent (Carter, 1993).
Cit-P	Inorganic phosphate content (ppm)	Extraction with 2% citric acid (corresponding to the Arrhenius method (Arrhenius 1934 and 1955))
Cit-POI	Total phosphate (ppm) (inorganic & organic)	Extraction with 2% citric acid on ignited soil
P quota	cit-POI /cit-P	Ratio of inorganic & organic to inorganic phosphate

These methods have been developed and adapted for soil prospection and bulk analysis of occupation soils and features (see below). Analysed parameters comprise organic matter (loss on ignition [LOI], Carter 1993), two fractions of phosphate (inorganic [Cit-P], and sum of organic and inorganic [Cit-POI])(Engelmark & Linderholm 1996, Linderholm 2007) and magnetic susceptibility (MS- χ_{lf}) and MS550 (Clark 2000, Linderholm 2007, Engelmark & Linderholm 2008). These analyses provide information on various aspects concerning: phosphate, iron and other magnetic components and total organic matter in soils and sediments, and its relationship to phosphate. (Further details can be found in (Viklund et al. 2013).

Archaeobotanical analysis:

Unfloated samples were water sieved with mesh widths of 2 and 0,5 mm. Organic remains larger than 0,5 mm was retrieved. The material was studied using a stereo microscope (8-50 times magnification) and plant remains was identified whenever possible.

Pollen analysis:

The pollen study is reported separately below.

3 Results

Analytical results from the four bulk samples are compiled in tables 1 and 2 below.

Table 1. Soil chemistry and magnetic susceptibility data from Hestehag 47/2.

MALNo	Sample no	FeatureNo	Layer	Type	MS _{lf}	MS550 _{lf}	CitP	CitPOI	PQuota	LOI
14_0064_001	1779	A400		Fra gammel markoverflate under langhaug	58	130	111	118	1,06	3,9
14_0064_002	3068			Fra haugfyll mellom nedre del av steinpakkning.	58	196	120	110	0,92	5,5
14_0064_003	2414	A1272	Lag 2	Fossile dyrkningslag	209	282	39	91	2,32	3,0
14_0064_004	2413	A1272	Lag 3	Fossile dyrkningslag	148	358	26	65	2,49	3,5

Figure 1 show the relation between Pquota to LOI of the four samples. The fossil agricultural soils clearly show presence enhanced organic phosphate levels most likely emanating from input of animal dung. Samples beneath the mound seem to be more settlement affectes as the CitP levels are quite high.

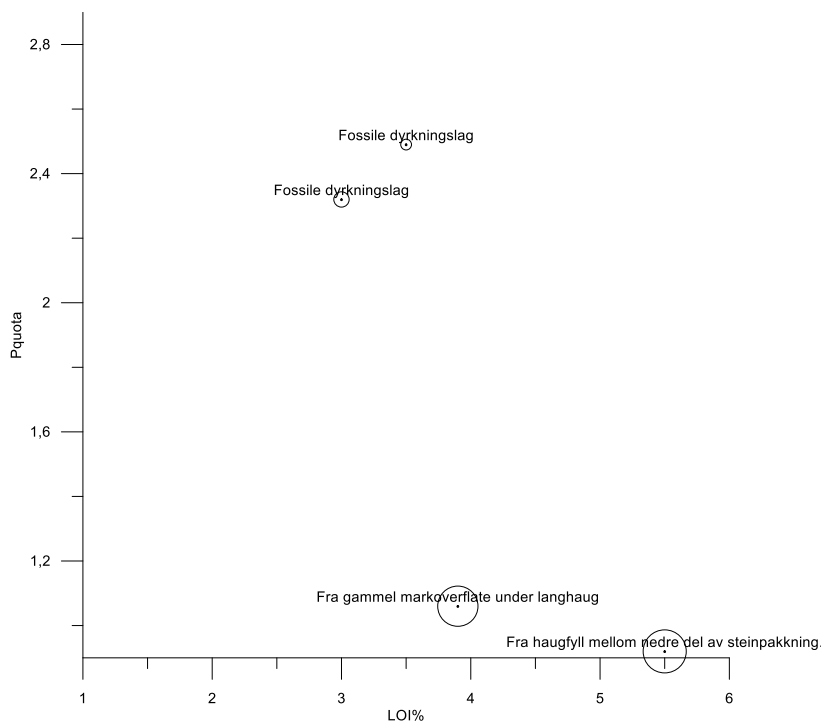


Figure 1. Graph displaying the relation between the Pquota and organic content (loss on ignition) and with CitP content displayed relatively in varying size of circles.

Table 2. Archaeobotanical finds.

Taxon				Indet.	
Genus	Spargula	Persicaria	Persicaria		Corylus
Species	arvensis	lapathifolia	sp.		avellana
Modifications	Carbonised	Carbonised	Carbonised	Carbonised	Carbonised, fragments
Element					shell
14_064_001					
14_064_002					
14_064_003	1	5	1	1	
14_064_004		15			3

Overall, very few charred seeds were identified in the samples.

In the samples from beneath the mound, no charred seed were found. *Persicaria lapathifolia* occurs in the samples from layers classified as representing lynchets/cultivation phases. One seed of *spargula arvensis* was also found here.

Resultat av pollenanalys, från Hesthag 47/2, Arendal, Aust-Agder, Norge. MAL 14-064

Jan-Erik Wallin
Pollenlaboratoriet i Umeå AB

INLEDNING

Jordproverna 3069 och 3070 är tagna under ett röse, A2000 (fig. 1). 6 stycken pollenprover är tagna ur en profil, 3C2337 (fig. 2).

METODER

Pollenanalys

Provet homogeniserades innan ett delprov togs ut för pollenanrikning. Prover behandlades enligt standardmetoden för pollenanrikning beskriven i t.ex. Moore et al. (1991). Återstoden, det koncentrerade pollenmaterialet, färgades med saffraninfärgad glycerin. På preparatet räknades mellan 300-600 pollen och procentvärden beräknades på basen av totalsumman för alla pollen från de landlevande kärleväxterna. Vid identifiering av pollentyperna användes bestämningsnycklar av Beug (1961) och Moore et al. (1991). Vid pollenanalys av jordprover finns en viss risk för att växtarter med tjockskaliga pollenkorner får en överrepresentation i analysen (t. ex korgblommiga växter). Att pollenkornen har ett tjockt skal minskar risken för nedbrytning, jämfört med tunnskaliga pollenkorner. Pollenproverna från profil 3C2337 innehöll rikligt med både tjockskaliga och tunnskaliga pollen. Någon ökad nedbrytning av tunnskaliga pollen har inte skett.

RESULTAT och DISKUSSION

A2000, pollenproverna 3069 och 3070

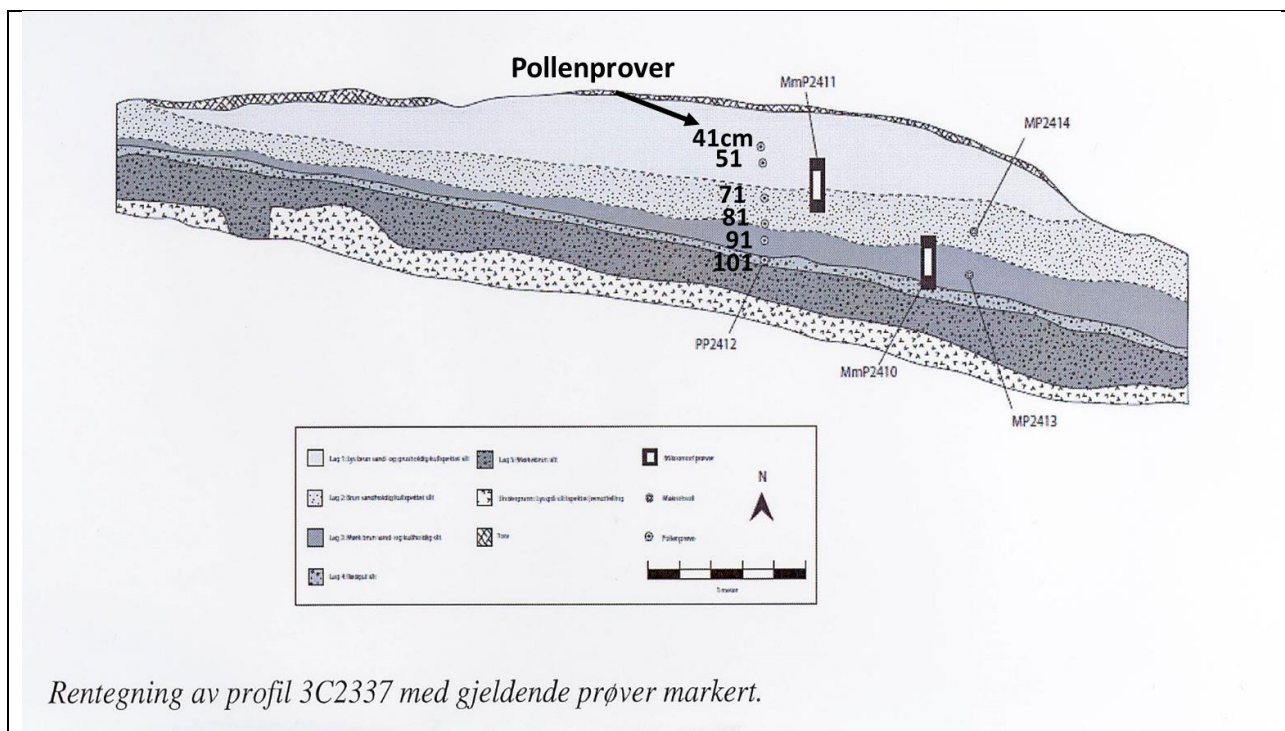
Båda pollenproverna innehöll endast enstaka pollenkorner, någon pollenanalys gjordes inte på dessa prover.



Figur 1: Röse A2000, pollenproverna 3069 och 3070 (foto Kulturhistorisk museum, Universitetet i Oslo)

Röse 1272, profil 3C2337

Alla uttagna prover innehöll rikligt med pollen. Resultatet presenteras i ett pollendiagram (1)



Figur 2: Pollenproverna från profil 3C gravhög 2337 41, 51, 71, 81, 91 och 101 cm. (ritning Kulturhistorisk museum, Universitetet i Oslo)

Lager 1 och 2, pollenproverna 41, 51, 71 och 81cm

Pollensammansättningen är tämligen lika i alla fyra prover. Lövskogsvegetationen minskar i andel jämfört med pollenproverna från lager 3 och 4. Speciellt lind och al (or) minskar. Andelen pollen som indikerar bete och odling är hög. Pollenanalysen visar att både korn (bygg) och vete (kveite) odlades på lokalen. Att åkrar fanns på lokalen kännetecknas även av att andelen pollen från åkerogräs är hög, såsom pollen från spärgel (bendel), brännässla (nesle), målla (meldestokk) och gräs (gras). Några pollen från gran har inte hittats i proverna.

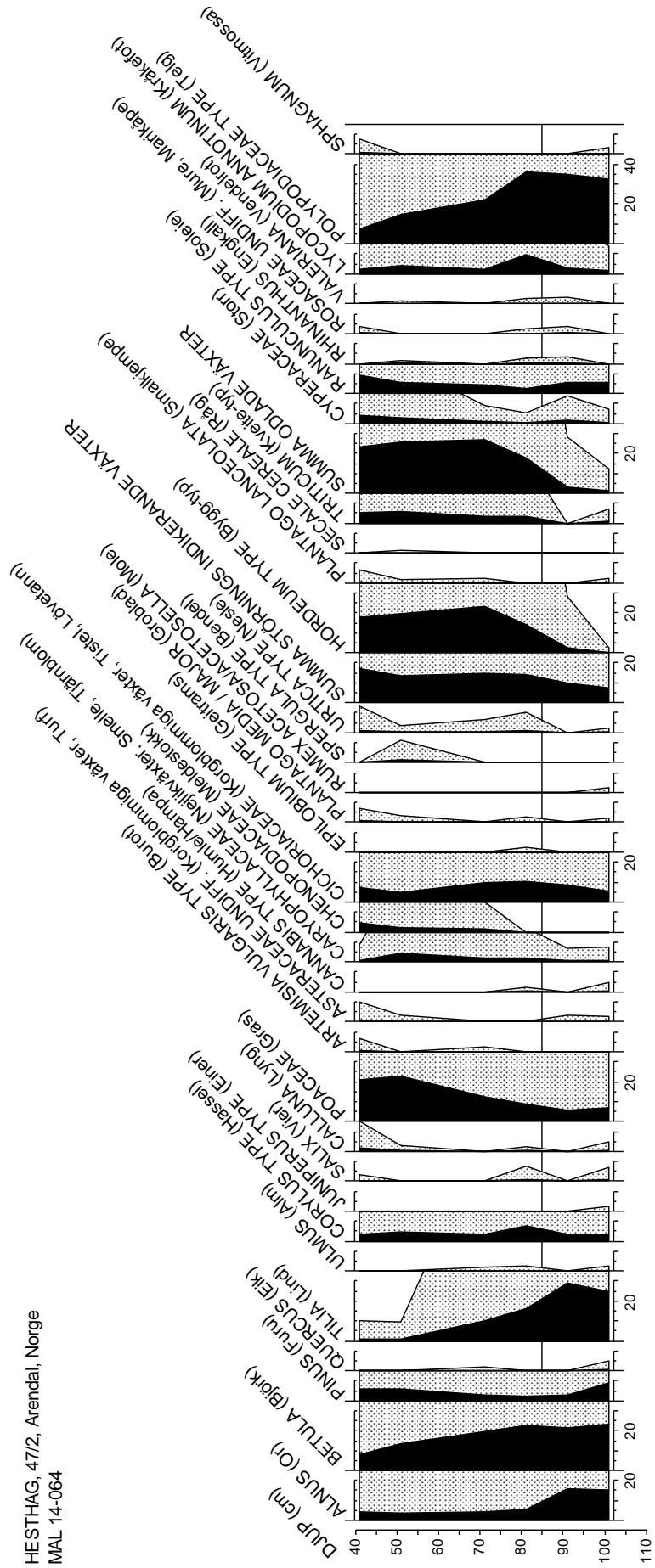
Lager 3 och lager 4, pollenproverna 91 och 101 cm

Pollensammansättningen i båda proverna är tämligen lika. Lövskogsvegetation dominerar med trädslagen lind, björk och al (or). Tall (furu) förekommer sparsamt. Inga pollen från gran har hittats. Svaga indikationer av bete och odling återfinns i pollenproverna (förekomst av enstaka pollen från korn och vete).

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HESTHAG, 47/2, Arendal, Norge
MAL 14-064



Analys Pollenlaboratoriet i Umeå AB Jan-Erik Wallin december 2014

4 Discussion and summary of all analytical work

The archaeobotanical remains were sparse in the four samples and leaves little room for any complex interpretations. However, the soil data gives away clear indication of dung manuring in what is interpreted cultivation layers. Furthermore, some kind of dwelling activity or percolating burial material may be seen in the elevated phosphate levels in the two samples beneath the mound. This also corroborates well with previous finds related to micromorphology (Macphail et al 2015).

The pollen study clearly points out an intensification of agricultural activities through time. Occurrence of cerealia show clear agricultural activities in the near vicinity of the mound. Also increase in calluna, plantago lanceolata in the upper part of the sedimentation points out increasing pasture compared to the base part of the sediment. Additionally, the tree curve decreases and general grass increase which further strengthen this reasoning. The absence of pollen in the cairn A2000

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