

Migration in the Cetina Phenomenon?

An Agent-based Perspective

Work in Progress

The Cetina Phenomenon

The so-called Cetina culture is one of the large-scale ideologically motivated interaction networks that spread over Europe in the 3rd mill. BC. It is mainly known for its burials, which consist in inhumations or incinerations, mostly single graves, under stone barrows which are often grouped together to form clusters. Most of the Cetina barrows are concentrated along the upper course of the Cetina River, in central Dalmatia. Settlements are infrequent and mostly in caves. Grave goods mostly consist in ceramics scattered throughout the barrow, although metals, lithic and other objects are also present. Distinctive Cetina ceramics are bowls with thickened rims and beakers decorated with incised lines and triangular impressions forming different geometric patterns. "Classic" Cetina Culture roughly dates to the second half of the 3rd mill. BCE (1).



Figure: Cetina potsherds from Palagruža(1, fig- 32, upper part)

The distribution of Cetina features overseas caught the attention of scholars interested in Mediterranean connectivity. The presence of Cetina-like pottery in the Peloponnese further contributed to ignite the interest in the Cetina culture, whose spread across the central Mediterranean is mainly identified through distinctive ceramics. The current interpretative model of what is now called the Cetina phenomenon suggests that Cetina is the common denominator behind the migration of small groups perhaps connected to the circulation of metals (2–4).



Figure: Bifacial points from Palagruža(1, fig. 66, lower part)

Recent research (1) suggest that groups of people migrated from Dalmatia to Italy for raw material procurement, in particular for chert from the Gargano that arrived in Dalmatia as finished artifacts (5). Small numbers of ceramics with Cetina features – presumably locally produced by Dalmatian potters – were recovered in Italy in both cemeteries and settlements. Since there is no comparable presence of Italian artifacts in Dalmatian contexts, it can be inferred that migration from the Eastern Adriatic coast to Italy was unidirectional.

References

- [1] S. Forenbergh, *Special Place, Interesting Time: The island of Palagruža and transitional periods in Adriatic prehistory*, Oxford: Archaeopress Publishing Ltd, 2018.
- [2] C. Broodbank, *The Making of the Middle Sea: A History of the Mediterranean from the Beginning to the Emergence of the Classical World*, Thames & Hudson London, 2013.
- [3] J. Maran, *Kulturwandel auf dem griechischen Festland und den Kykladen im späten 3. Jahrtausend v. Chr.: Studien zu den kulturellen Verhältnissen in Südosteuropa und dem zentralen sowie östlichen Mittelmeerraum in der späten Kupfer- und frühen Bronzezeit*, Habelt, 1998.
- [4] J. Maran, *Seaborne contacts between the Aegean, the Balkans and the Central Mediterranean in the 3rd millennium BC: The unfolding of the Mediterranean world*, na, 2007.
- [5] S. Forenbergh and Z. Perhoč, "Lithic Assemblages from Nakovana (Croatia): Raw Material Procurement and Reduction Technology from the Early Neolithic until the End of Prehistory," *Journal of Mediterranean Archaeology*, vol. 30, no. 2, pp. 189–211, 2018.
- [6] B. Kamiński, K. Growiec, and J. Growiec, "A Dynamic Model of Social Capital and Economic Performance in Social Networks," in *Social Simulation Conference 2017, Dublin*, 2017.
- [7] P. Bourdieu, "The forms of capital," in *Handbook of Theory and Research for the Sociology of Education* (J. Richardson, ed.), pp. 241–258, Westport, CT: Greenwood, 1986.
- [8] M. Gori and F. Schaff, "Migration in the Cetina Phenomenon? An agent-based perspective," forthcoming.
- [9] M. Pacciarelli, T. Searano, and A. Crispino, "The transition between the Copper and Bronze Ages in southern Italy and Sicily," *H. Meller et al.(Ed.)*, vol. 2200, pp. 253–282, 2015.
- [10] D. L. Clarke, "Models and paradigms in contemporary Archaeology: Chapter 1," in *Models in archaeology* (D. L. Clarke, ed.), pp. 1–60, London: Methuen, 1972.

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In this poster we present an agent-based model (ABM) for the Cetina phenomenon. On the basis of the available archaeological record, we assume that small groups of people migrated from Dalmatia to Italy. The question that cannot be answered with (current) data is:

"Why did people migrate from Dalmatia to Italy?"

We provide a formalised theory based on current work by (6) who combine social capital theory (7) with economic reasons to provide a theory of network formation in human societies. By extending the approach to a two-regions system, this work will provide a formal theory potentially capable to explain migration patterns related to the Cetina phenomenon (8).

Migration Hypothesis

Migration is a constant of human behaviour and both indicator for and a result of change. The spread of the Cetina phenomenon across the Adriatic in the 3rd mill. BCE represents an outstanding case study to understand the relationship between people and objects on the move, and to assess the impact that migration has on cultural and societal changes. On the basis of archaeological data we assume that the Dalmatian communities who participated into the Cetina phenomenon were closely interconnected by shared ideologies, lifestyle and practices. Differently, in Italy, in the last centuries of the 3rd. mill. BCE seem to have been characterised by a demographic crisis. When the local Laterza long-lasting tradition breaks down the presence of Adriatic communities reaches its peak (9).

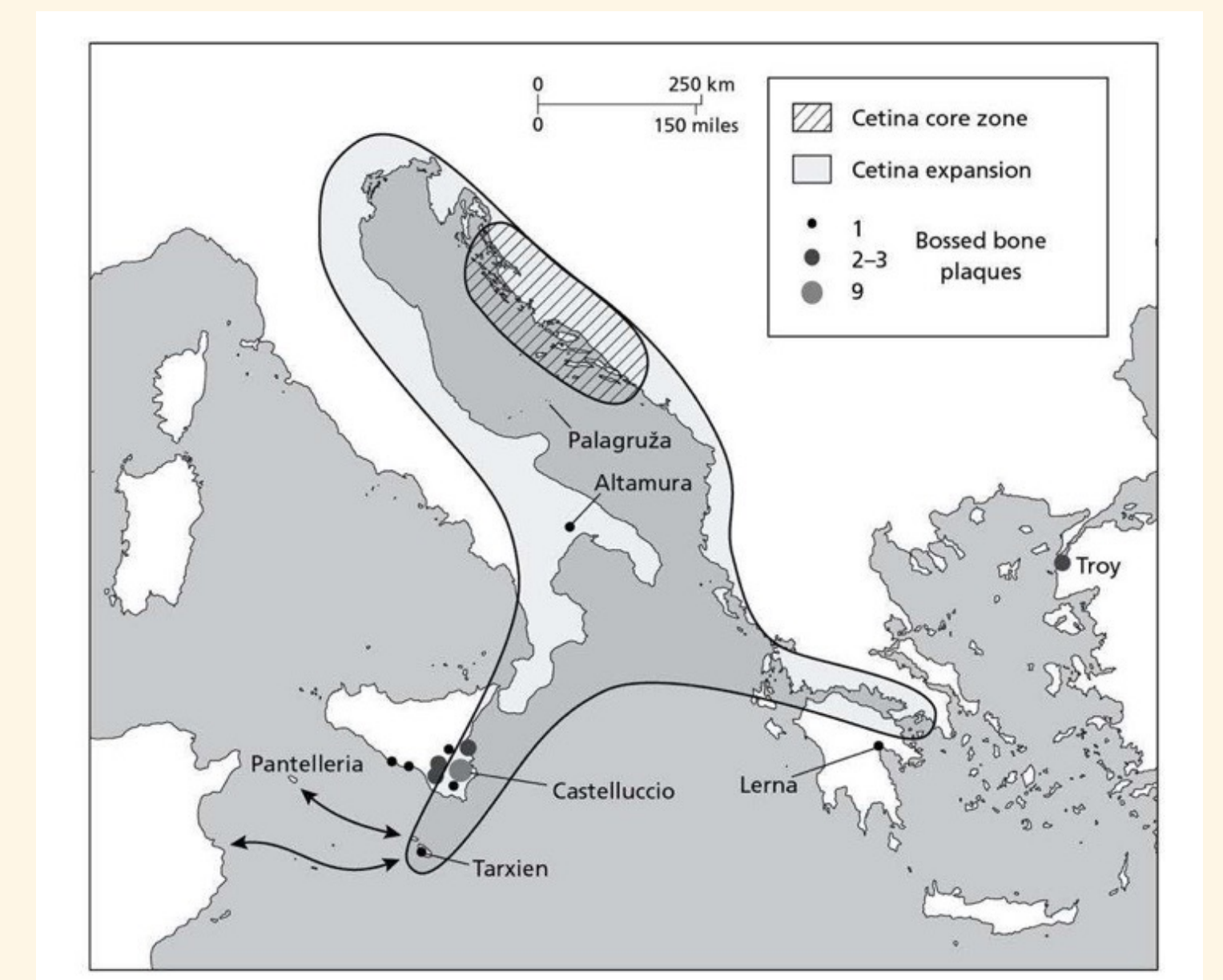


Figure: Cetina expansion in the central Mediterranean (2, fig. 8.3)

"Models are pieces of machinery that relate observations to theoretical ideas"(10)

Agent-based Modelling & Complexity Perspective

Agent-based modelling

- ① allows to represents single entities of the system under study as single, and in principle even unique, objects called *agents*,
- ② allows these agents to interact on the local and global scale,
- ③ allows for an explicit topology (i.e., space, distance) for both, physical and metaphysical concepts (e.g., friendship, reputation) and
- ④ allows the state-space to change dynamically and in principle unbound (e.g. the number of agents, but also the relation between agents).

Complexity Perspective

A complex system:

- consists of a network of interacting agents (processes, elements)

- exhibits a dynamic, aggregate behavior that emerges from the individual activities of the agents
- can be described in its aggregate behaviour without a detailed knowledge of the behavior of the individual elements

An agent in such a system is adaptive if it satisfies an additional pair of criteria:

- the actions of the agent in its environment can be assigned a value (performance, utility, payoff, fitness, or the like)
- the agent behaves so as to increase this value over time

A complex adaptive system, then, is a complex system containing adaptive agents, networked so that the environment of each adaptive agent includes other agents in the system.

Migration meets Social Capital Theory: An Agent-based Modelling Approach

Social Capital Theory (7)

- Social capital relates to the position in a network.
- The value of this position is defined by the other sorts of capital (economic, cultural or symbolic) possessed by these acquaintances, i.e. the aggregate resources accessible.

An ABM implementation (6)

Social capital is formalised via four dimensions:

Network degree: More people known is better.

Centrality: Connecting local cliques increases ones own importance for others.

Bridging capital: Connections to dissimilar others increase *effectiveness*, i.e. economic performance.

Bonding capital: Connections to similar others increase *safety*, i.e. social utility.

In addition, agents are characterised by:

Family location: A proxy defining kinship as relative euclidean distance on a circle.

Agent type: A proxy defining *sameness* as negative euclidean distance on a line.

Agent age: Related to frequency of tie creation and breaking.

Deviations from (6)

- Two *different* societies: Dalmatia and Italy
- Geographical space (connection via Palagruža)

Expected Results

- Agents from Dalmatia migrate to Italy, but not vice versa.