Bronze Age Human Communities in the Southern Urals Steppe:

Sintashta-Petrovka social and subsistence organization

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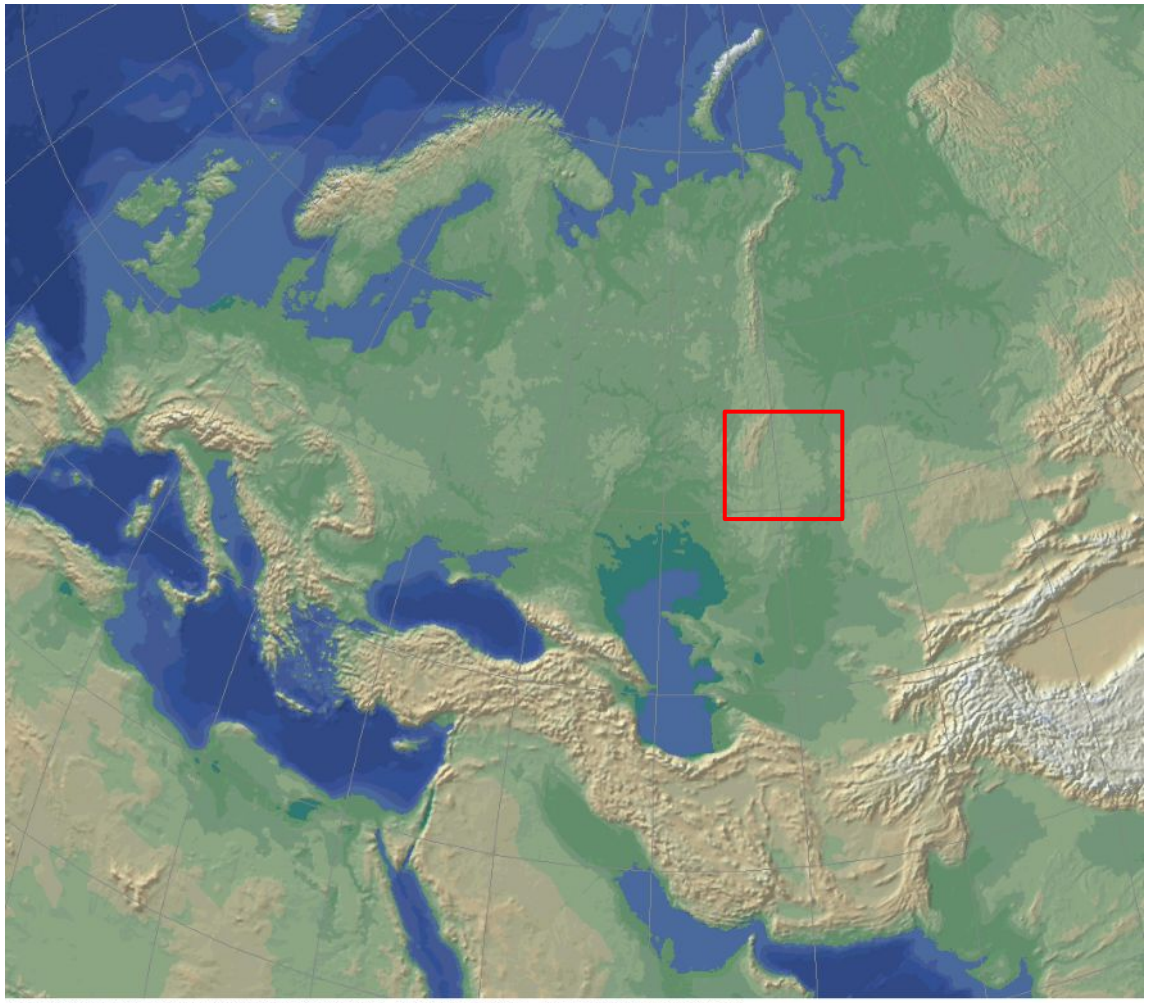
The Case Study:
the Sintashta-Petrovka Archaeological Culture (cal. 2000-1700 BC)

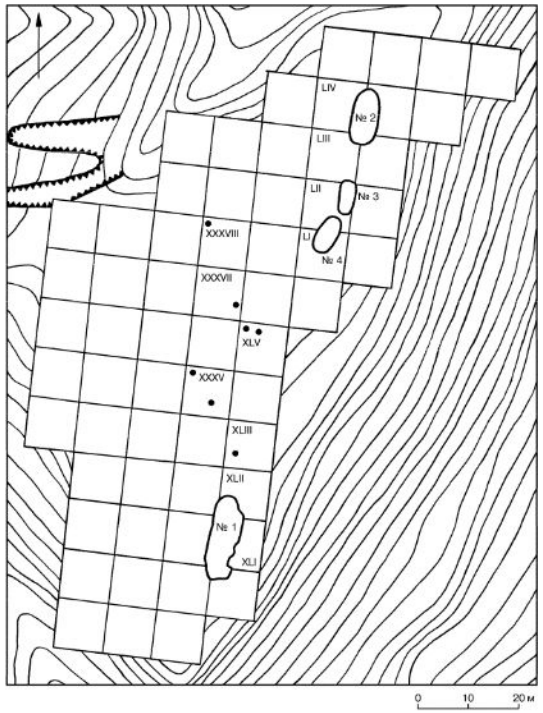
- 25 settlements paired with cemeteries
- nucleated and walled settlements
- houses are packed within the surrounding walls and ditches sharing their internal walls
- no social differentiation between the houses in terms of their sizes and patterns of architecture
- kurgan cemeteries with rich animal offerings (cattle, horses, sheep)
- graves of individual males accompanied by weaponry (projectile weapons and chariots), the insignia of power (stone mace heads), craft tools, and a specific set of sacrificed animals (horses and dogs)



The Case Study:

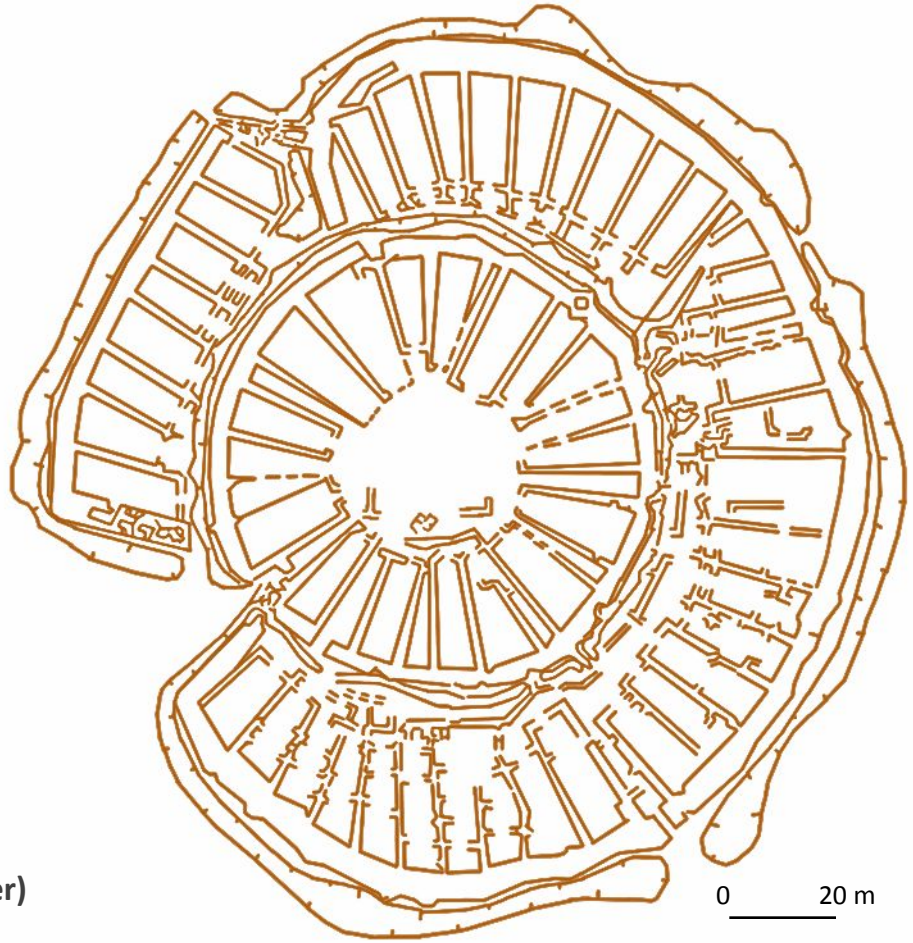
how does Sintashta differ from the rest of the Bronze Age cultures?

Early Bronze Age:
unfortified settlements and seasonal camps



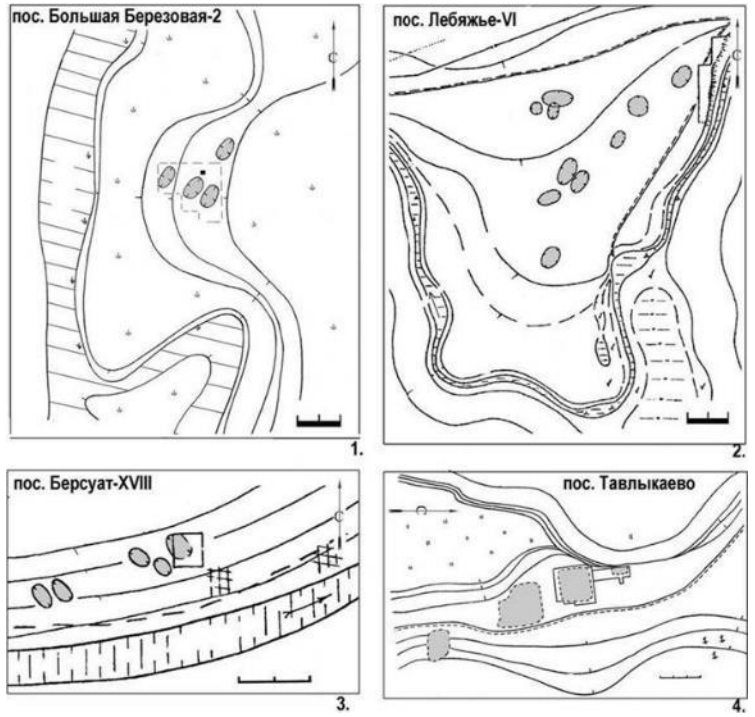
The Pit-Grave culture Settlement (the Don River) (Korobkova and Shaposhnikova 2005)

Middle/Late Bronze Age



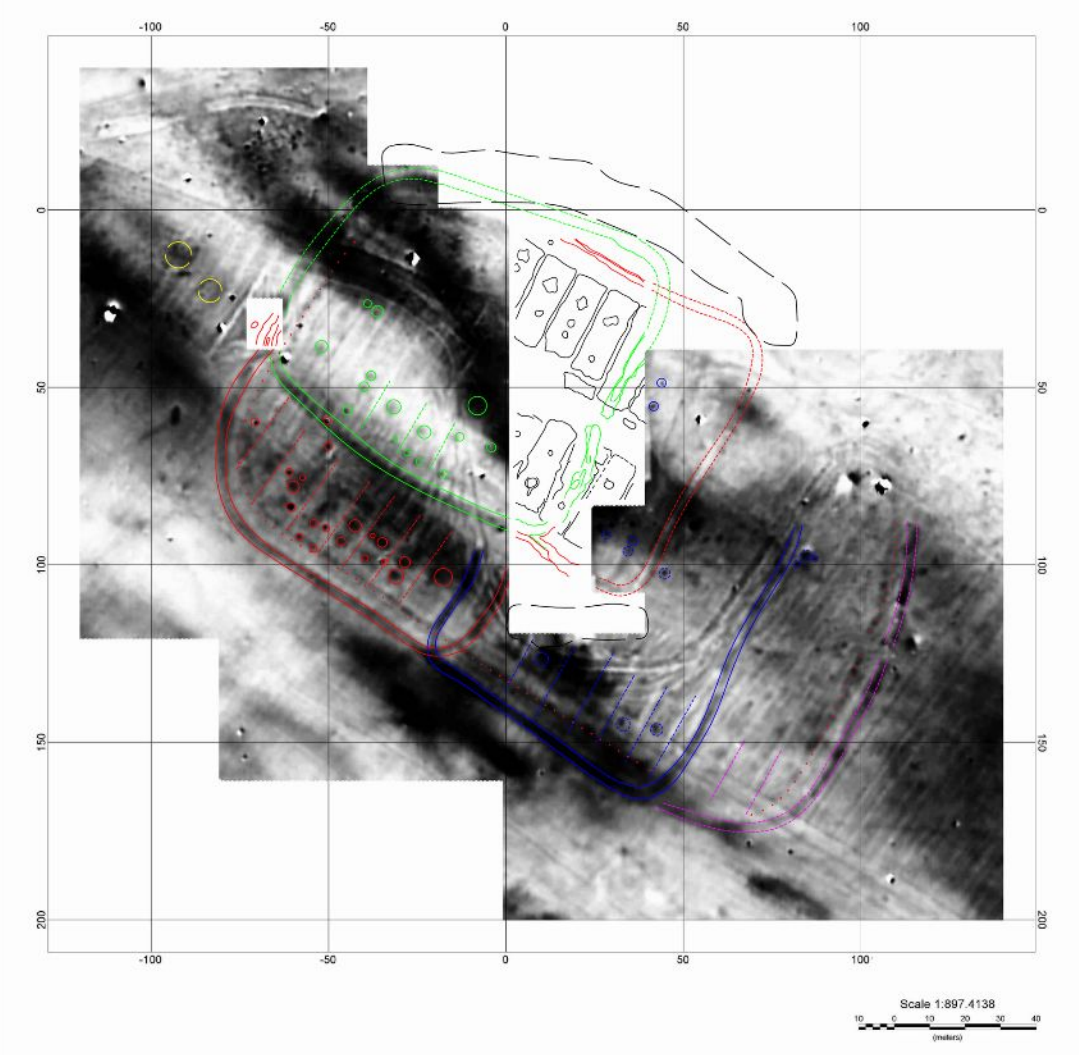
Arkaim (Zdanovich and Batanina 2007)

Late/Final Bronze Age:
unfortified smaller settlements

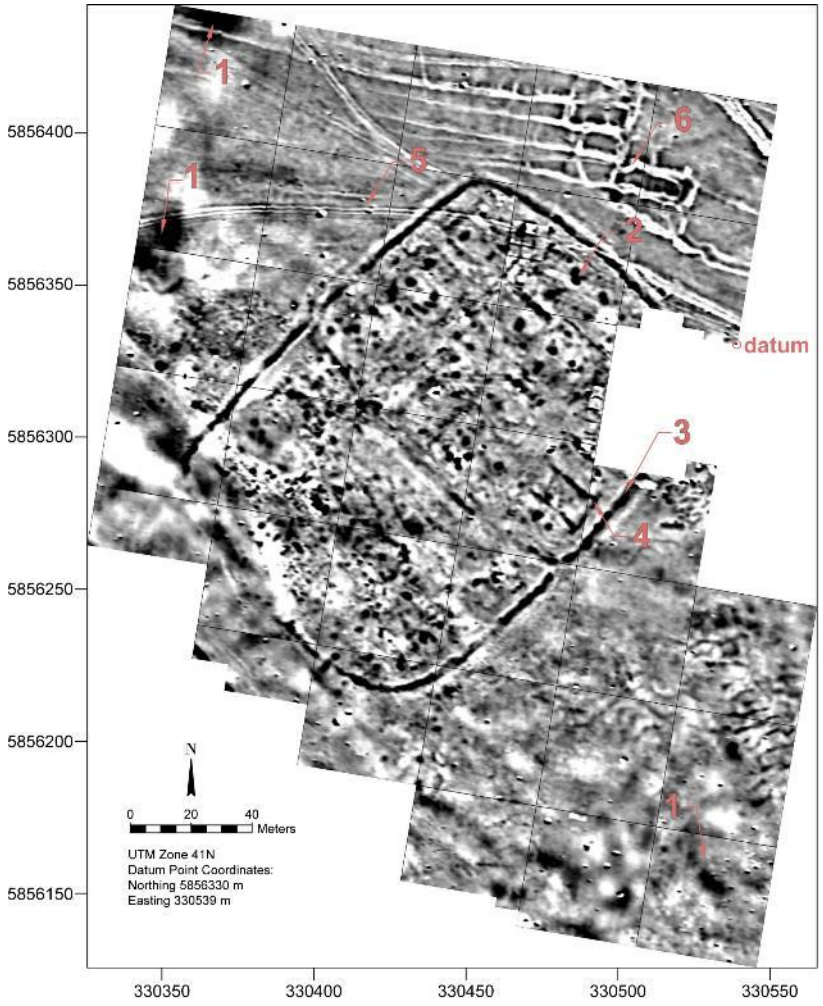


The Settlements of Alakul'-Srubnaya cultures (Alaeva 2015)

Sintashta-Petrovka settlements
embankments, ditches and houses with shared walls



Ust'ye (Hanks et al. 2013)

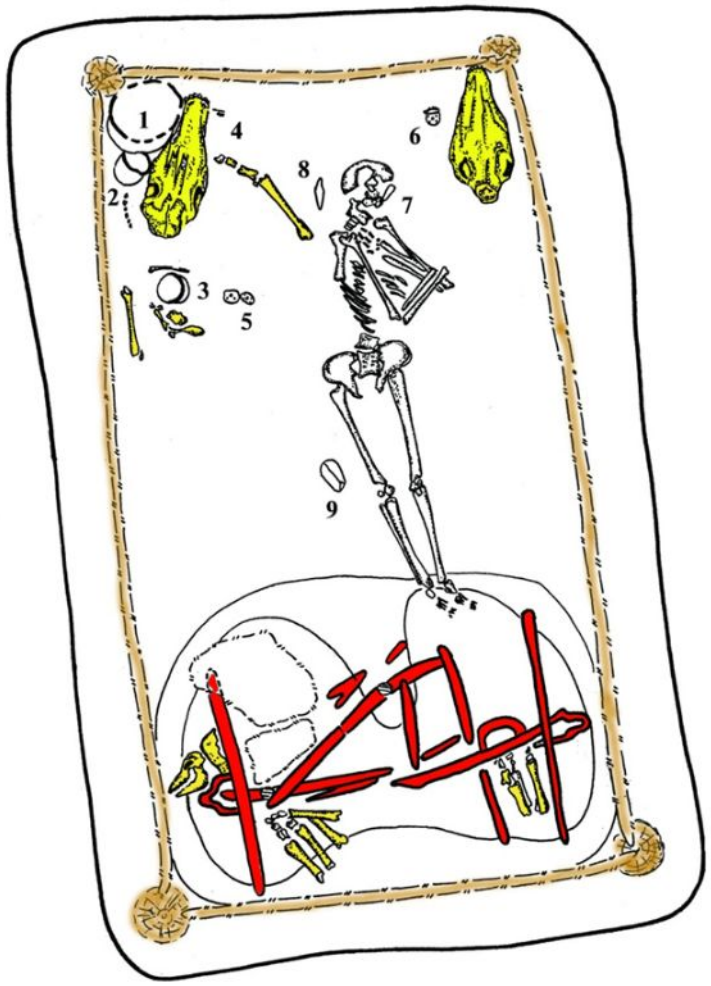


Kamennyi Ambar (Krause and Koryakova 2013)

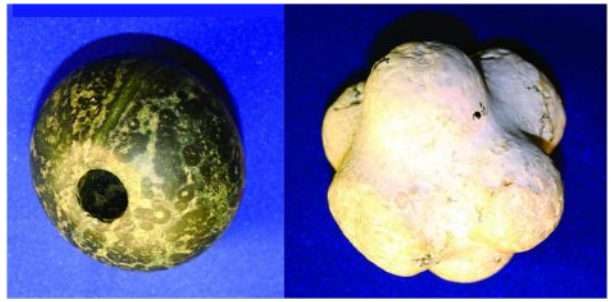
Elite Mortuary Rituals:
chariots, weapons and outstanding animal sacrifice

Novoilinovsky Cemetery (Chechushkov and Usmanova, forthcoming)

Sintashta Cemetery (Gening et al. 1992)



Krivoe Ozero Cemetery (Vinogradov 2003)



Kamennyi Ambar-5 Cemetery (Epimakhov 2005)
Sintashta Cemetery (Gening et al. 1992)

Research Objectives and Questions

The research aims to complement previous archaeological investigations of Sintashta-Petrovka chiefdoms, which have told us a great deal about lifestyles within settlements and elite burials, but we are lacking knowledge of those who dedicated they labor to the construction project and were involved into the subsistence.

Documenting missing part of population allows investigation of settlement rationality, illuminating functioning of the settlements as administrative and ritual centers, fortresses or seasonal shelters against harsh environmental conditions.

1. To what extent do the remains outside the walls indicate actual residence there?

3. If the residence present, did the residents have less wealth and prestige that occupants of the inside?

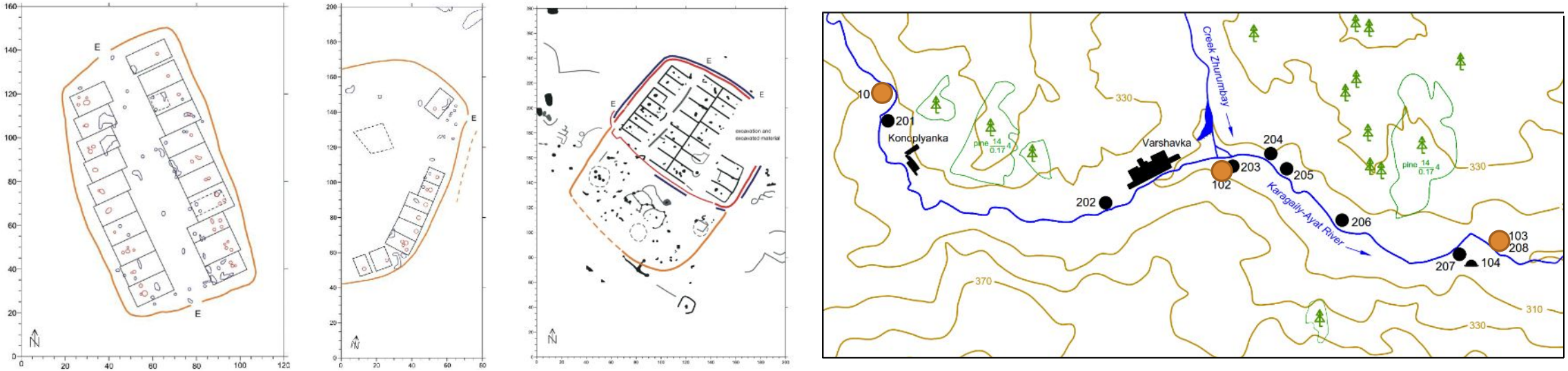
6. How did the people choose the spots in the local environments to locate the settlements?

Research Methodology

1. Focus on nearby areas of three settlements in the Karagaily-Ayat River Valley

2. Intensive subsurface and surface testing, including:
   - cross-sectioning of slopes of natural ravines
   - core drilling
   - excavating of test pits
   - surface collection
   - total station surveys of microtopography

Konoplyanka, Zhurumbay and Kamennyi Ambar (left to right) as visible on magnetic plans (Krause and Koryakova 2013) and map of the valley



Research Results:

intense subsurface testing nearby three Sintashta settlements

Kamennyi Ambar:

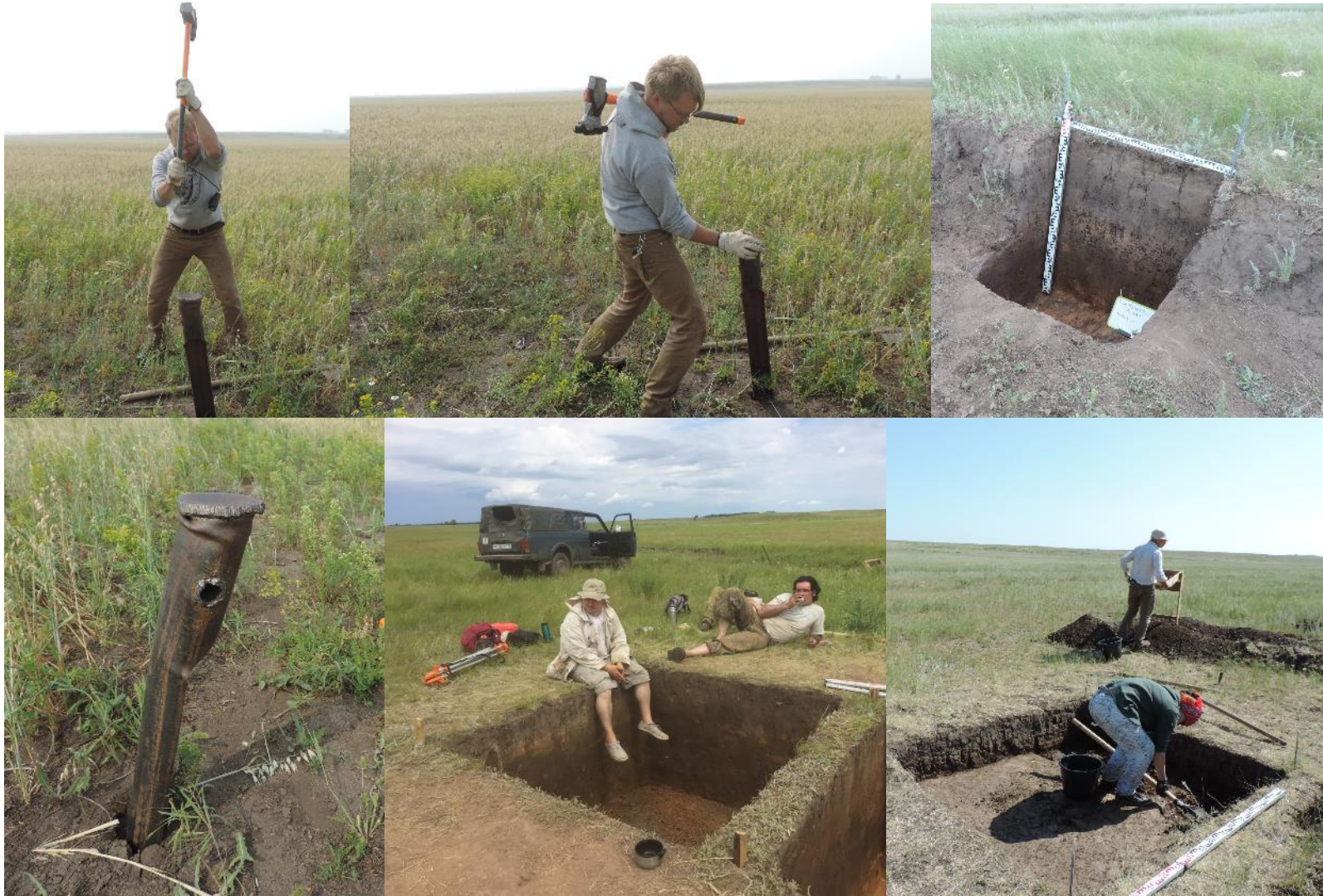
- 9 cross-sections
- 16 test pits
- 179 cores
- 126 cores sampled for WDXRF
- map of microtopography

Konoplyanka:

- 10 test pits
- 126 cores
- map of microtopography

Zhurumbay:

- 10 test pits
- 84 cores
- surface collection



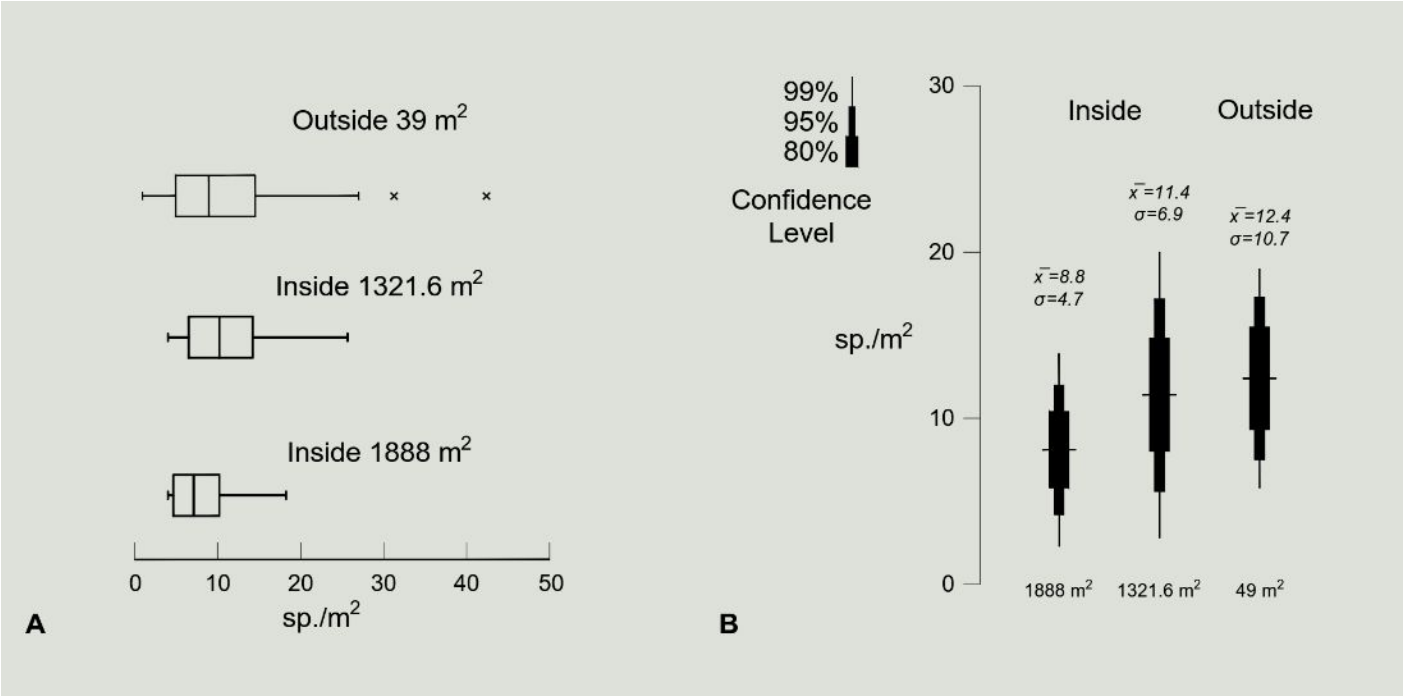
Research Results:
comparing outside areas to cultural layers inside the walls

1. Evidence for intense cultural layers found outside the walls of all three settlements

2. The cultural layers consist of ruined bonfires, artefacts and ecofacts, depleted humus

3. The artifact density **inside the walls** of Kamennyi Ambar is 11.4±5.8 artifacts per 1 sq.m (95% CL; n=8; σ=6.9).

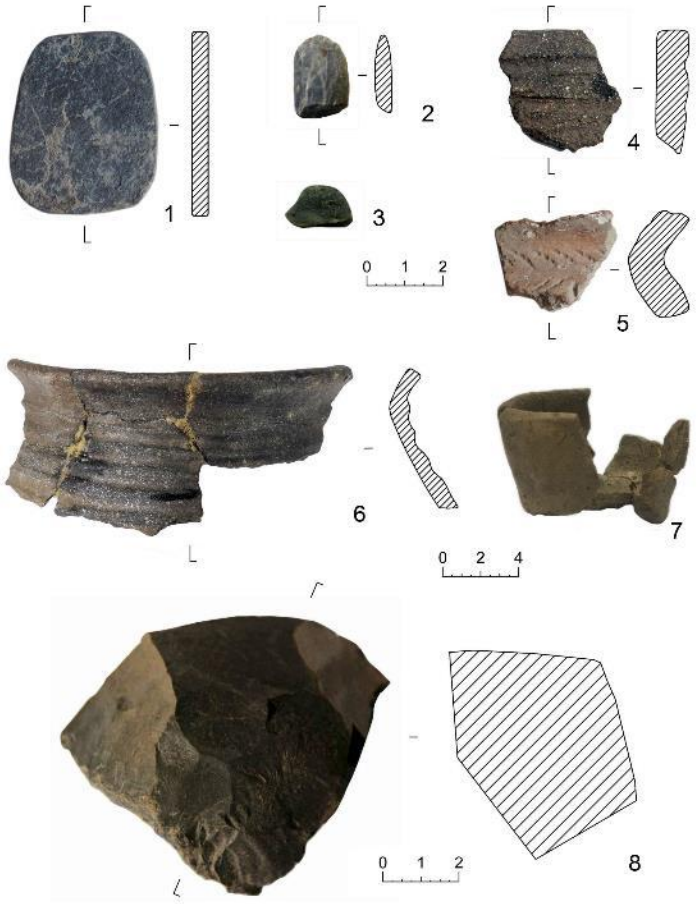
The mean density of materials **outside the walls** is *very similar* with 12.4±4.9 artifacts per 1 sq.m (95% CL; n=23; σ=6.9).

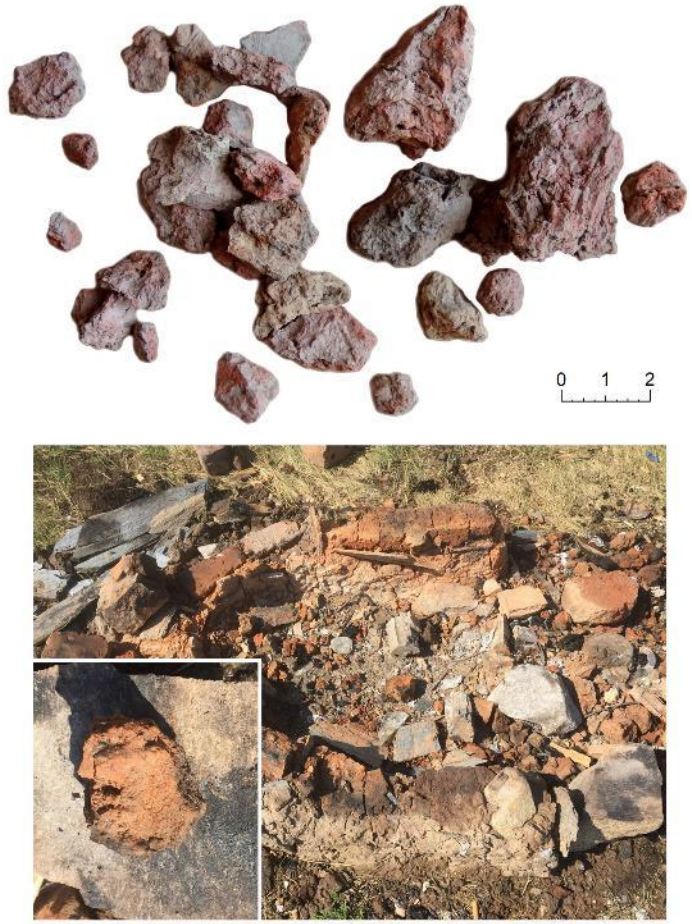


Research Results:
comparing outside areas to cultural layers inside the walls

4. The artifact assemblages from the outside might represent two kinds of seasonal events:
   - the winter habitation of families that practiced transhumance
   - summertime ore smelting carried by sedentary craft specialists from the inside.

5. This idea is supported by abundance of baked clay (remains of bonfires) and metallurgical slag.



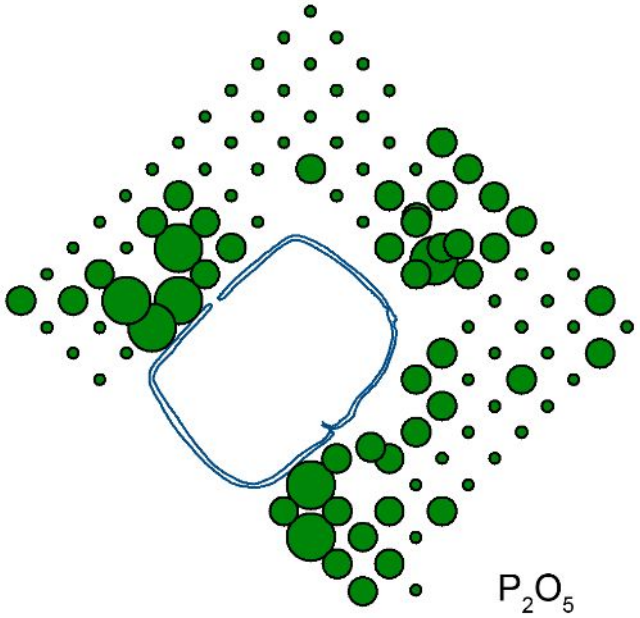


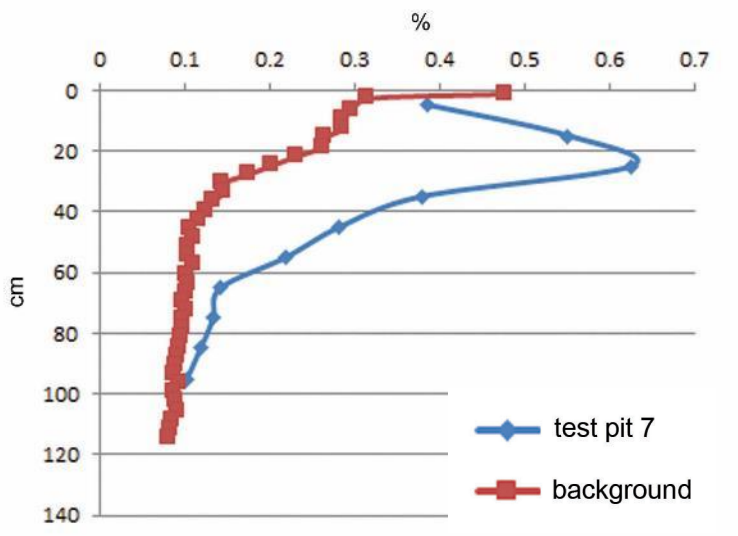
Research Results:
chemical analysis (WDXRF) of Kamennyi Ambar outskirts

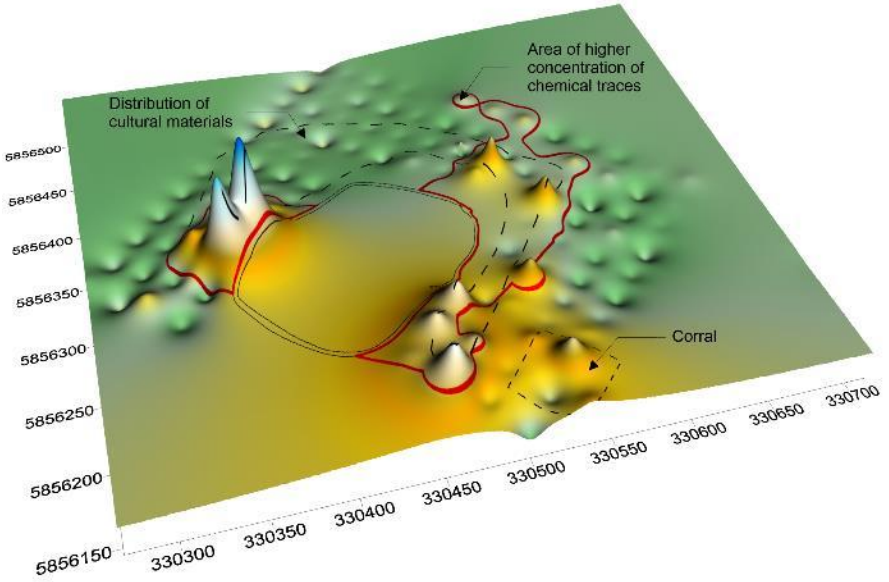
1. In comparison to normal values, zones of higher accumulation of phosphates are to the west, north-east, and south-east from the walls. The cultural materials and layers also common for these area, supporting that is due to past human activities.

2. The standardized values of nine element compounds (P_2O_5, NaO, Cu, CaO, K_2O, MnO, S, Sr, Zn) were summarized to create a proxy value that can be plotted to delineate the cultural layer as a smoothed topographic surface (Drennan and Peterson 2006; 2008).

3. The total estimated area of the cultural layer outside Kamennyi Ambar is about 1 ha.







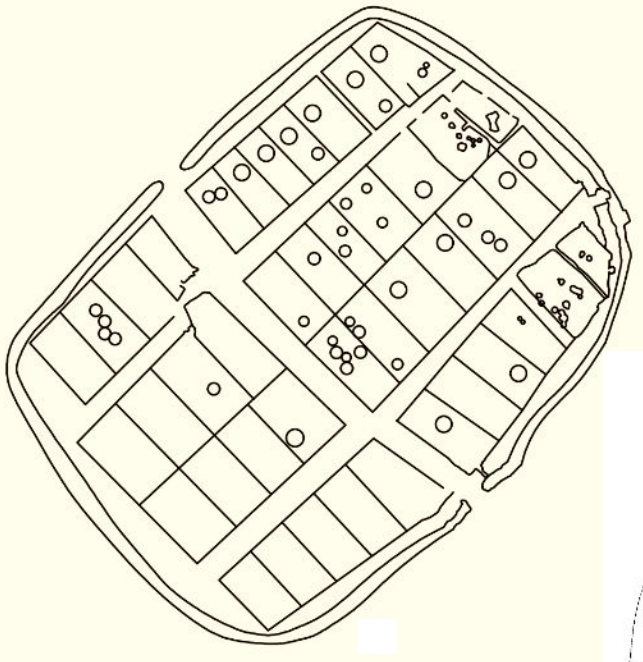
Research Results:
demography of Kamennyi Ambar inside and outside the walls

1. The settlement has 46 houses inside the walls, so the median value is 460±40% people who lived within the walls simultaneously (the average family size is 10)

2. The area-density index suggests that outside population who lived there on the seasonal basis is 292±40% people.

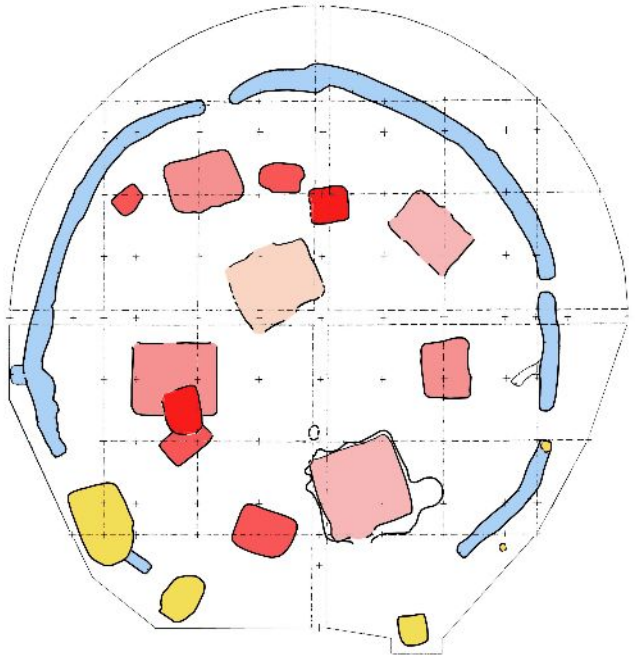
3. The cemetery of Kamennyi Ambar-5 yielded about 100 individuals, or 2%–5% of the total population of 4,896±1,960 people in four generations who lived in the nearby settlement for 100 years.

4. In the Sintashta-Petrovka chiefdom, the 2%–5% of elite would have consisted of priests and warriors, 48%–55% of dependent producers and 50%–60% of the lower social class of herders.

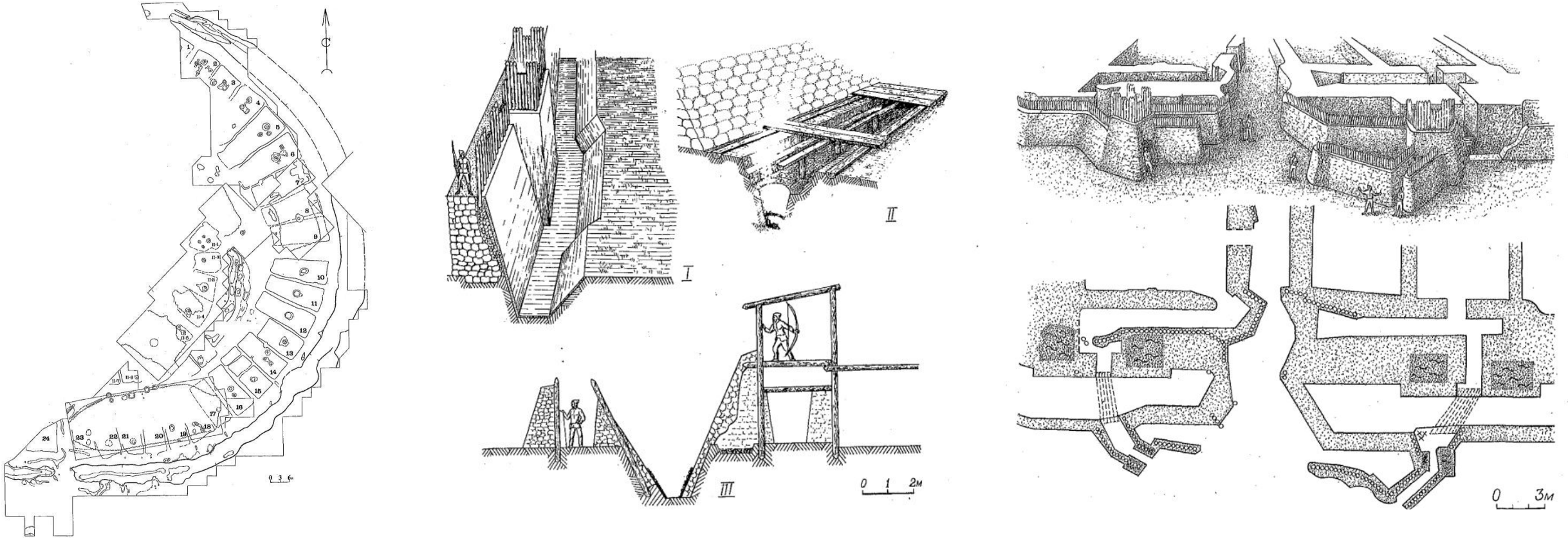


46 houses of Kamennyi Ambar (as visible on the magnetic plan) (Krause and Koryakova 2013)

15 graves of the biggest kurgan 4 of the Kamennyi Ambar-5 Cemetery. There are 5 kurgans and about 100-120 people in total (Epimakhov 2005)



The Sintashta Settlements:
a stronghold as a common explanatory model



Sintashta and Reconstruction of the Fortification System (Gening et al. 1992)

The Sintashta Settlements:
alternative interpretations

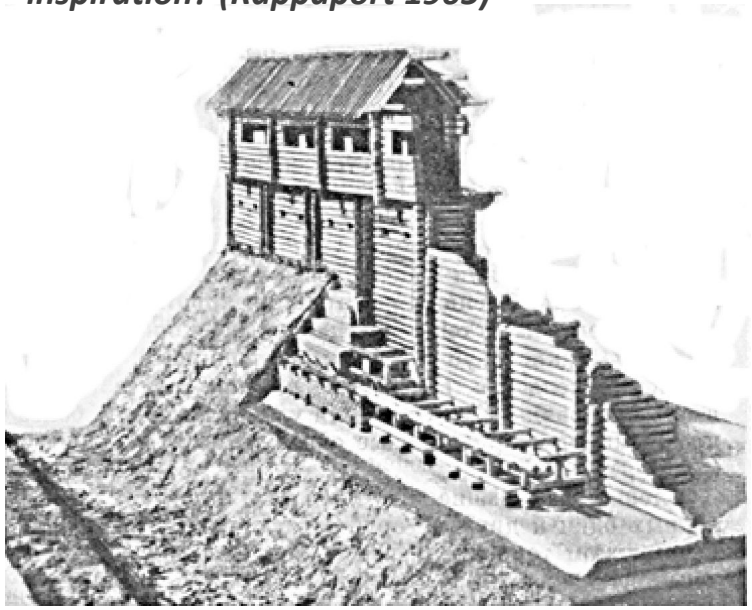
A Common Hypothesis:

25 Sintashta “towns” are strongholds and the centers of political and religious life (Zdanovich et al. 1995; Zdanovich D. 1997; Anthony 2007, etc.)

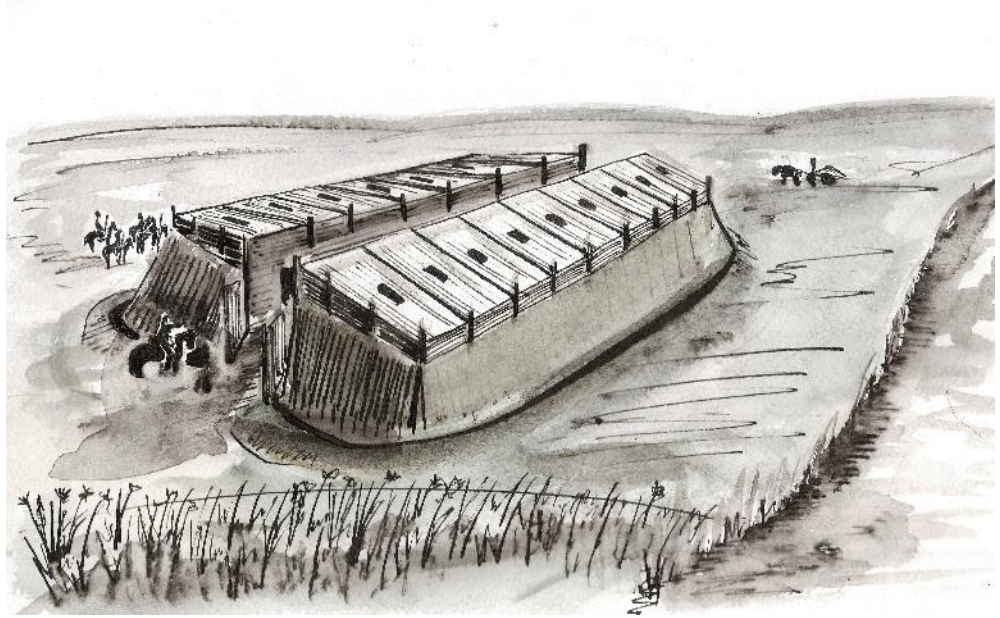
An Alternative Hypothesis:

the Sintashta enclosed settlements are sophisticated systems of livestock maintenance in the harsh environment (Anisimov 2009)

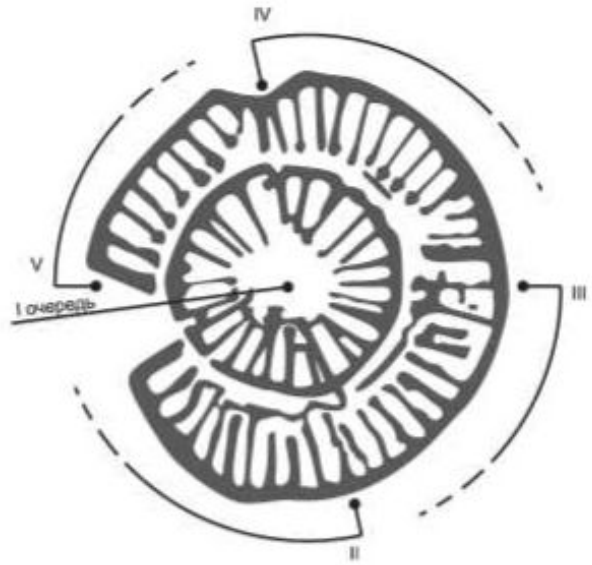
Medieval fortresses as the source for inspiration? (Rappaport 1965)



Settlement as shelters (Nikolay Petrov’s original artwork 2017)



Phases of Arkaim construction (Anisimov 2009)

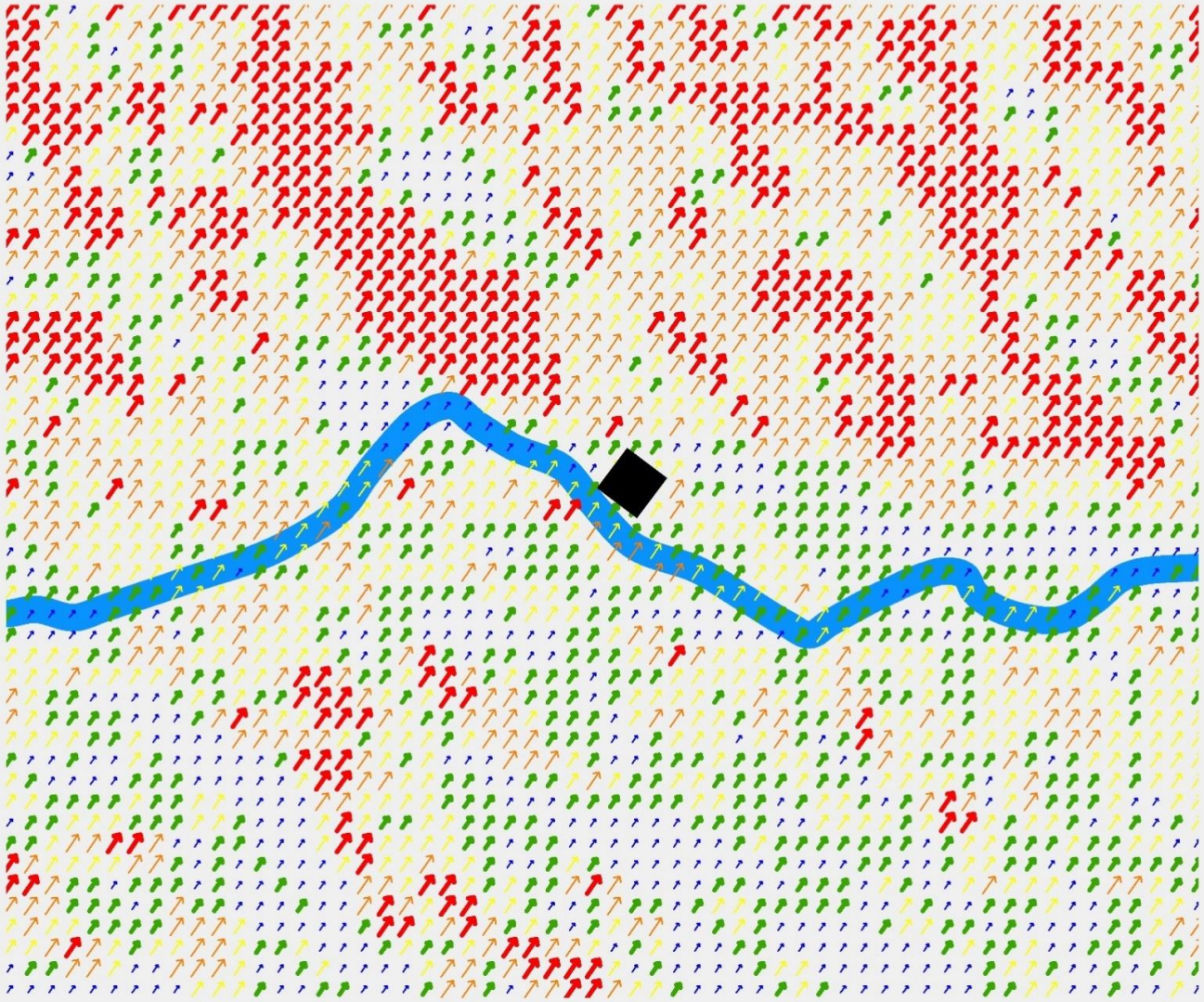


Methods to Test the Hypotheses

Three settlements in the Karagaily-Ayt River Valley in the southern Urals

- Analysis of dependency of wind speed on the local landscape
- Analysis of dependency of hydrology on the local landscape
- Analysis of local elevations and visibility

The Winds Speed Analysis



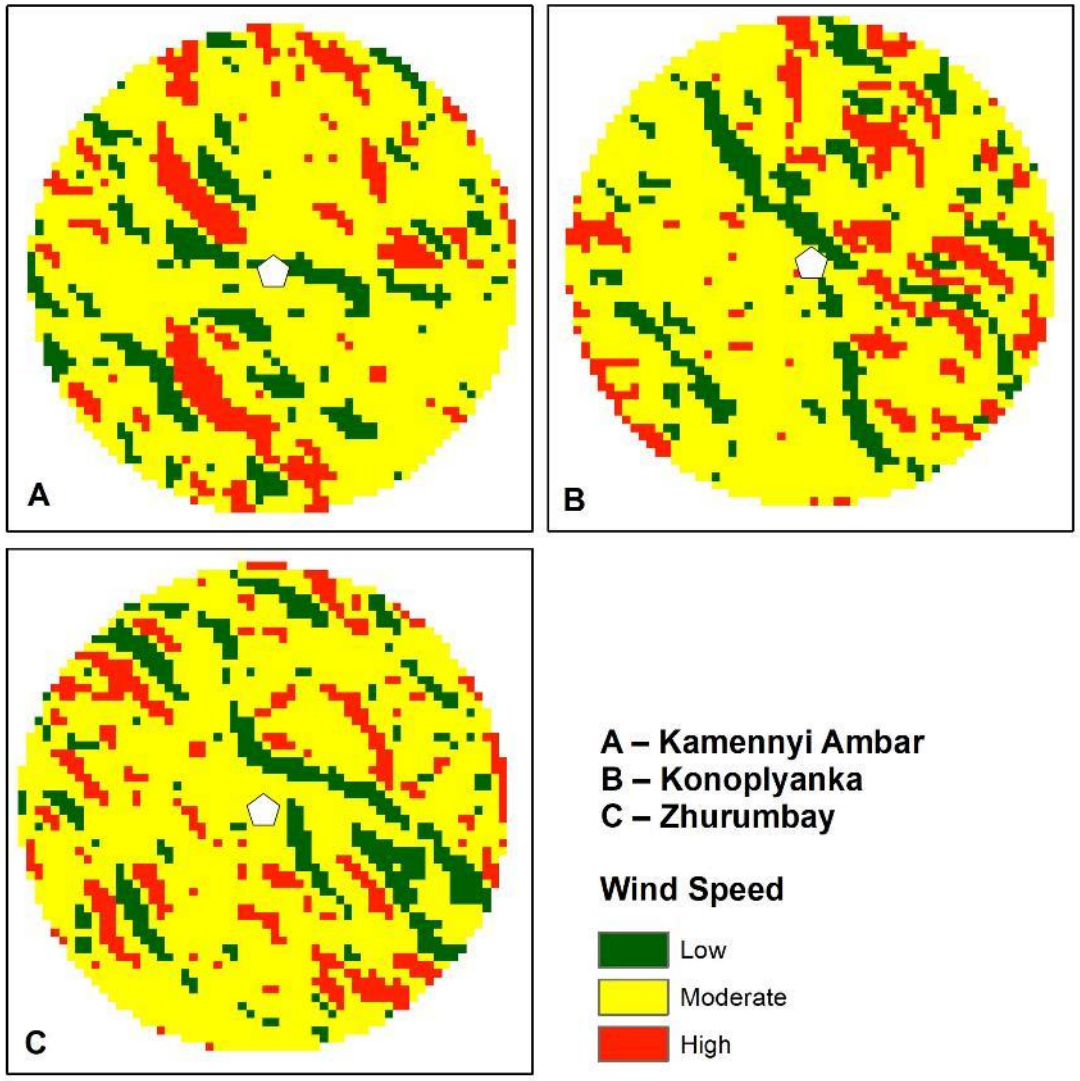
The output from *WindNinja*

The speed of wind
depending on the landscape (m/s)

Kamennyi Ambar
December 16th, 2016

- 0-4,78
- 4,79-4,80
- 4,81-4,83
- 4,84-4,86
- 4,87-5,06

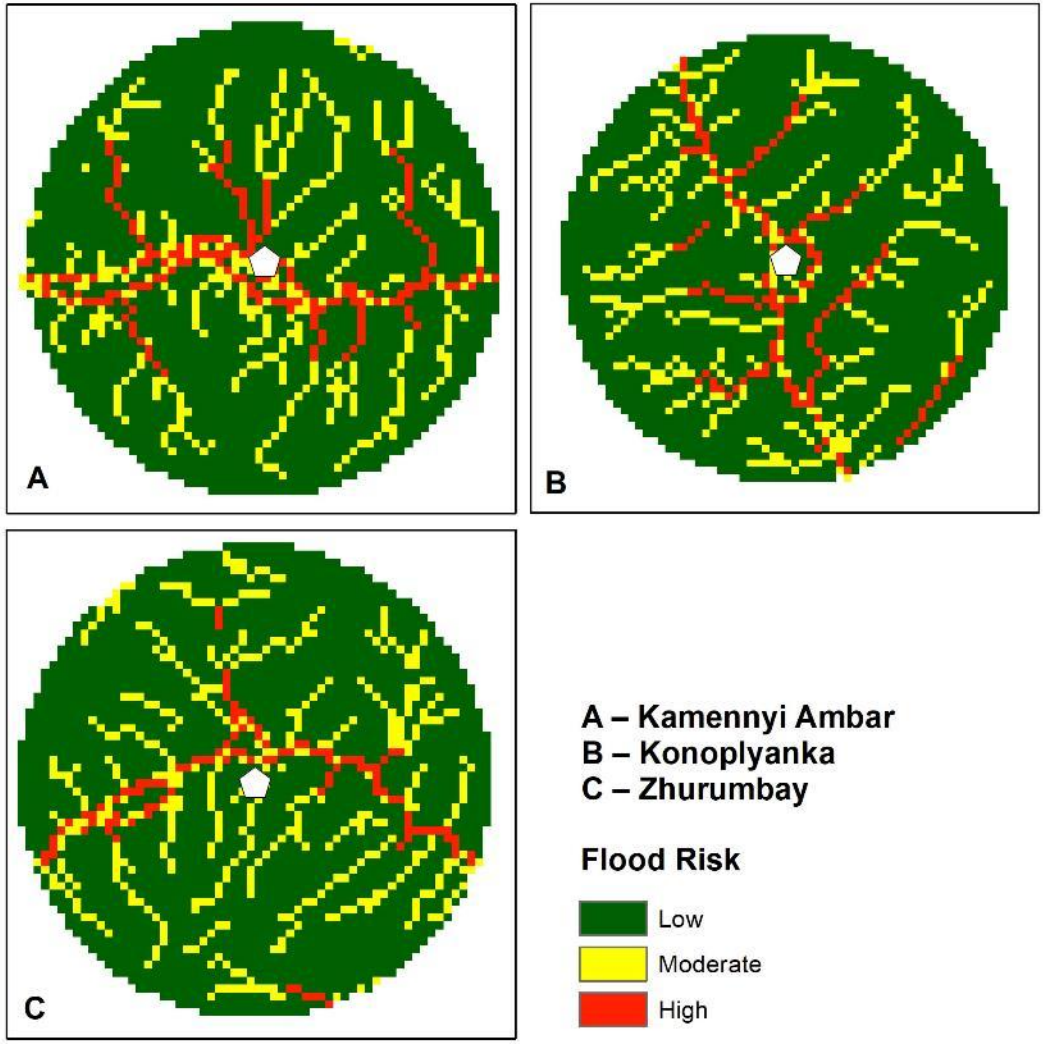
The Winds Speed Analysis



The output from *WindNinja*

The classified wind within the buffers of 3 km from three analyzed settlements
A – For Kamennyi Ambar, winds between 3.58 m/s and 3.66 m/s are classified as low, 3.66 m/s and 3.74 m/s as moderate, and 3.74 m/s and 3.9 m/s as high winds.
B – For Konoplyanka winds between 3.57 m/s and 3.66 m/s are classified as low, 3.66 m/s and 3.73 m/s as moderate, and 3.73 m/s and 3.86 m/s as high.
C – For Zhurumbay winds between 3.56 m/s and 3.67 m/s are classified as low, 3.67 m/s and 3.73 m/s as moderate, and 3.73 m/s and 3.85 m/s as high.

The Hydrology Analysis



The output from *ArcGIS 10.5 (Flow Accumulation)*

The classified area within the buffers of 3 km from three analyzed settlements with respect to flood risk

Low flood risk zone: 0 inflowing cells

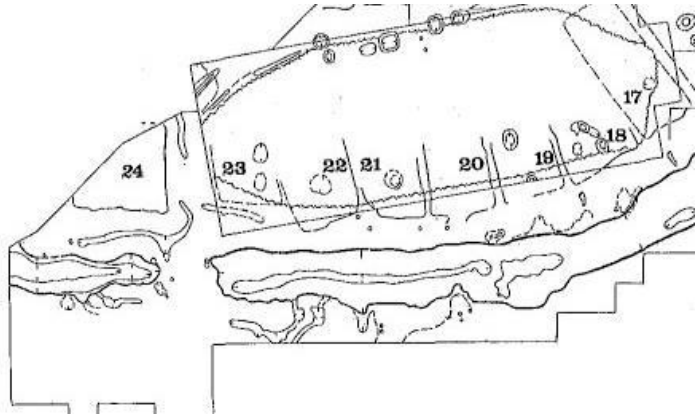
Moderate flood risk zone: 0 to 100 inflowing cells

High flood risk zone: more than 100 inflowing cells.

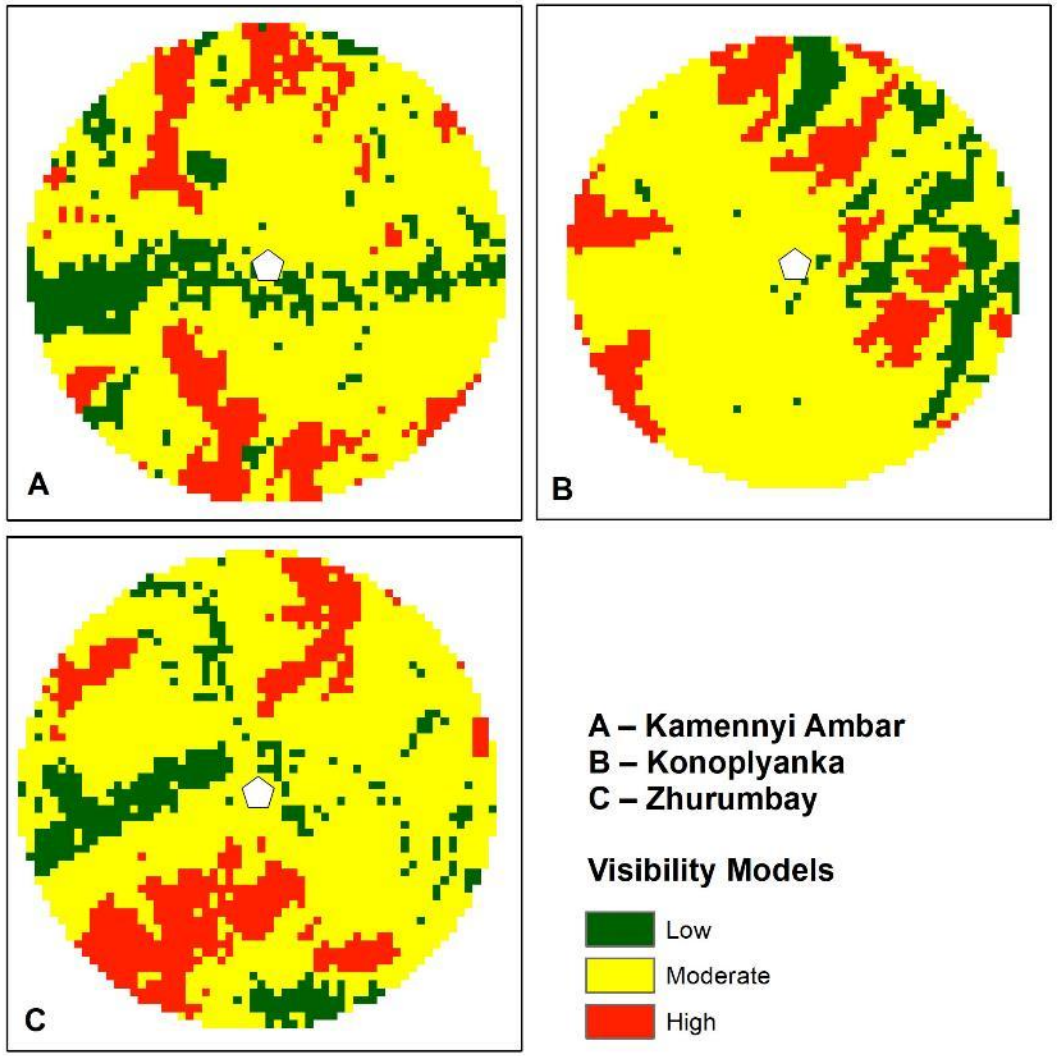
The modern and old channels of the river are drawn from the satellite image, and then the value of 100 assigned to each cell within the channels.

The Karagaily-Ayat River

Flood on April, 8th 2018
vs
Summer Flow, July, 2017
and
the possible drainage system of the Sintashta Settlement



The Visibility Analysis



The output from *ArcGIS 10.5 (Visibility 2)*

The classified area within the buffers of 3 km from three analyzed settlements with respect to local visibility

Classification in accordance with the natural breaks on histograms

The Visibility Analysis:
the visibility values within the buffer zones

	Visibility within buffer zone around Kamennyi Ambar	Visibility within buffer zone around Konoplyanka	Visibility within buffer zone around Zhurumbay
Minimum	716.0	510.0	468.0
Maximum	7,975.0	10,547.0	9,998.0
Arithmetic Mean	3,277.6	3,522.8	3,755.0
Standard Deviation	1,222.3	1,379.3	1,669.3
Standard Error of Arithmetic Mean	22.9	25.9	31.3
Visibility from the site	2,196.0	2,899.0	2.664.0
Difference between visibility at the site and mean values (ha)	-388.6	-633.8	-1,091

Insights from the Analysis

The settlements are located:

- in the relatively calm spots of the landscape, where speed of wind is either low or moderate
- on the banks of the rivers, however within the low to moderate flood risk zones
- where the river most likely did not flow in the Bronze Age
- in the spots of the little visibility
- in the lowest spots of the local landscapes

Answering the Research Questions

1. To what extent do the remains outside the walls of the settlements indicate actual residence there?

- My combined methodology of sub-surface testing and laboratory analysis revealed existence of the cultural layers in the outskirts of all three sites
- The area of cultural deposits outside KA is about 1 ha, or similar to the total area of houses inside (1.2 ha)
- Evidence for bonfires (baked clay, charcoal, tiny pieces of burnt bones) allow suggesting that area could be used for the residence

3. If the residence present, did the residents have less wealth and prestige that occupants of the inside?

- The artifact assemblage from the outside demonstrate lower values of richness and diversity, suggesting that people accumulated less possessions, or they were made of less durable materials. Presumably, this means less wealth accumulation in terms of material things.
- Their life-style differed, but it doesn't say much about social prestige.
- Though, the most prominent members of the society were buried with the attributes of warriors, what suggests that the pastoral part of the society had less social prestige

6. How did people choose the spots to locate the settlements?

- the settlements located in the lower spots near the sources of fresh water, so the need to water animals played the most crucial role
- within the river's flood-risk zones, but surrounded by ditches to drain the water during the floods
- low wind speed locations to protect from harsh winter conditions
- no role of local visibility, suggesting that people didn't think about unexpected attacks

Acknowledgments

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