

Micro-GIS Evidence And Analysis of Settlement Refuse

Petr Květina
Archaeological Institute Prague, Czech Republic
kvetina@arup.cas.cz

Micro-GIS Evidence And Analysis of Settlement Refuse

The paper deals with the problem of detailed recording and analysis of artifacts' position in the settlement pits on prehistoric sites. The goal is to clarify the process in which the settlement pits were filled. Natural processes (N-transformation) and human refuse behaviour (C-transformation) are the main, though inconsistent agents. The solution of this question consists of two factors: 1. the method of artifacts' position documentation in an archaeological feature during excavation; 2. the spatial and correlation analysis of the obtained data. The investigation was conducted at the Habrkovice site (Czech rep., Hallstat period semi-subterranean dwelling), and at Bylany near Kutna Hora (Czech rep., Neolithic settlement area). Different methodological approaches were applied, including the EDM laying process and segment recording of archaeological finds. GIS and PCA analysis of the data were carried out.

The Aim

The aim is to clarify the process in which the settlement pits were filled.

The essential question is: **was the pit filled naturally or culturally ?**

Different methodological approaches leading to artifacts' position documentation were applied:

using EDM Topcon GTS 212 at Habrkovice site (Czech rep., in particular Hallstat period semi-subterranean dwelling)

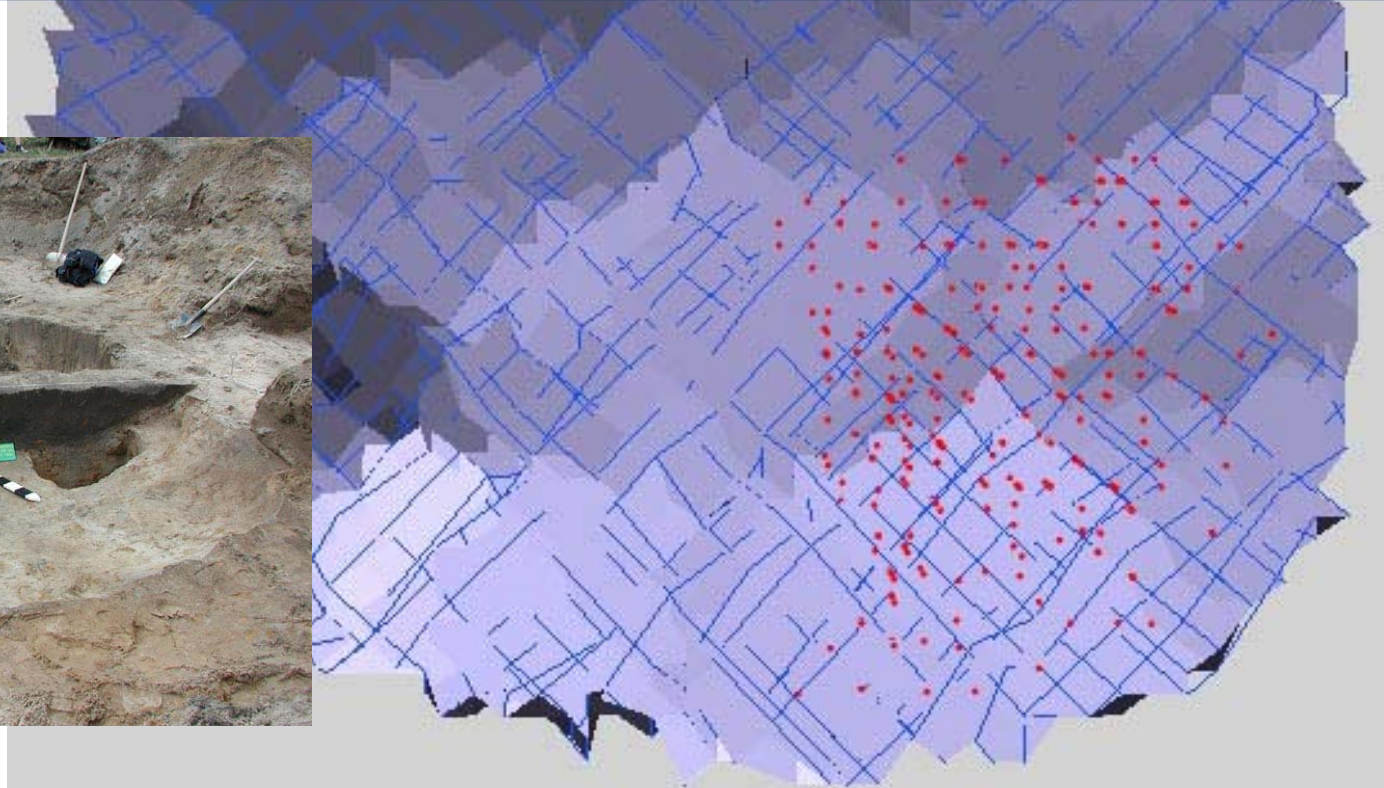
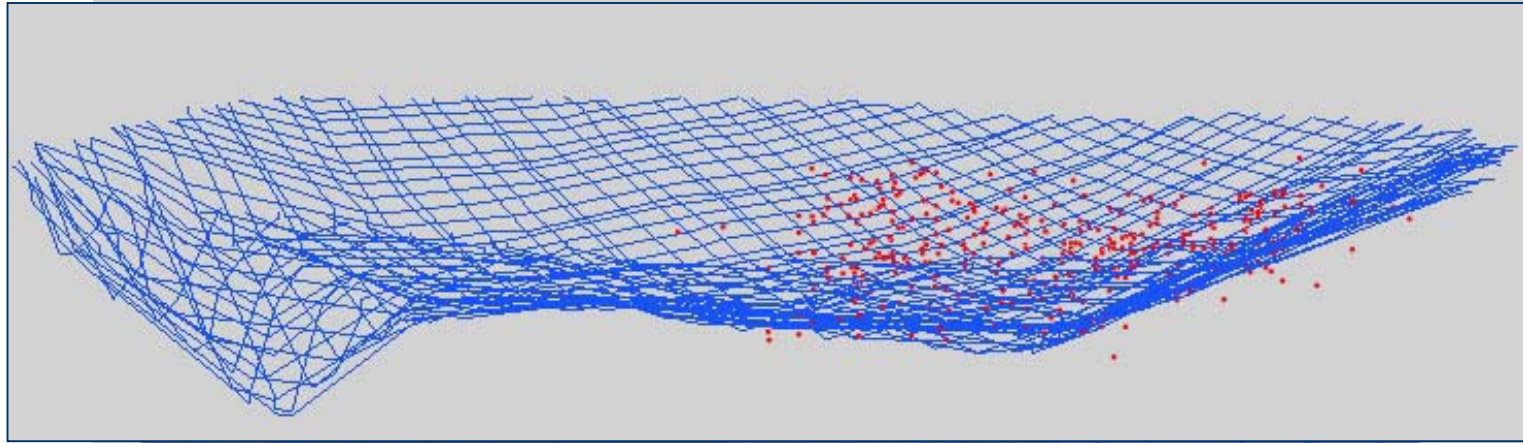


using segment recording at Bylany site (Czech rep., in particular pits from the Neolithic period)



case Habrkovice

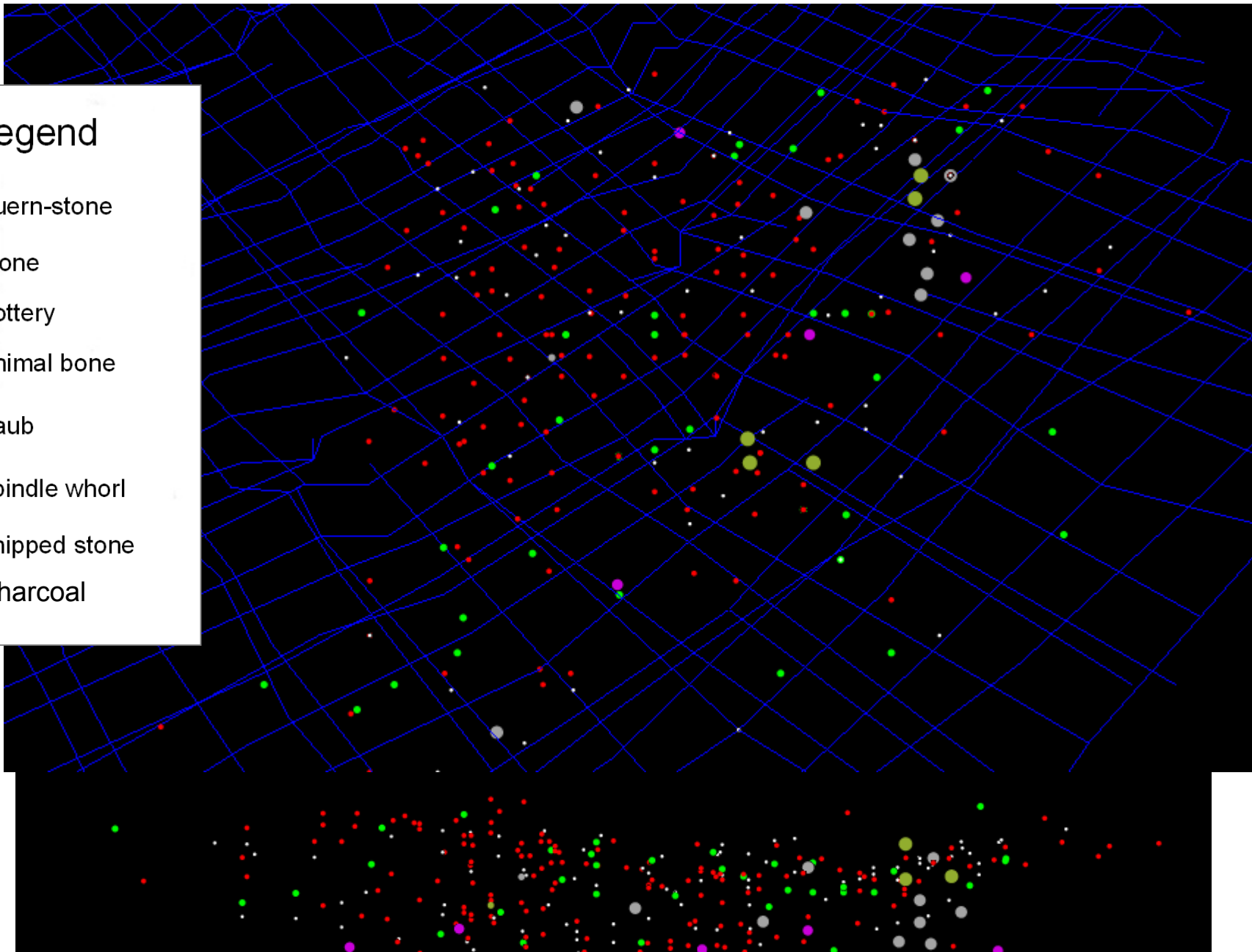
- 3D wire-model of feature at Habrkovice
- findings in sector 1400



position of findings distinguished in categories

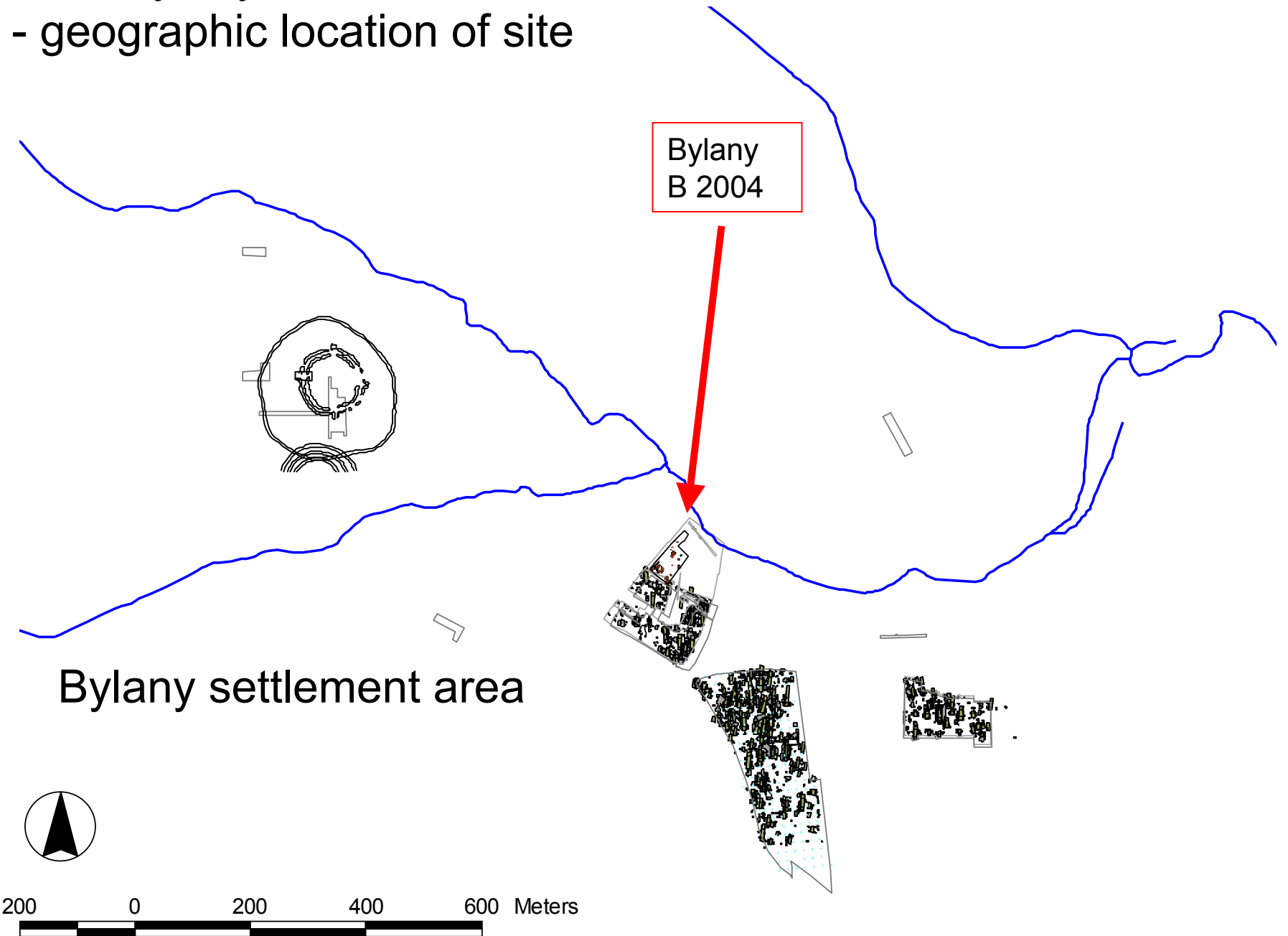
Legend

- quern-stone
- stone
- pottery
- animal bone
- daub
- spindle whorl
- chipped stone
- charcoal



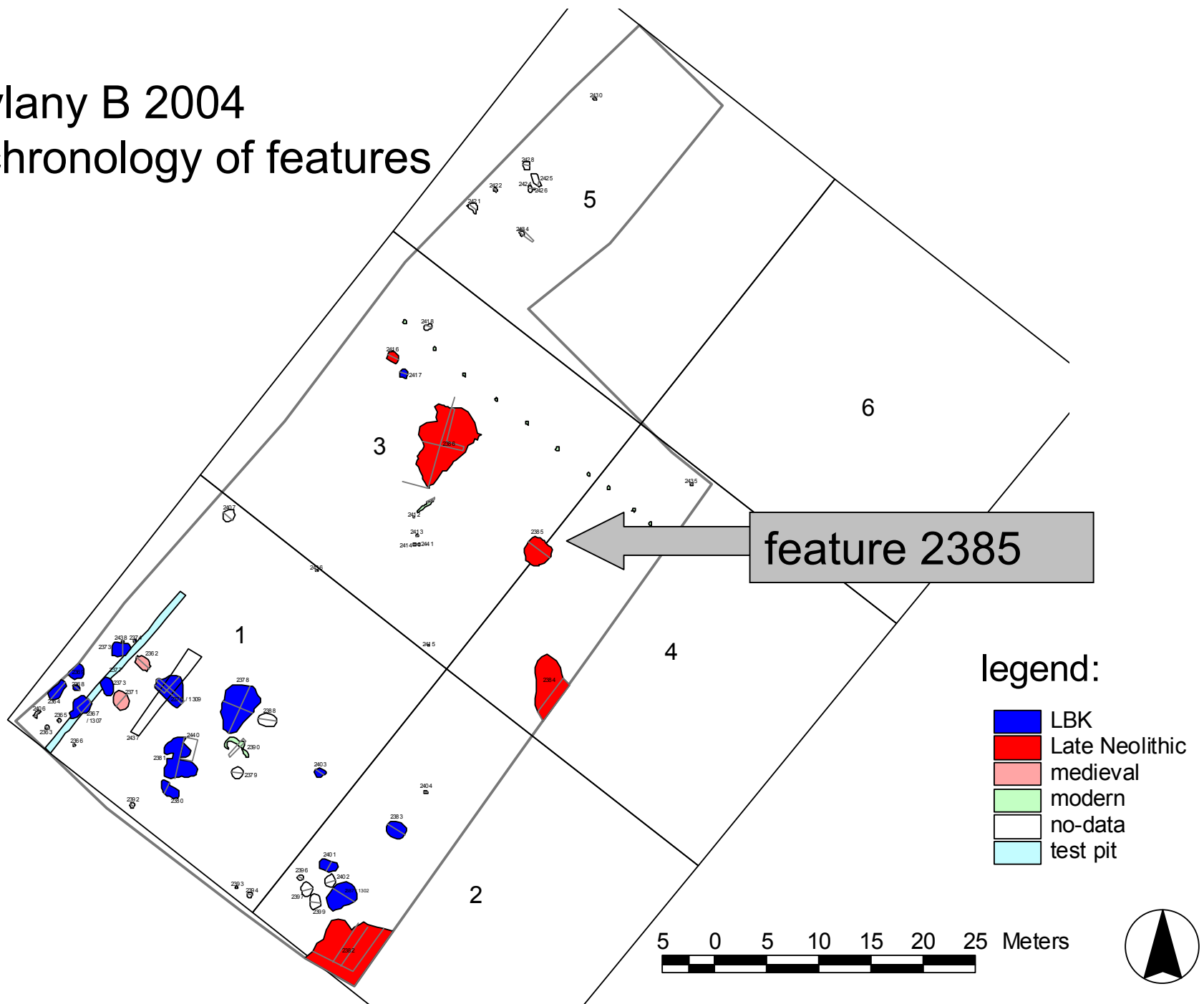
case Bylany B 2004

- geographic location of site



Bylany B 2004

- chronology of features

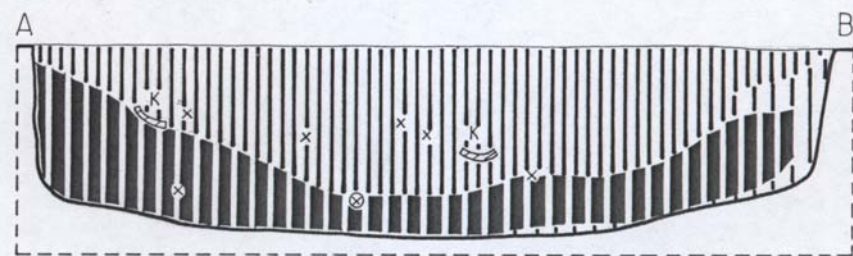
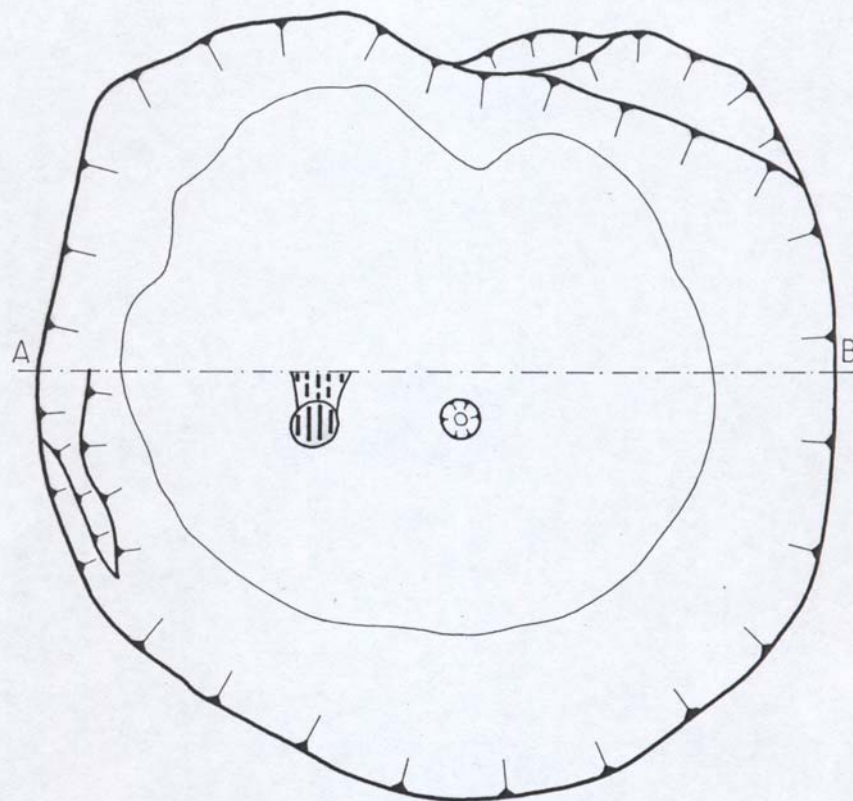


excavations Bylany B 2004 - essential information

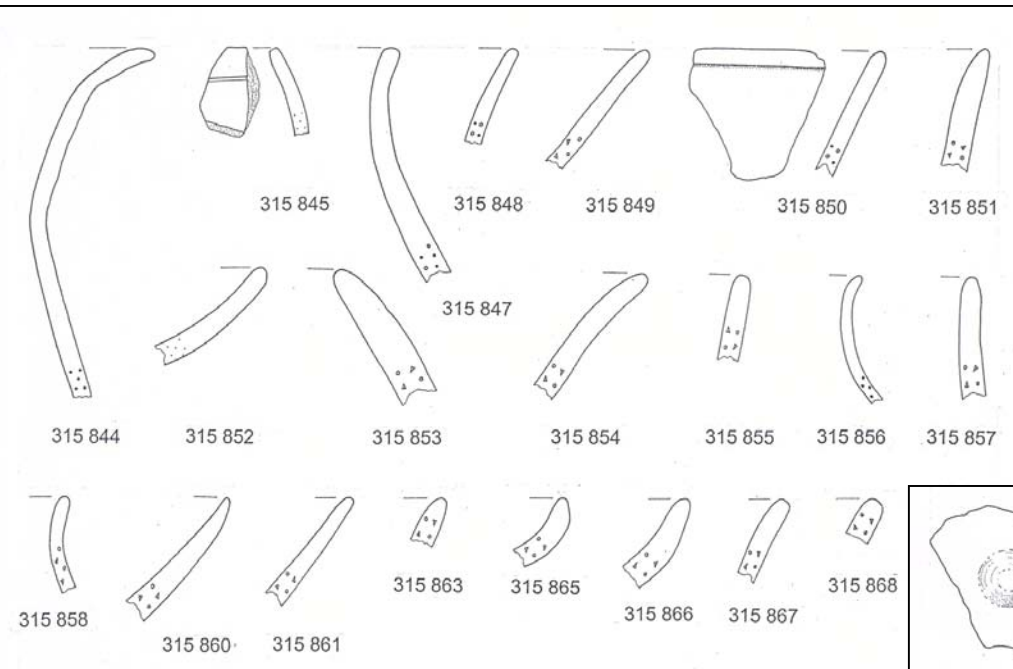
- polygon 40 x 59 m + 26 x 11 m.
- altogether 57 archaeological features were identified
- 16 features, located in the SW part of excavated area, dated to the LBK period
- 5 features dated to the Late Neolithic (final phase of STK)
- 2 features dated to the Medieval period (14th century)
- several modern pits
- post holes were not identified (if they existed at all)

feature 2385

- feature evidence of findings position within „virtual“ prisms
- size: 30 x 30 x depth 10 cm

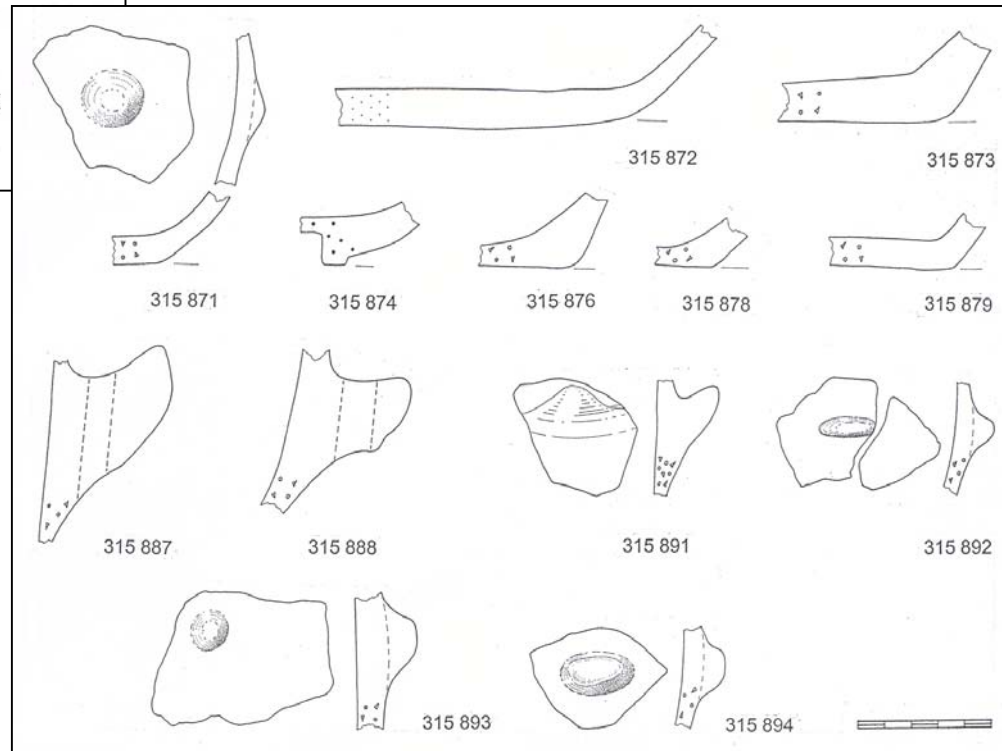


pottery fragments from the f. 2385



- dated to the Late Neolithic (final phase of the Stroked Pottery Culture)

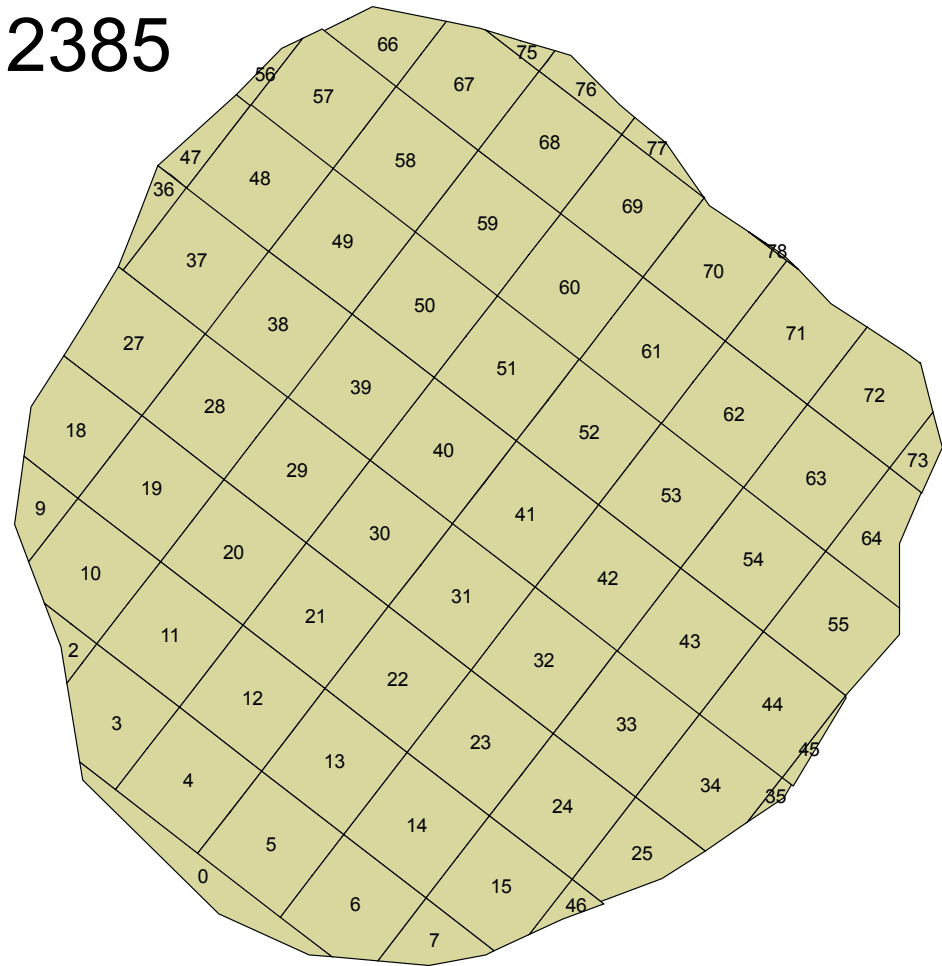
findings in the feature:
370 sherds, 21 stones, 1605g of
daub, several animal bones and
charcoal concentrations



sector prisms in the feature 2385

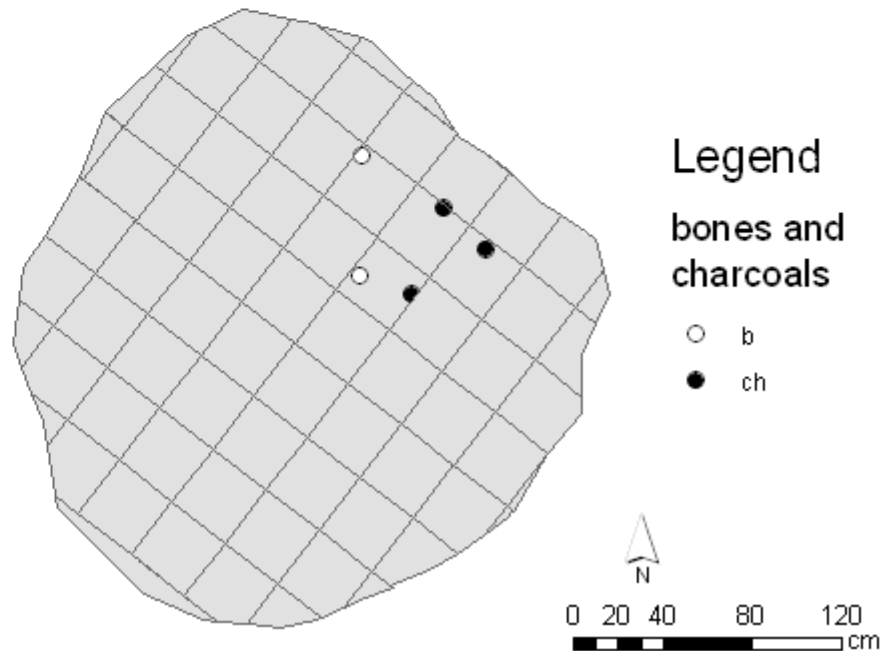
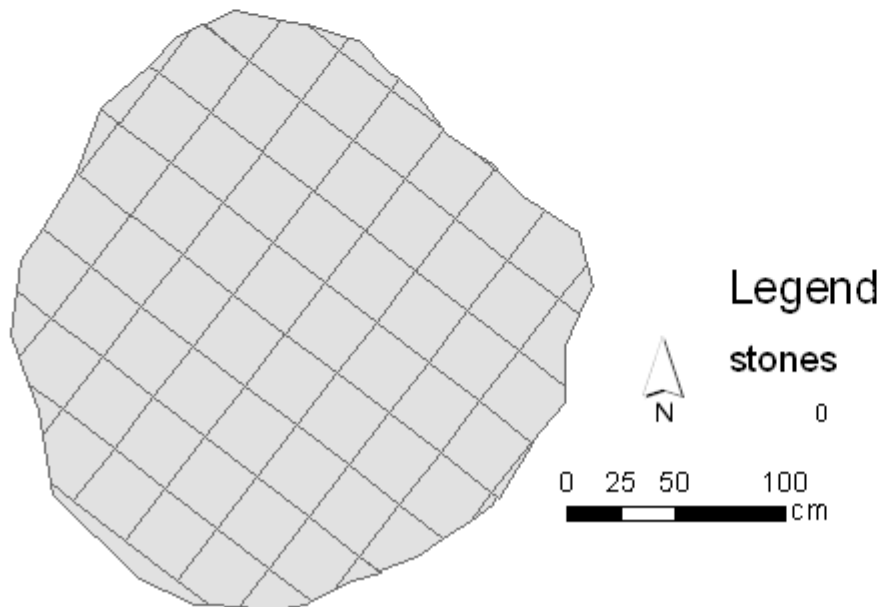
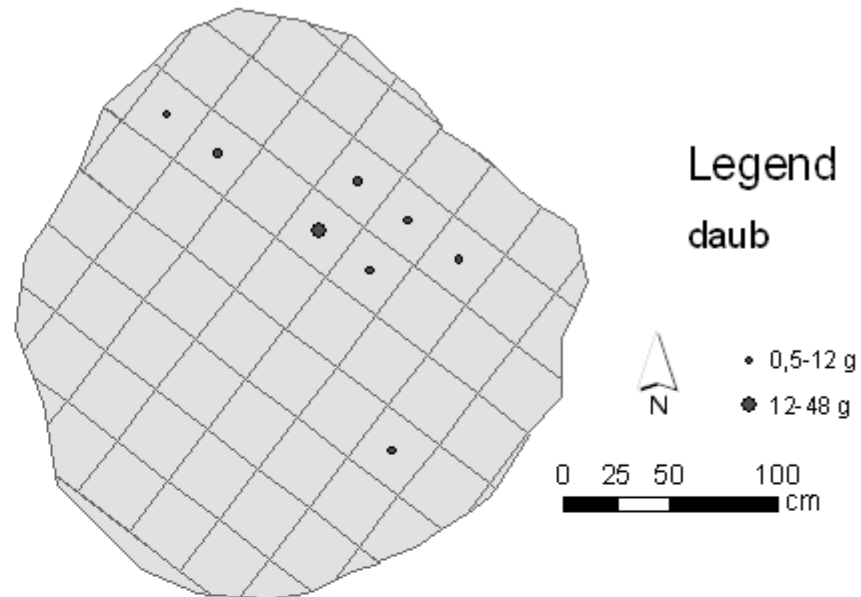
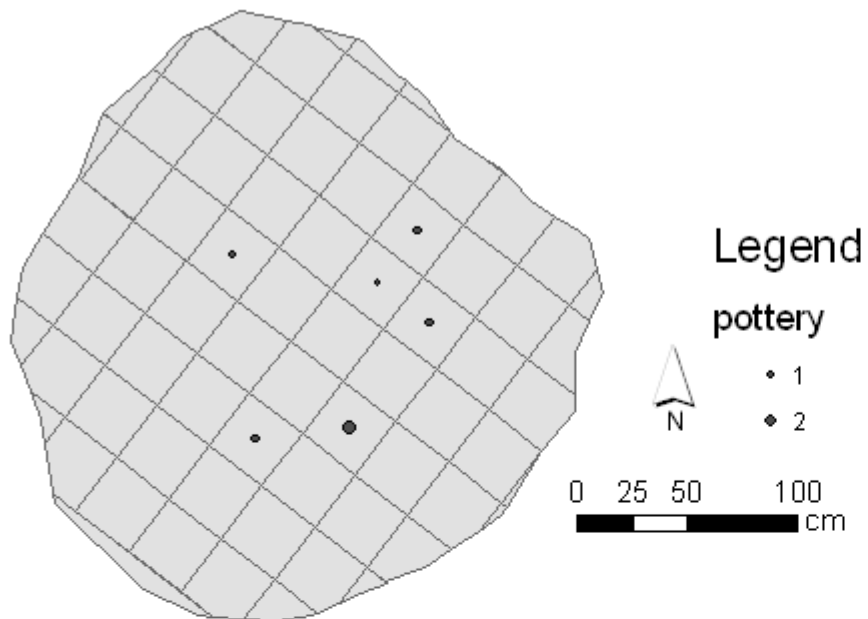
feature dimension:
250 x 240 cm, depth 60 cm

number of prisms:
71 in ground plan x 6 layers = 426 prisms

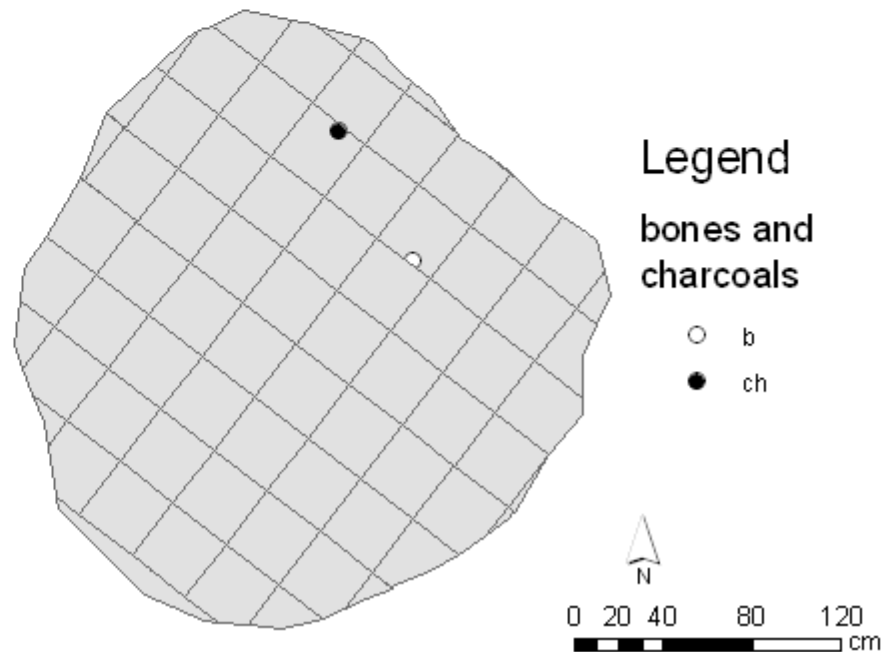
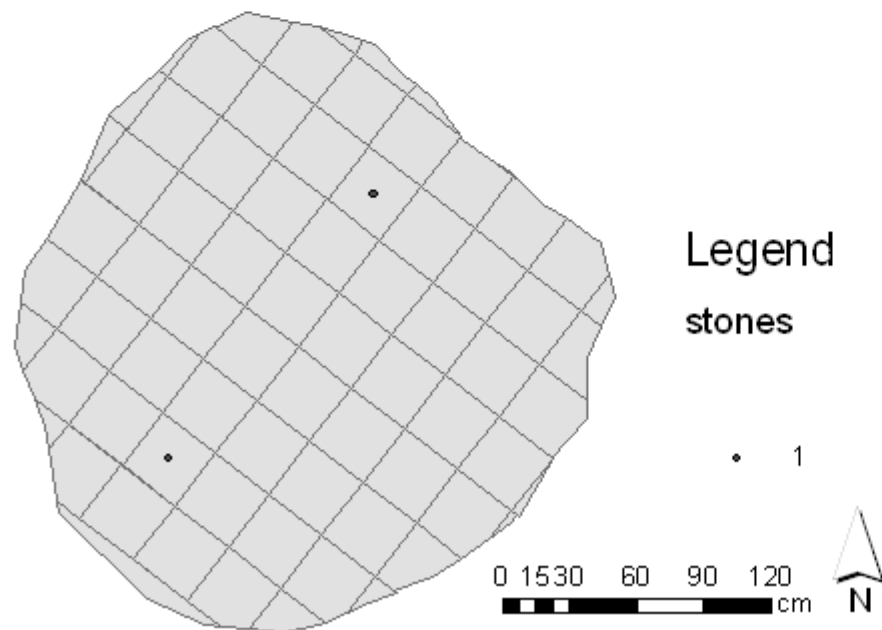
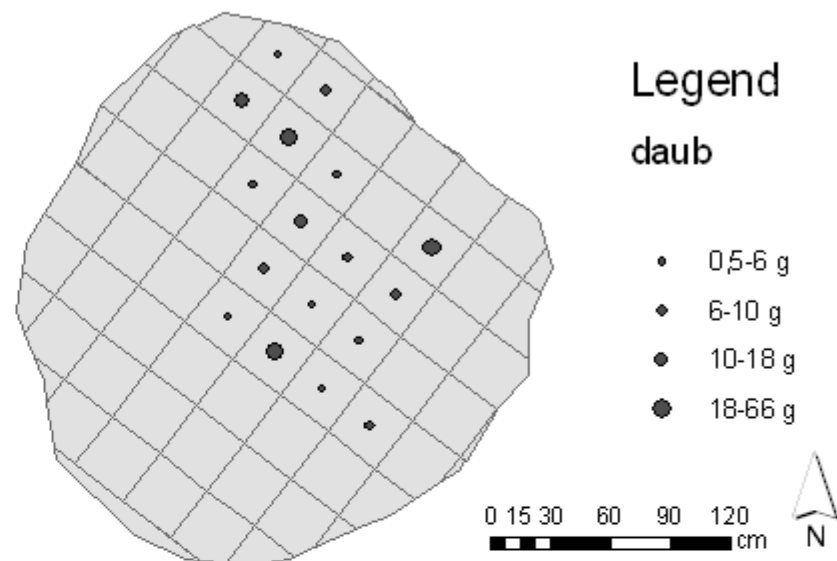
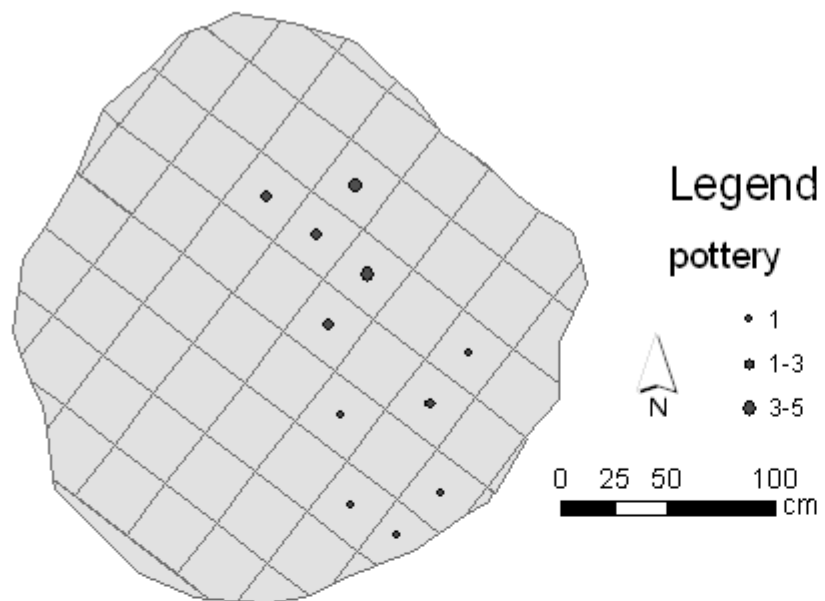


11	21	31	41	51	61	71	81	91	101
12	22	32	42	52	62	72	82	92	102
13	23	33	43	53	63	73	83	93	103
14	24	34	44	54	64	74	84	94	104
15	25	35	45	55	65	75	85	95	105
16	26	36	46	56	66	76	86	96	106

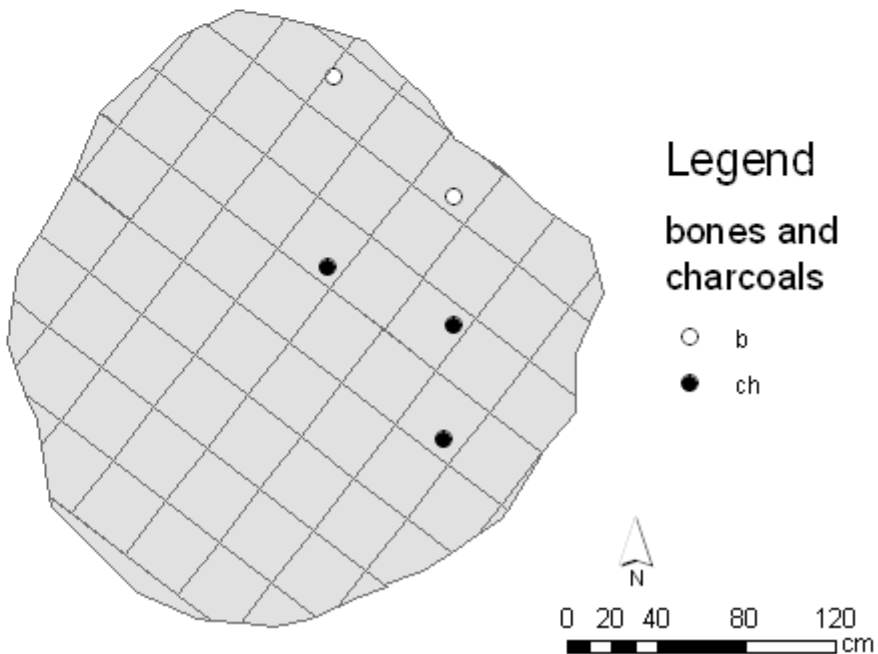
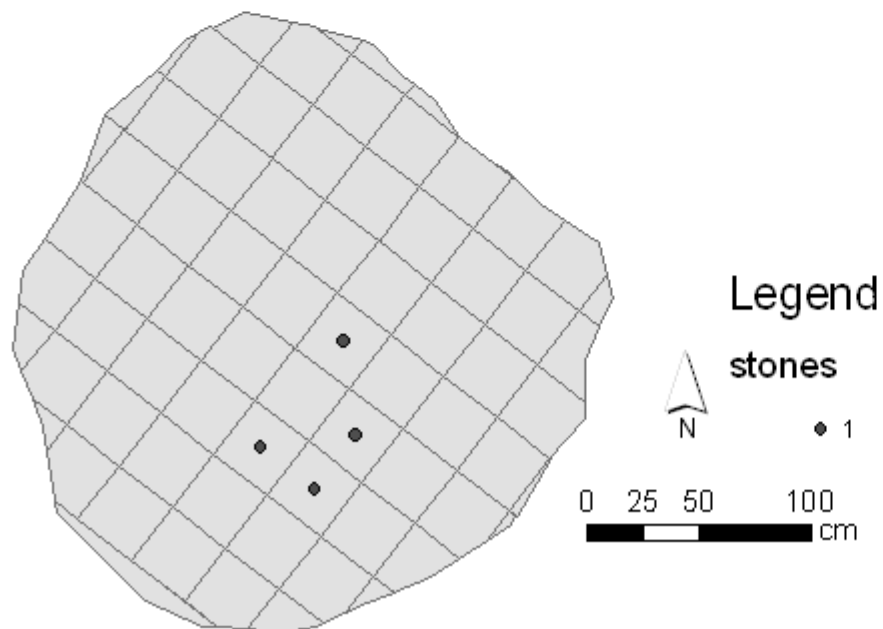
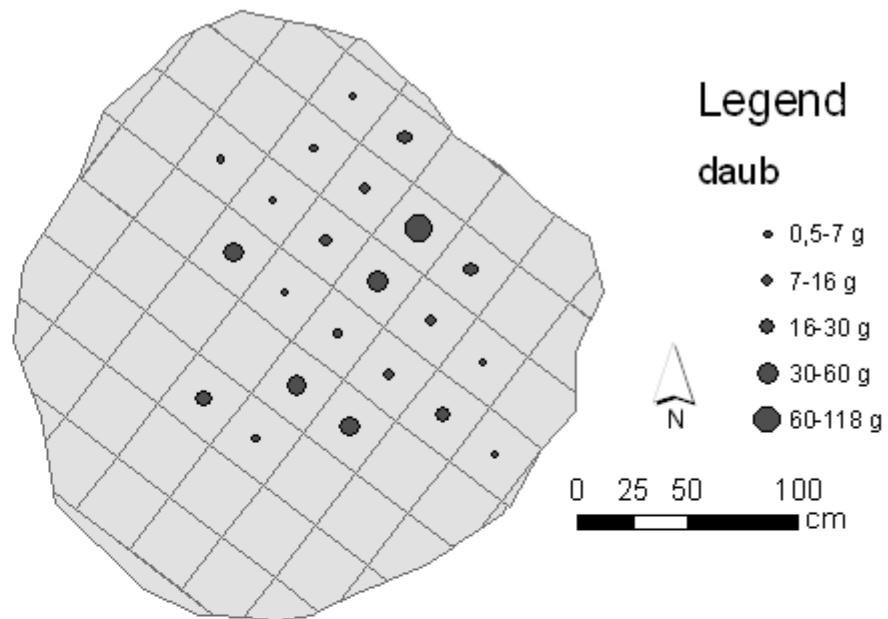
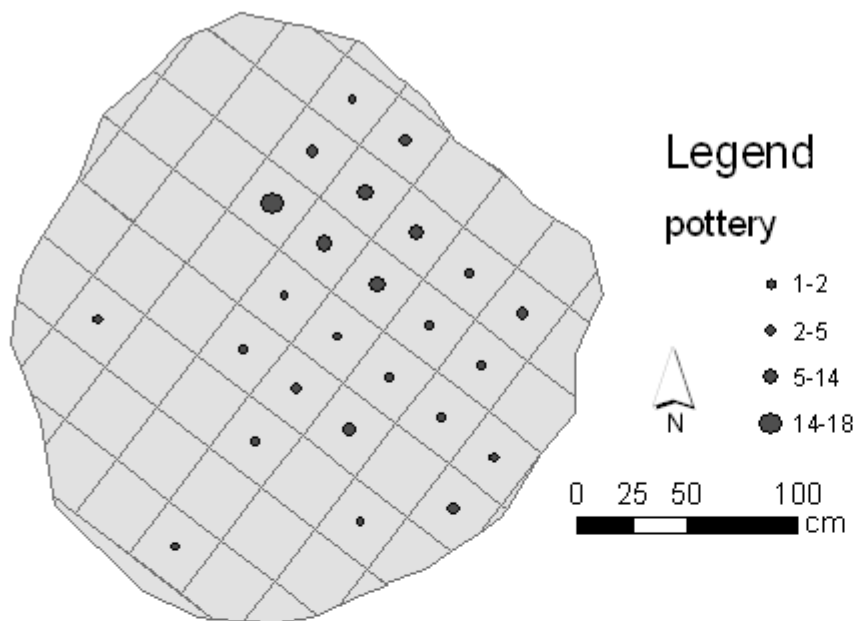
layer 6 (bottom): 50-60 cm



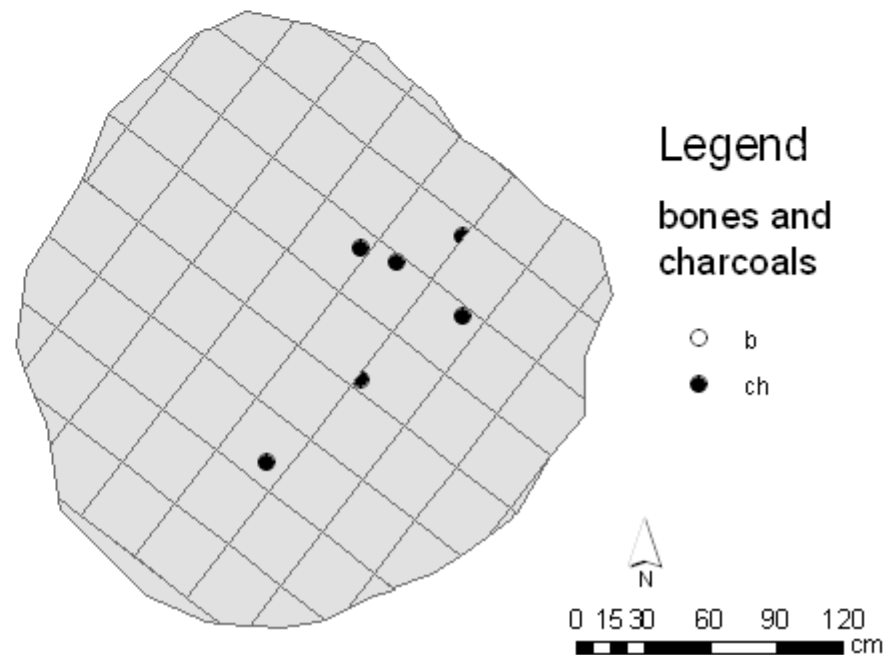
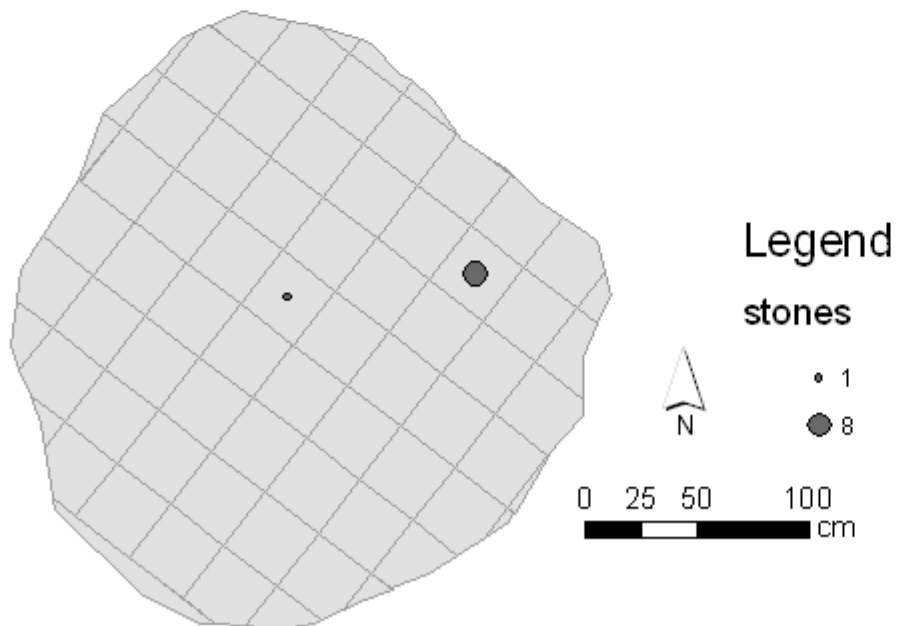
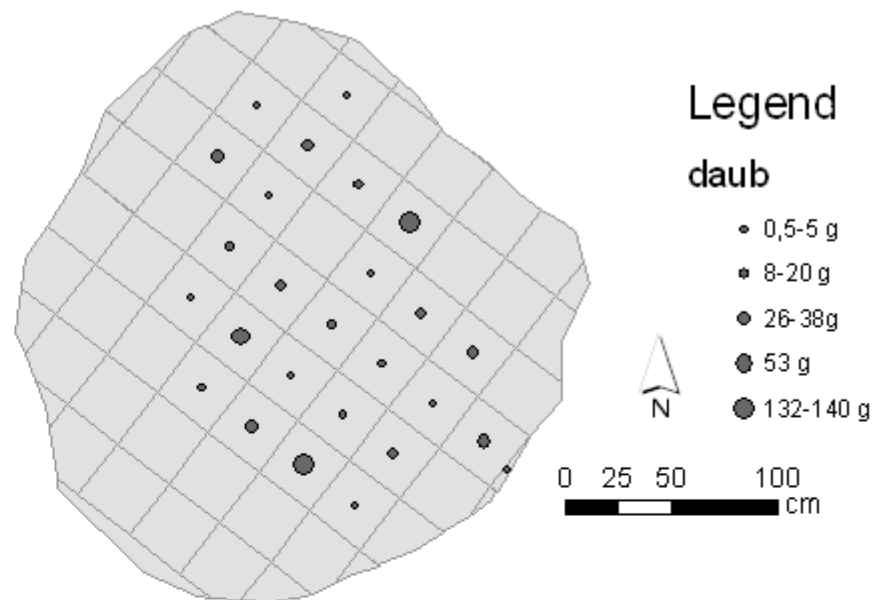
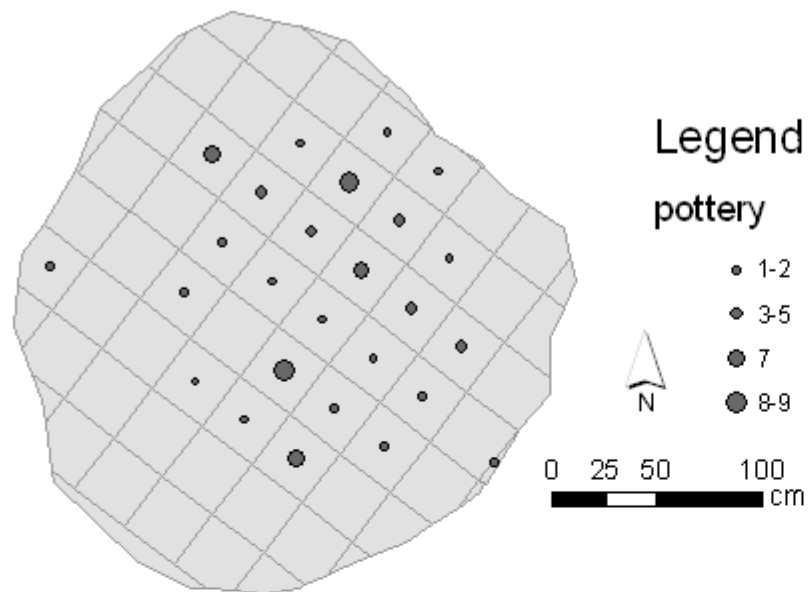
layer 5: 40-50 cm



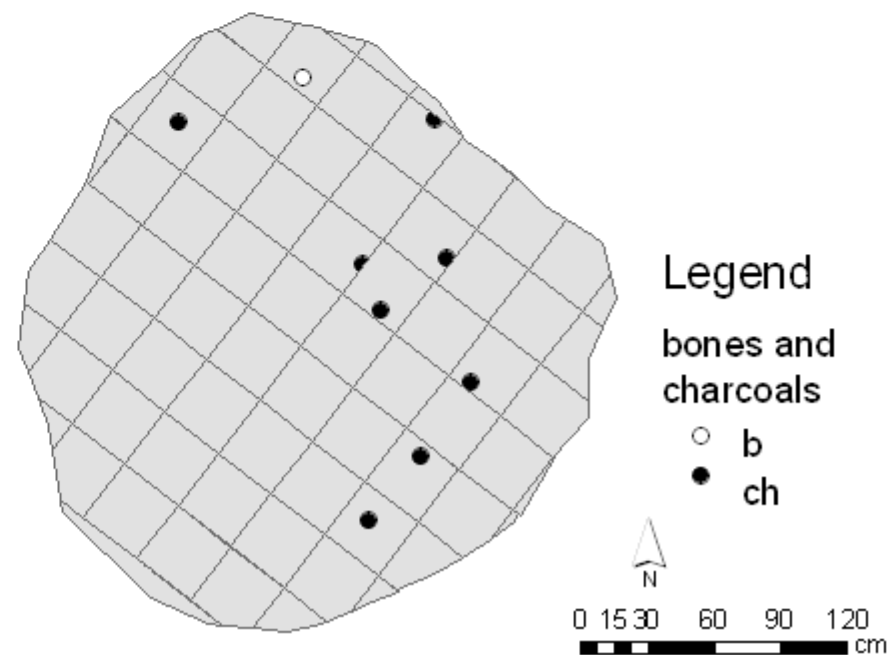
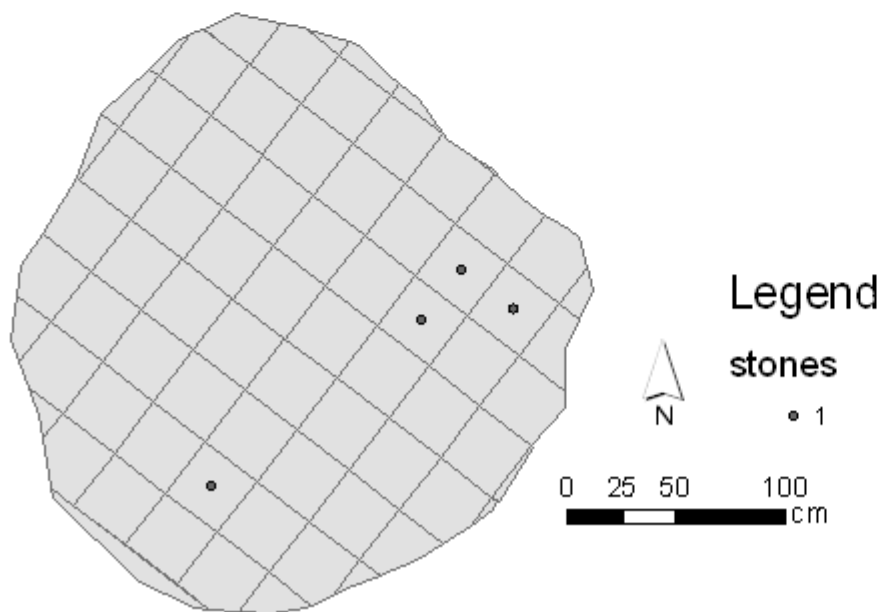
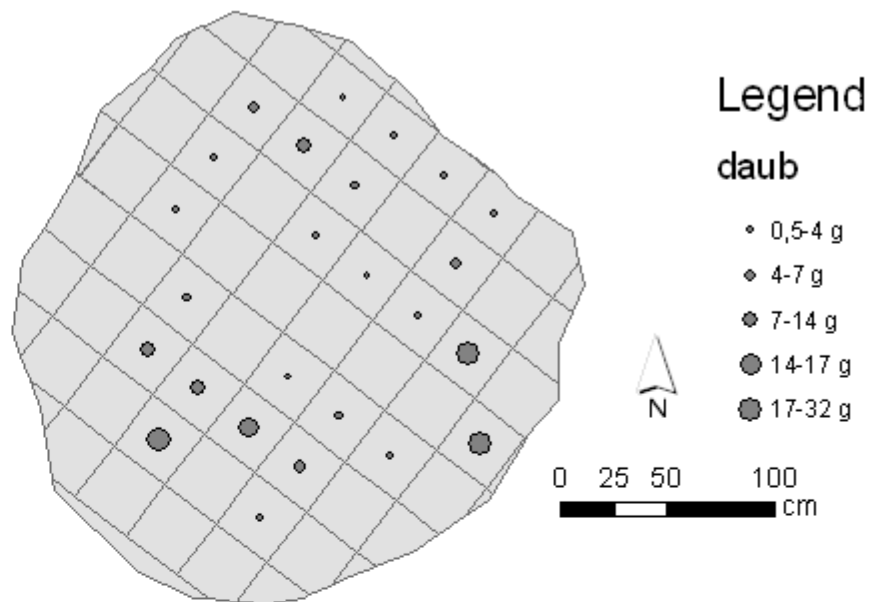
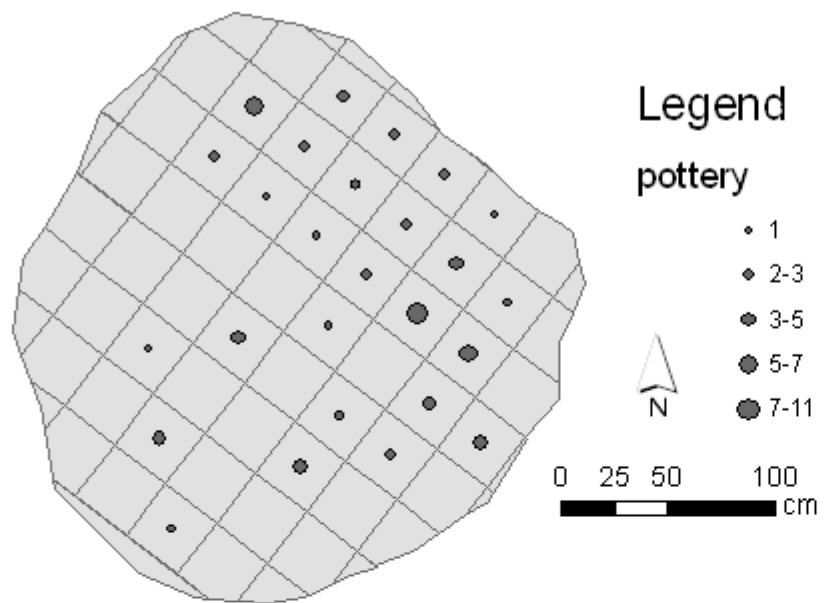
layer 4: 30-40 cm



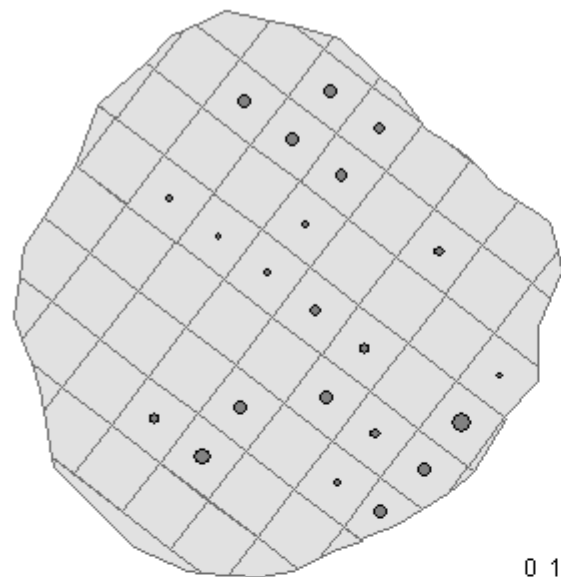
layer 3: 20-30 cm



layer 2: 10-20 cm

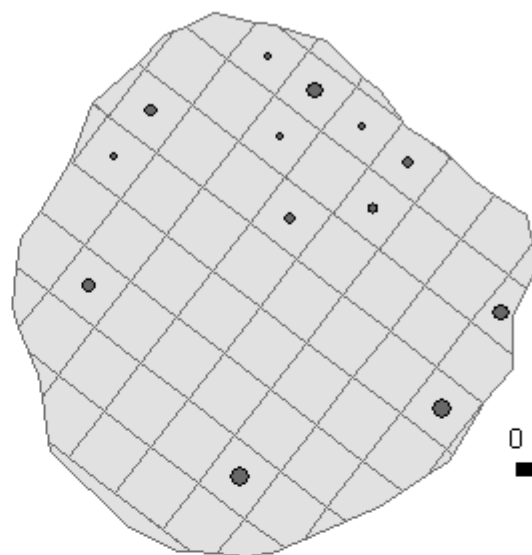
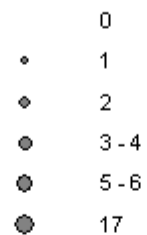


layer 1 (top): 0-10 cm



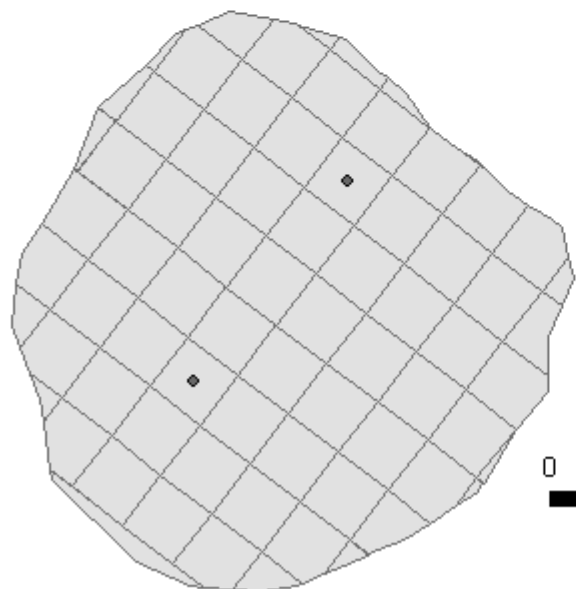
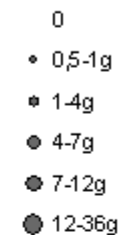
Legend

pottery



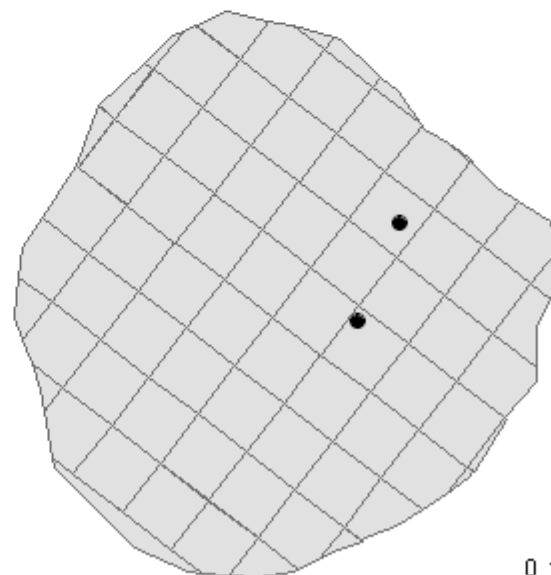
Legend

daub



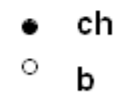
Legend

stones

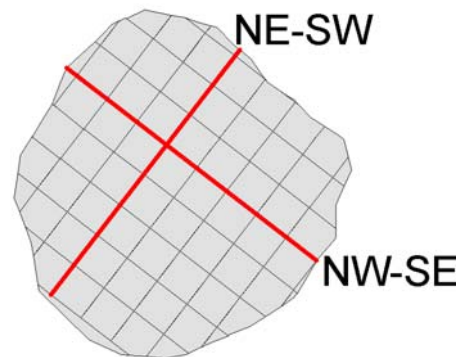


Legend

bones and charcoals



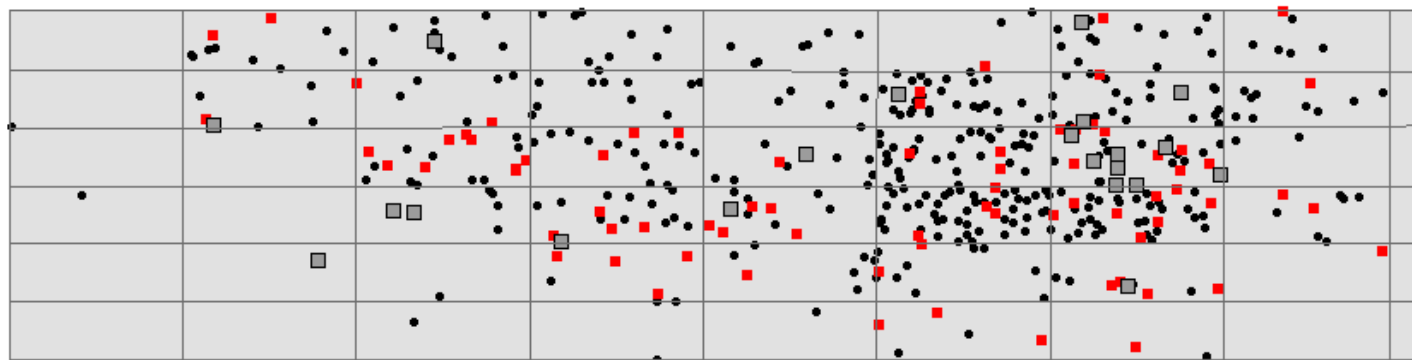
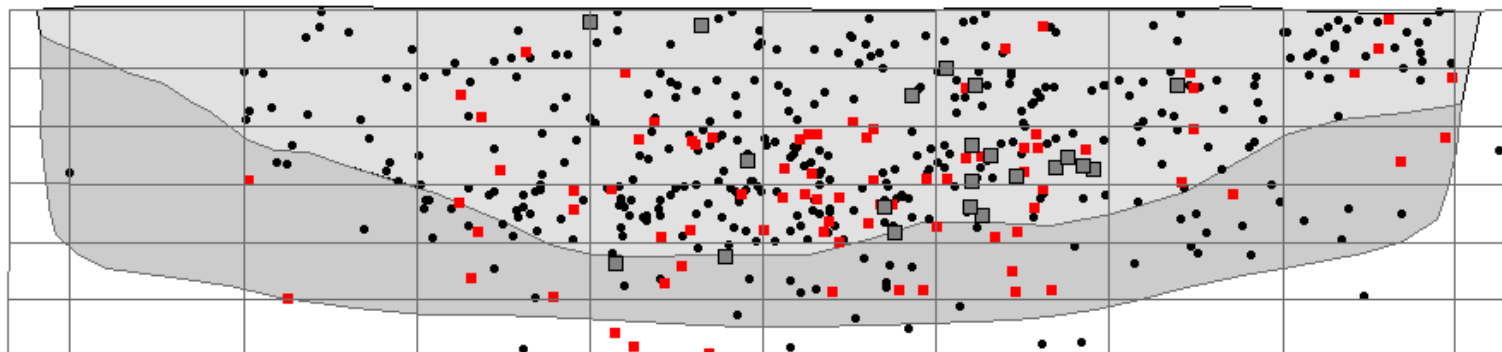
position of finds in the sections



Legend

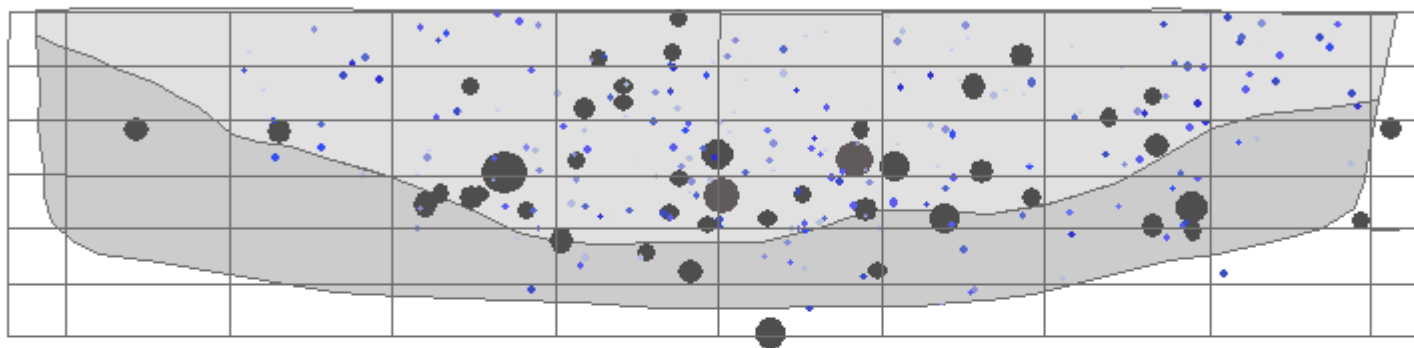
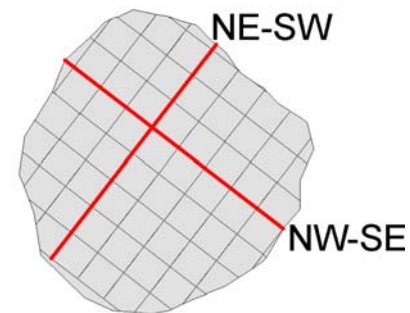
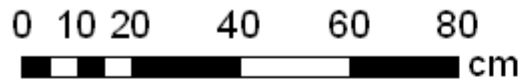
- stones
- daub
- sherds

section NW - SE

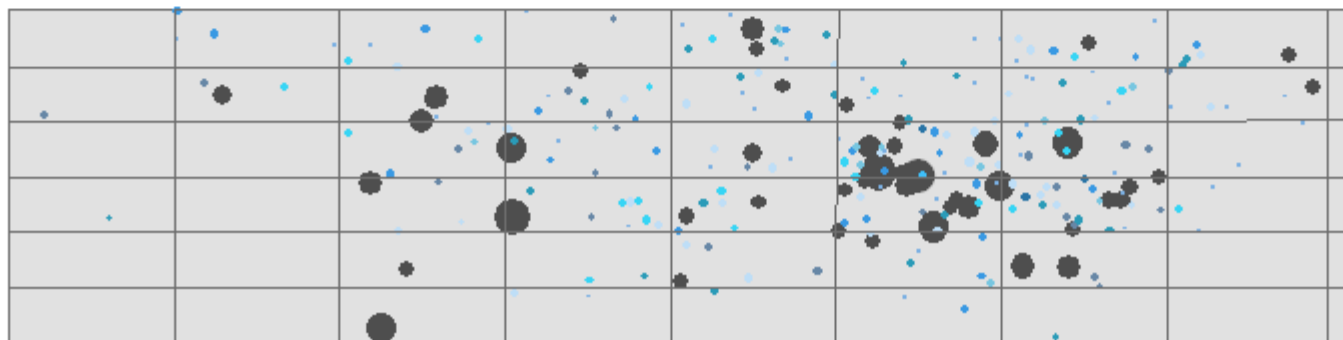
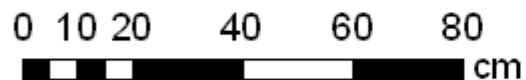


section NE - SW

S / W index in the section NW-SE



S / W index in the section NE-SW



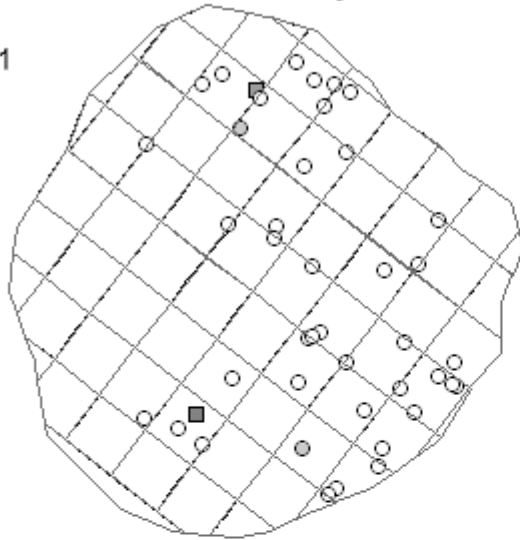
curvature of sherds on the ground plan

Legend

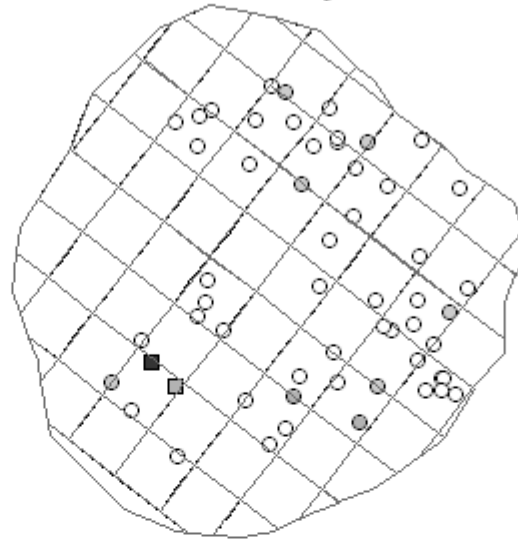
1 Dot = 1

- F0
- F3
- F4
- F5
- F6
- F7
- F8-9
- F10
- F11-15
- >F15

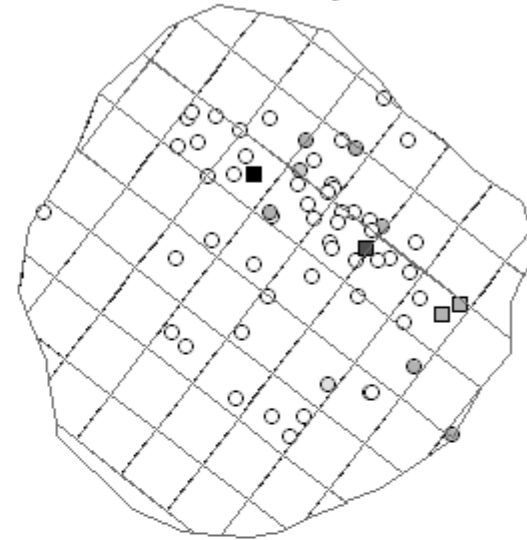
layer 1



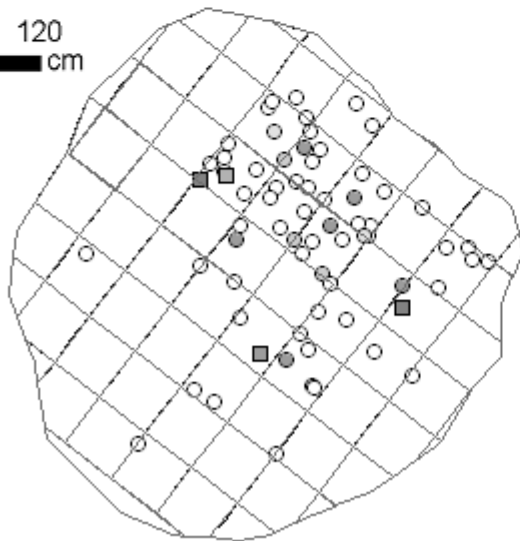
layer 2



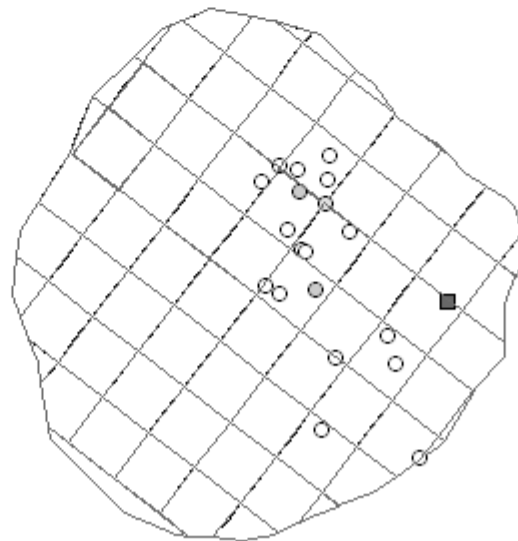
layer 3



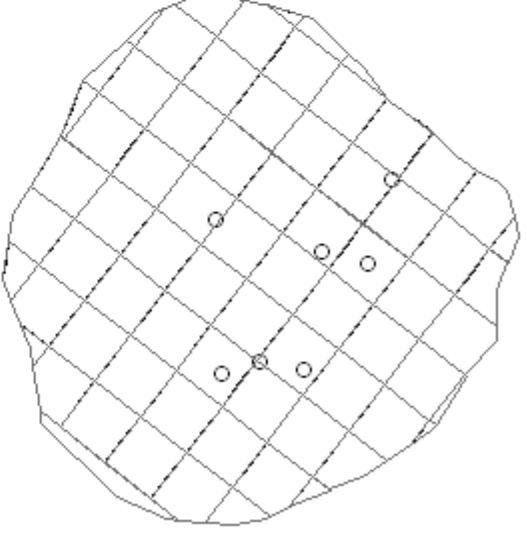
layer 4



layer 5

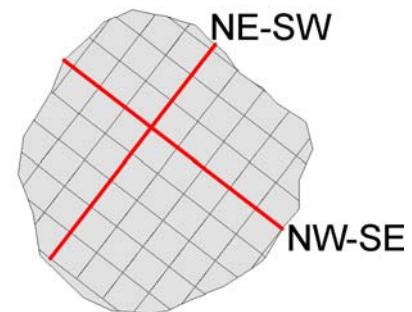


layer 6 bottom



0 15 30 60 90 120 cm

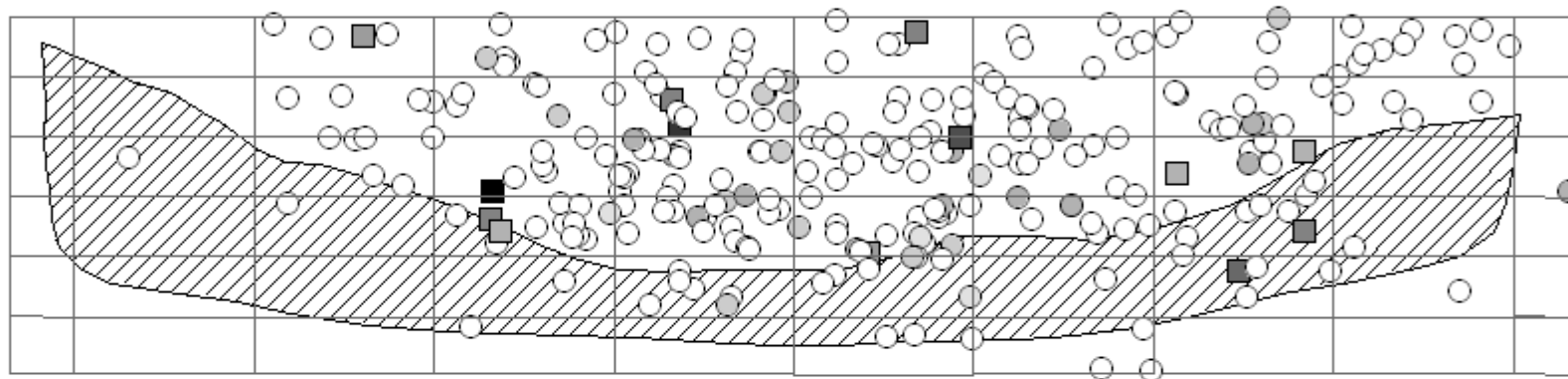
curvature of sherds on the sections



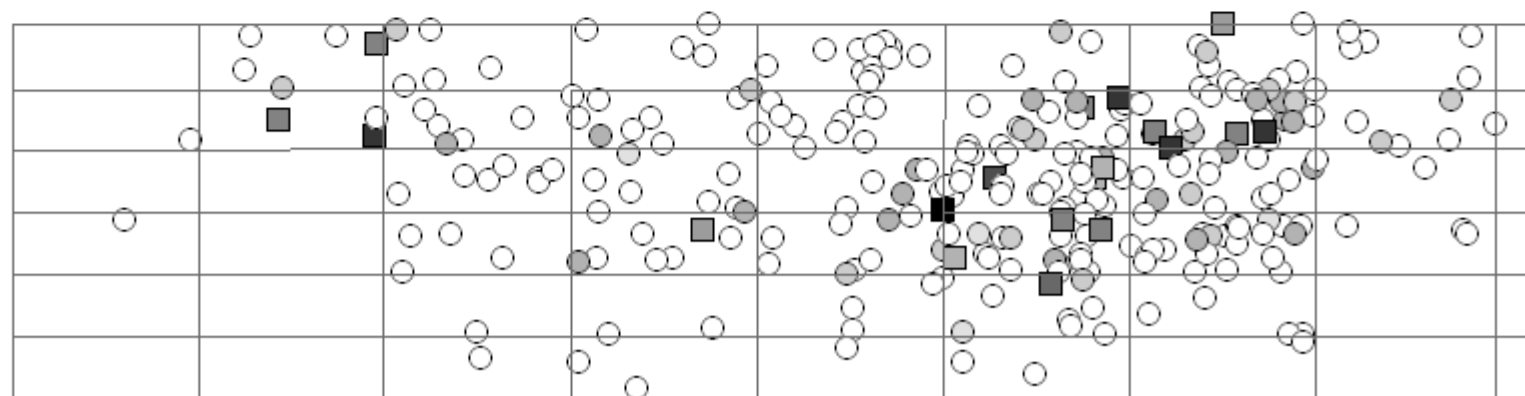
Legend

- 1 Dot = 1
- F0
- F3
- F4
- F5
- F6
- F7
- F8-9
- F10
- F11-15
- >F15

section NW - SE



section NE - SW



0 15 30 60 90 120 cm

Sherds belonging to the same vessel (displayed 10/27)

Legend

1 Dot = 1

S1

S2

S3

S4

S5

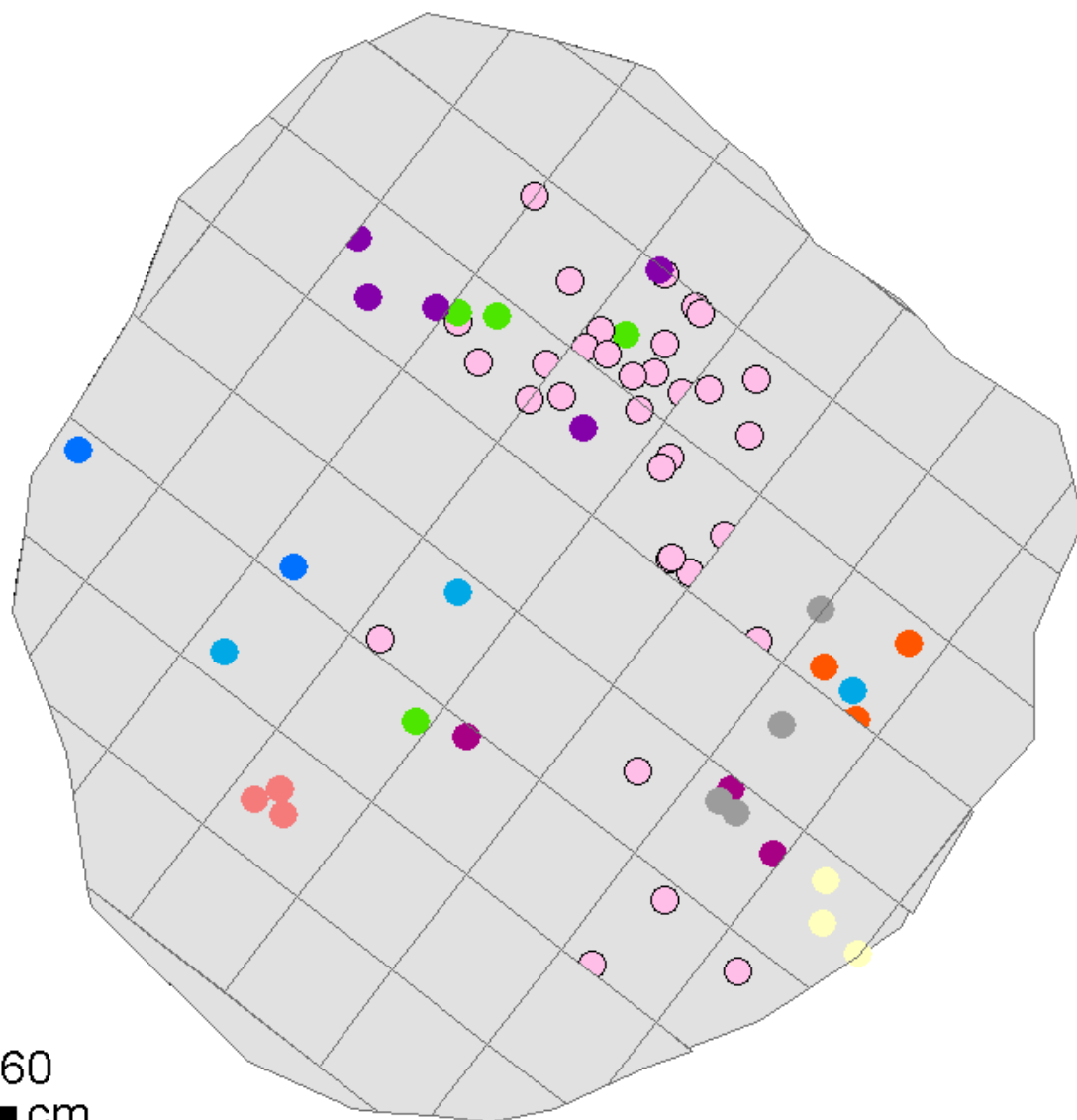
S6

S7

S8

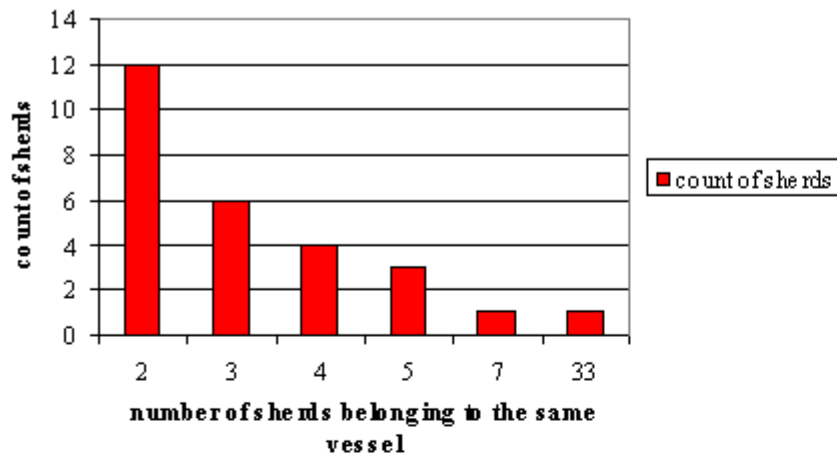
S9

S10

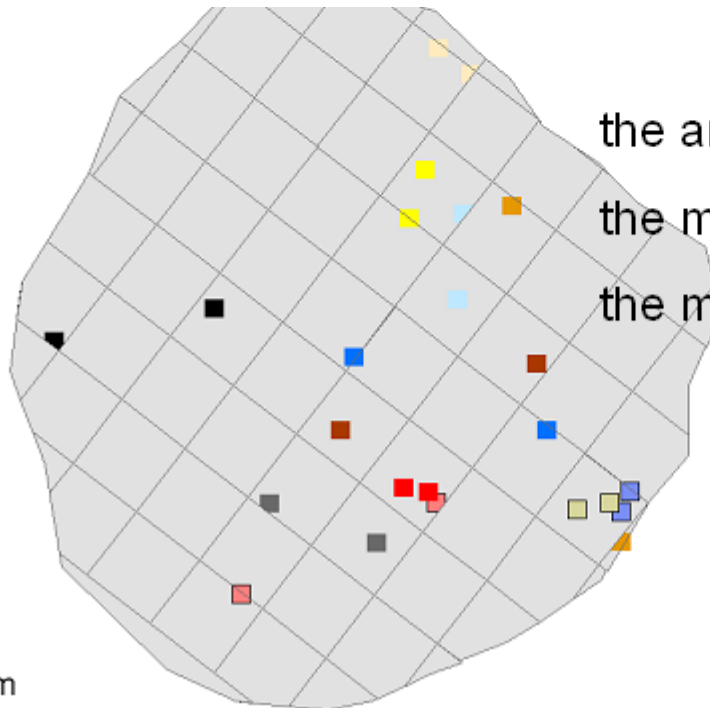
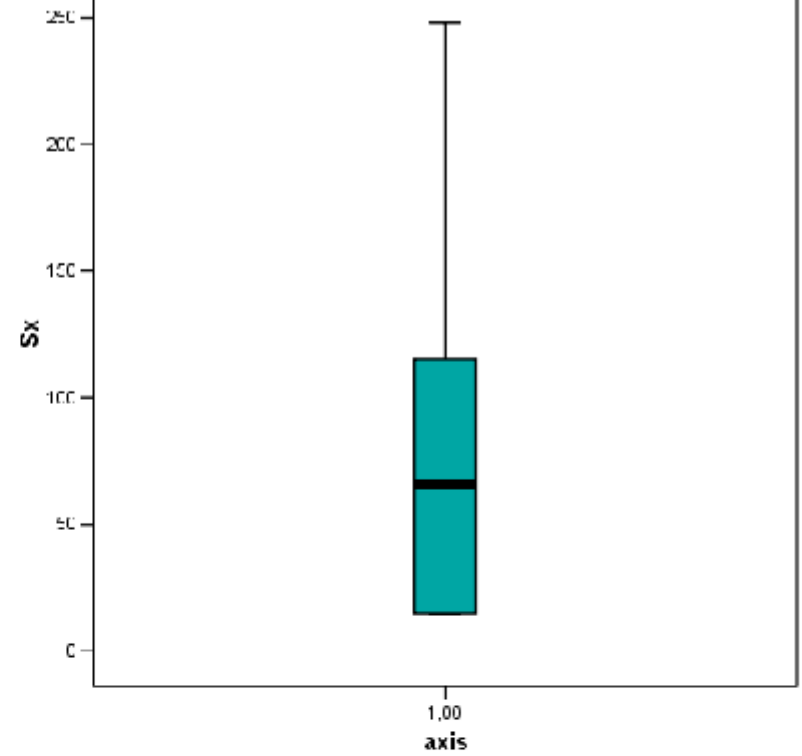


0 20 40 80 120 160 cm

count of sherds



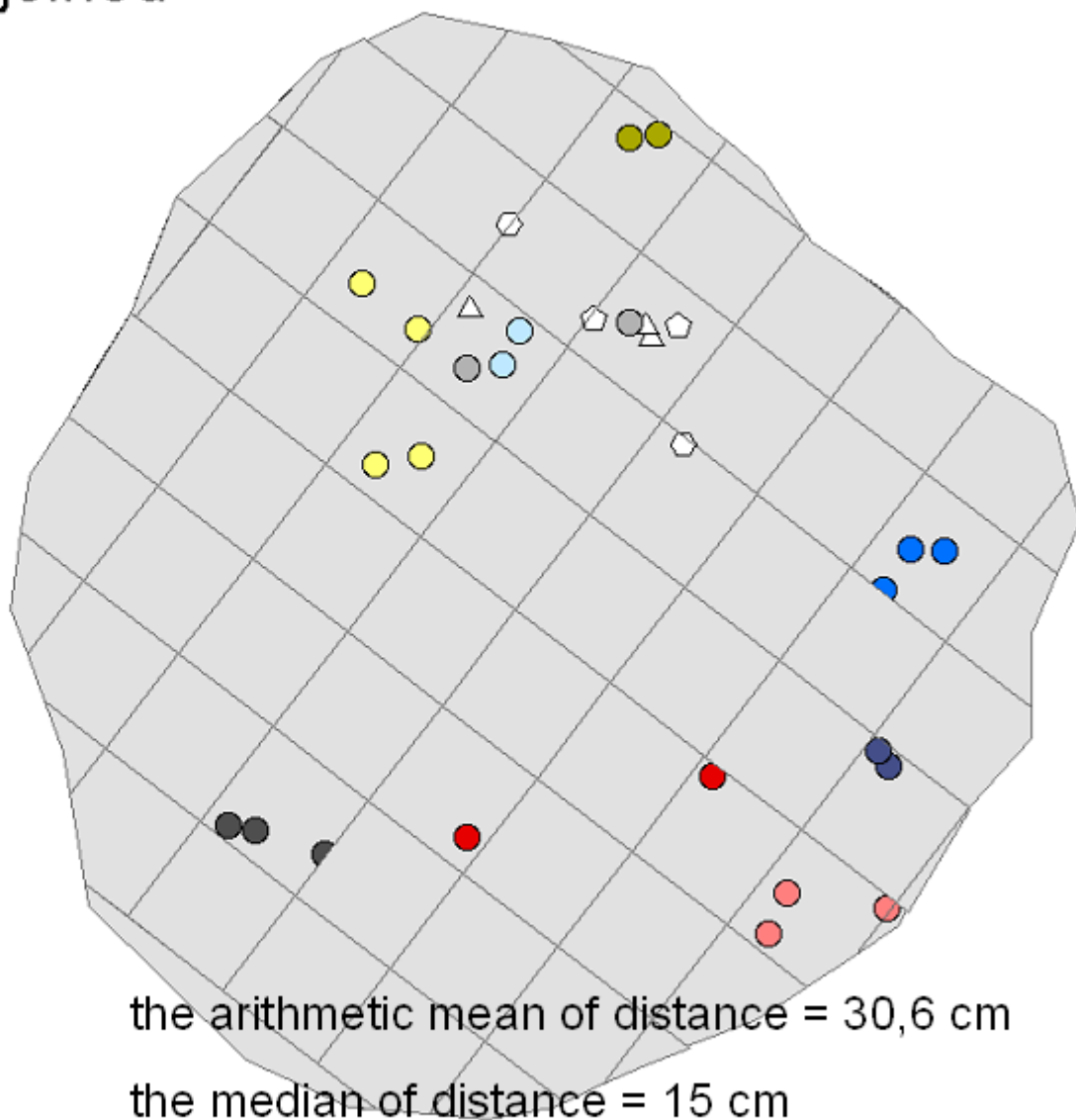
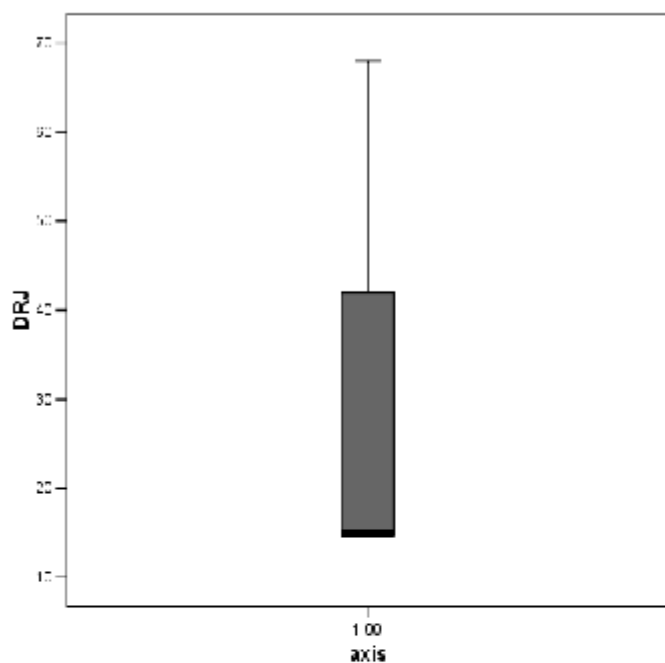
2 sherds belonging to the same vessel
Different colour means different vessel



the arithmetic mean of distance = 75,2 cm
the median of distance = 66 cm
the modus of distance = 15 cm

0 15 30 60 90 120
cm

Sherds belonging to the same vessel which can be really re-joined



the arithmetic mean of distance = 30,6 cm

the median of distance = 15 cm

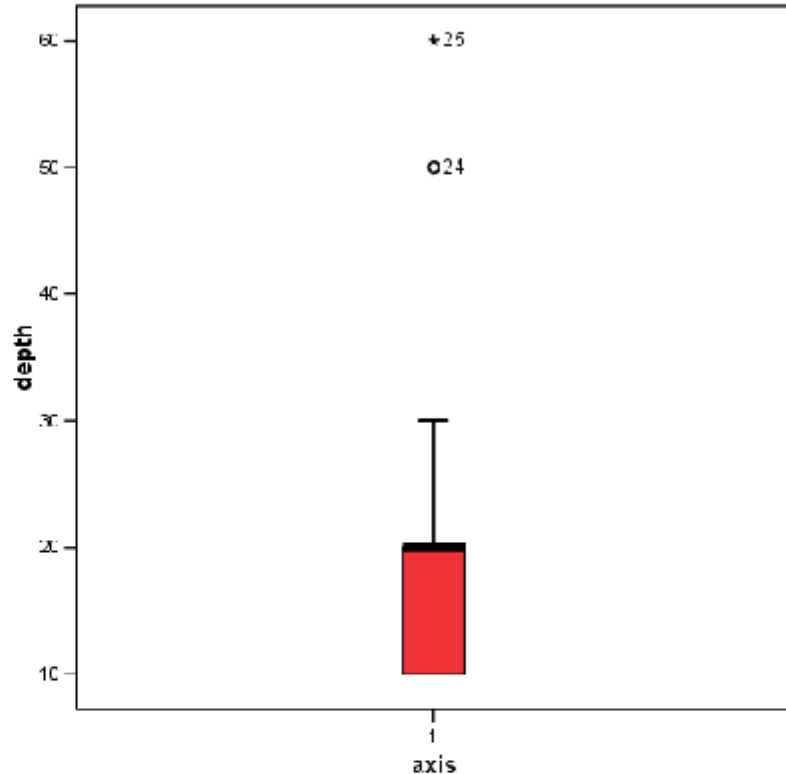
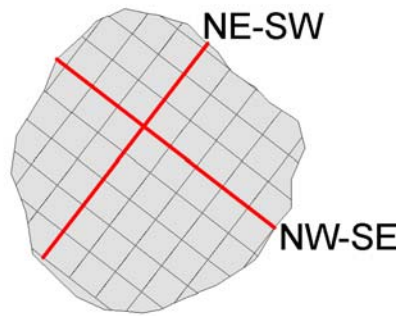
the modus of distance = 15 cm

Depth of sherds which belong to the same vessel

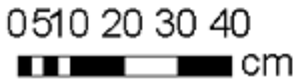
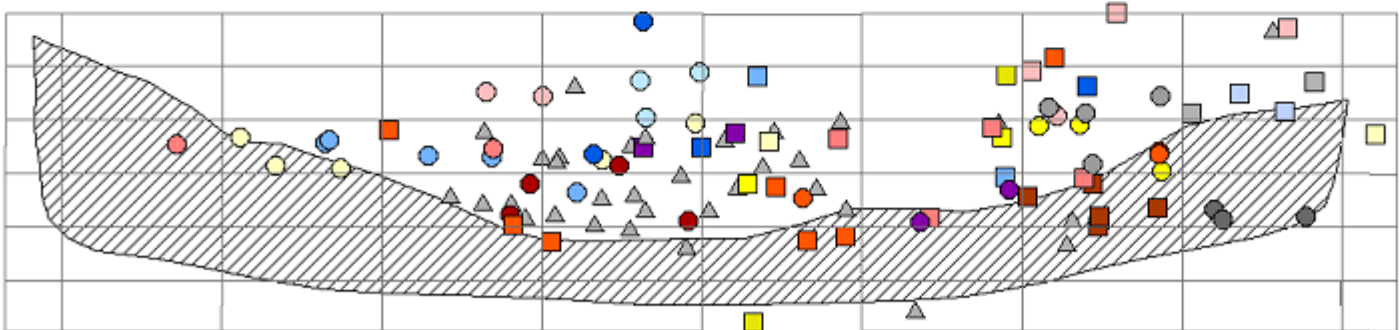
the arithmetic mean of depth = 20 cm

the median of depth = 20 cm

the modus of depth = 10 cm



Section NW-SE



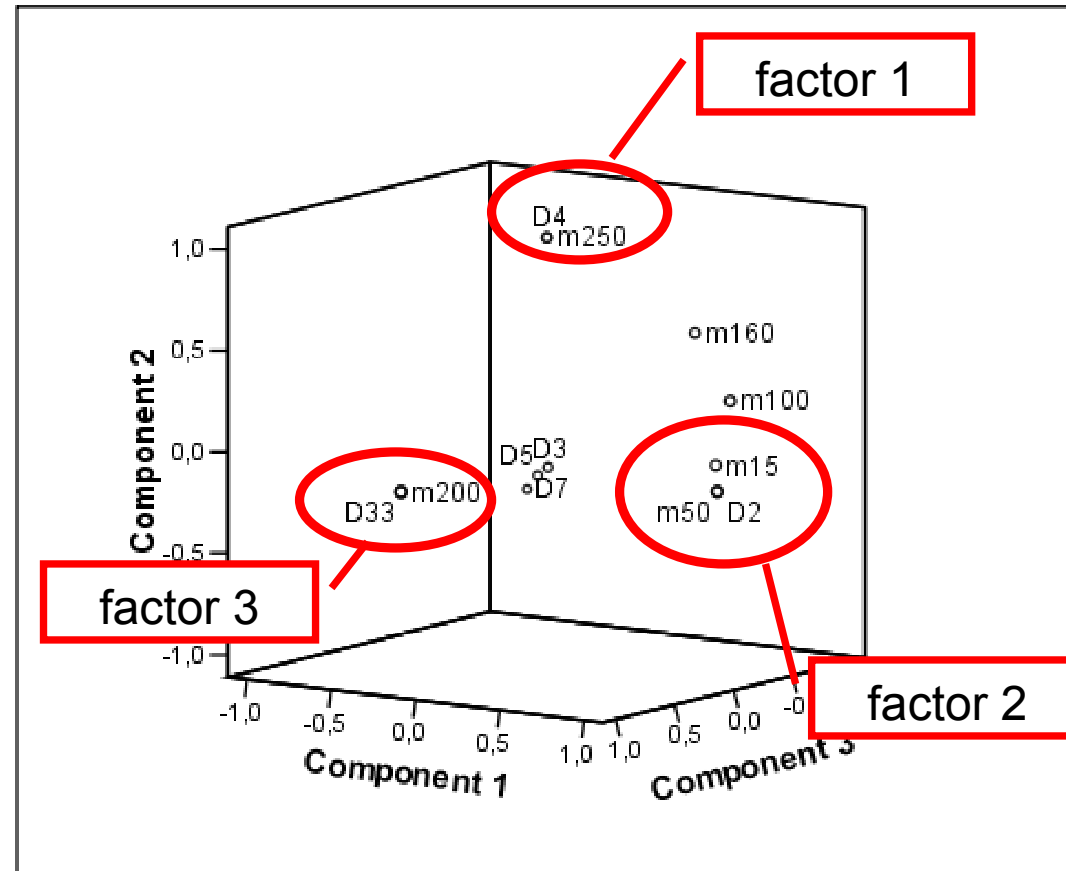
Principal Component Analysis

- PCA displays correlation between distance of fragments and number of preserved sherds belonging to the same vessel

d = count of sherds belonging to the same vessel

m – distance between prisms

Component Plot in Rotated Space



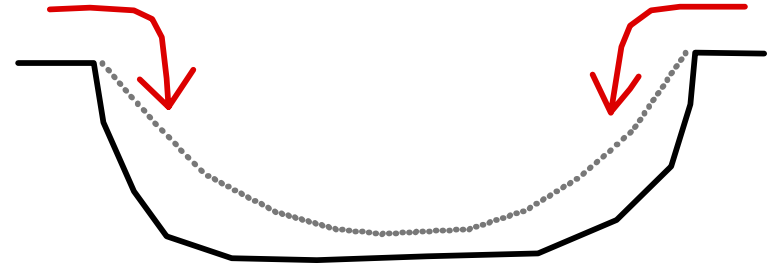
Results

- **primary function of the pit was not identified**
- **findings in the ground plan:**
 - minimal number of findings in the bottom layers and also in the upper layer
 - greatest amount of findings in the middle layers (4th, 3rd and 2nd).
 - findings in the bottom and the top levels located out of the centre of the pit
 - greatest amount of findings is in the central part of the pit
- **findings in the sections:**
 - identified bottom (washed down) layer, which contains findings only exceptionally
 - most findings in the NW-SE section located in the centre of the pit (layers 3rd and 4th)
 - most findings in the NE-SW section located near the northeast edge of the pit
- **S/W index of pottery fragments** (i.e. quotient of fragment size and wall thickness)
 - fragments with high values of S/W index are mostly located in the layers 3rd and 4th
 - NE-SW sect. show that concentration of these sherds are out of the centre of the pit
- **sherds belonging to the same vessel**
 - at 28,4 % vessels preserved more than 1 fragment
 - mutual horizontal distance is usually up to 60 cm, vertical distance up to 15 cm
 - vessel id.315844 is exceptional: its 33 fragments are wholly vertically dispersed

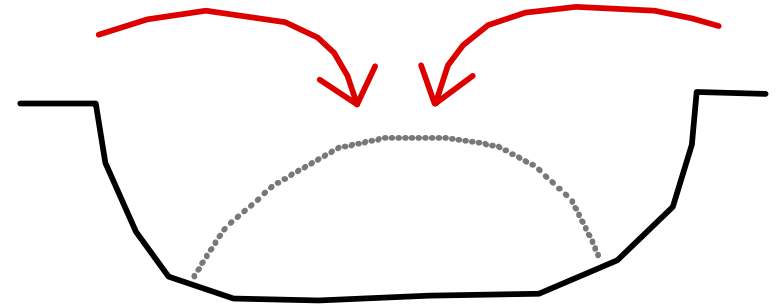
The interpretations

question: was the pit filled naturally or culturally ?

- natural (washed down) agents cause concave shape of filling



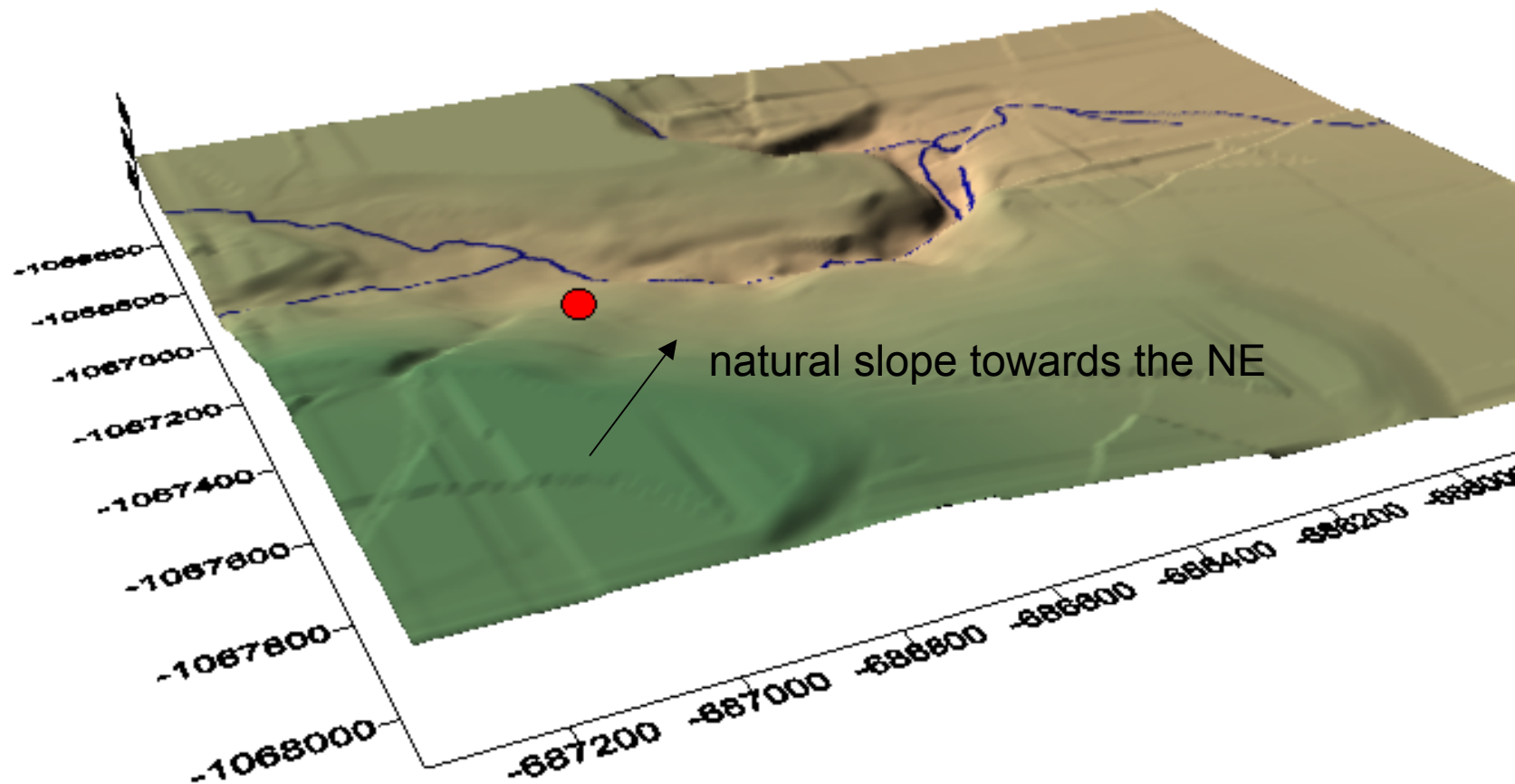
- cultural (human) agents cause convex shape



- examined results of analysis argue for both agents participated.

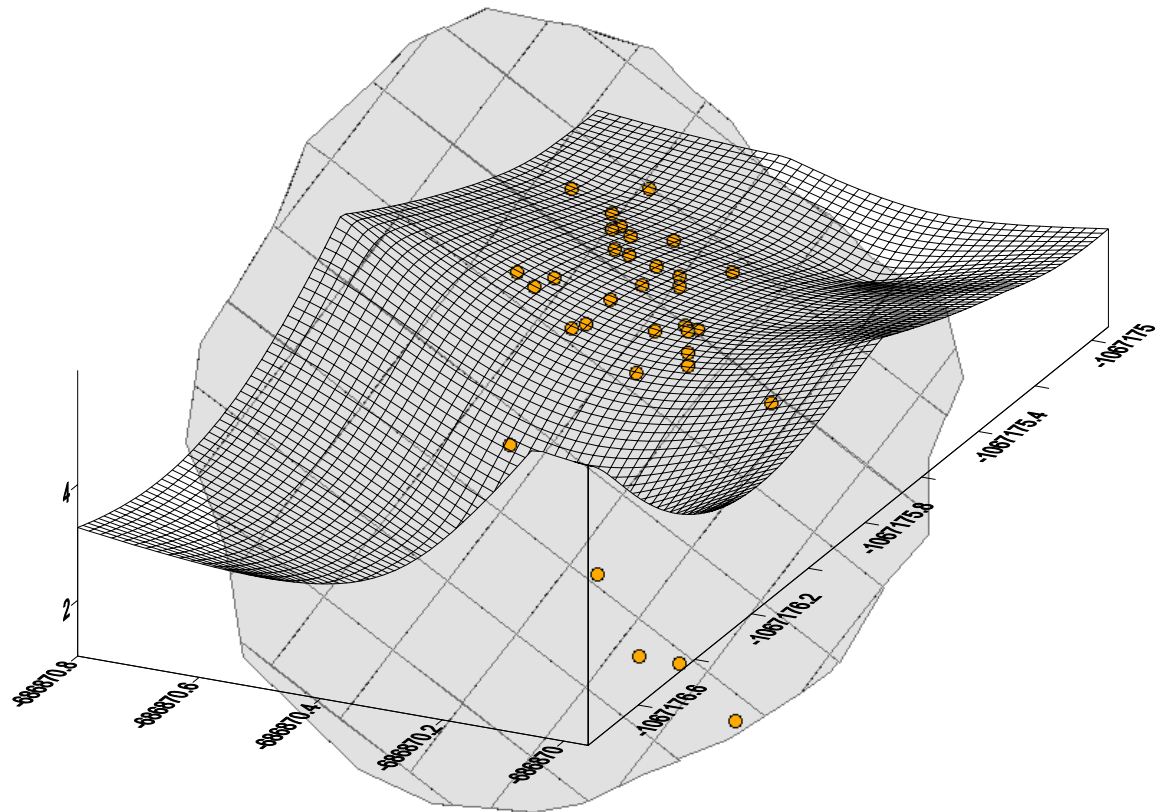
N transformation:

- washed down layer on the edge of the pit (findings were not located at the center of the bottom layer)
- great amount of findings in the NE part of the pit according to natural slope of area



C transformation:

- the least fragmented sherds in the centre of the pit (i.e. convex shape of filling)
- max. depth of 33 sherds from the vessel id.315 844 displayed in 3D space shows convex shape



Conclusion:

- major part of the pit fillings consist of culturally transported and transformed settlement refuse