CULTURAL RESILIENCE THEORY AS AN INSTRUMENT OF MODELING HUMAN RESPONSE TO GLOBAL CLIMATE CHANGE. A CASE STUDY IN THE NORTH-WESTERN BLACK SEA REGION ON THE PLEISTOCENE-HOLOCENE BOUNDARY.

APLICACIÓN DE LA TEORÍA DE LA RESILIENCIA CULTURAL COMO MODELO DE RESPUESTA HUMANA AL CAMBIO CLIMÁTICO GLOBAL. EL CASO DE LA REGIÓN NOROESTE DEL MAR NEGRO ENTRE PLEISTOCENO Y HOLOCENO.

OLENA SMYNTYNA
smyntyna_olena@onu.edu.ua
ODESSA I.I. MECHNIKOV NATIONAL UNIVERSITY[1]

ABSTRACT

Resilience theory was first introduced in the field of natural sciences during the last third of the twentieth century and soon gained transdisciplinary significance having demonstrated its high cognitive potential in the fields of ecology, psychology, cultural studies and many of the other neighbouring sciences dealing with the study of human responses to external challenges. The concept of cultural resilience was only introduced for studying past human responses to global climate change during the last decade and, in spite of relatively restricted number of case studies to verify it, it highlights many important aspects of human behaviour which were traditionally underestimated within the framework of other theories (such as the theories of adaptation, environmental stress and others). The purpose of this current contribution is to demonstrate the cultural resilience concept as a

[1] Head of Department of Archaeology and Ethnology of Ukraine. Head of G. Garibaldi Center of History and Culture of Italy. Odessa I.I. Mechnikov National University, Dvoryanskaya str., 2, Odessa, UKRAINE 65082.

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relevant application in the context of studying human response to global climate change in the North-Western Black Sea region on the Pleistocene-Holocene boundary.

KEY WORDS: Resilience, Global Climate Change, North-Western Black Sea, Pleistocene, Holocene.

RESUMEN

La Teoría de la Resiliencia se introdujo por primera vez en el campo de las Ciencias Naturales durante el último tercio del siglo XX y pronto alcanzó significación transdisciplinar, mostrando su alto potencial cognitivo en los campos de la Ecología, la Psicología, los Estudios Culturales y otras ciencias afines relacionadas con el estudio de las respuestas humanas a los cambios externos. El concepto de resiliencia cultural no ha sido aplicado al estudio de las respuestas humanas del pasado al cambio climático global hasta la última década y, a pesar del número relativamente limitado de casos de estudio analizados, pone de relieve muchos aspectos importantes de la conducta humana que se subestimaron tradicionalmente dentro del marco de otras teorías. El propósito de esta contribución es demostrar el concepto de resiliencia cultural como una aplicación relevante en el contexto del estudio de la respuesta humana al cambio climático global en la región noroccidental del Mar Negro en el límite temporal entre el Pleistoceno y el Holoceno.

PALABRAS CLAVES: Resiliencia, Cambio Climático Global, Mar Negro Noroeste, Pleistoceno, Holoceno.

1. Introduction

The traditional theoretical background of interdisciplinary studies of human responses to global climate changes in a historical context includes a somewhat broad spectrum of concepts and notions borrowed mainly from ecology and environmental sciences[2]. The theories of cultural adaptation, evolution and transformation, environmental stress, adjustment, or regulation, and sustainability today are integral and essential instruments for the interpretation of changes in tool production industries, household and subsistence strategies, and residence and mobility systems in prehistory and archaeology demonstrating, however, methodological differences in their application within the framework of a broad variety of disciplines as well as in connection with the tradition of certain national scientific schools[3].

Resilience theory is one of the newest inventions adopted by prehistorians and archaeologists, as well as by the neighbouring sciences, and successfully applied to explain the scale (i.e. durability and extent) of changes in human life and economy provoked by external agencies, most importantly those which are climatic and environmental changes.

The subject of the current contribution is to verify perspectives of resilience theory application in order to gain a deeper understanding of quantitative and qualitative changes that happened in the life of populations in the North-Western Black Sea region at one of the most challenging times in human history: the Pleistocene-Holocene boundary with its accompanying global climate changes.

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2 O. SMYNTYNA, "The Environmental approach to Prehistoric studies: approaches and theories", *History and Theory: Studies in the Philosophy of History* 42, 4, 2003, 44-59.

3 O. SMYNTYNA, "Environment in Soviet and Post-Soviet archaeology", M.I.J. DAVIS, F. NKIROTE M'MBOGORI (Eds.), *Humans and environment: new archaeological perspective for the twenty-first century*, Oxford 2013, 27-44.

2. Resilience theory: from a disciplinary to transdisciplinary approach

The concept of resilience was broadly applied primarily in physics (particularly with respect to the theory of elasticity where it describes a quality of a material to regain its original shape after being bent, compressed, or stretched) and engineering (namely in material sciences and construction) to determine the capacity of an entity or system to maintain and renew itself, particularly in the presence of stressors.

The resilience concept was introduced to the studies of ecological systems in the mid-1970s by Canadian ecologist C.S. Holling[4]. A decade later, based on his field studies and long-term observation of contemporary terrestrial ecosystems, Holling updated his definition of resilience to be "the ability of a system to maintain its structure and patterns of behaviour in the face of disturbance"[5].

During the last third of the twentieth century, the term 'ecological resilience' was coined; it was defined as the amount of disturbance that an ecosystem could withstand without changing self-organized processes and structures and was conceptualized in the close relation with adaptation to the environmental changes[6]. Multilevel comparison of ecological resilience with adaptability and transformability allowed for the detection of its four basic parameters (latitude, resistance, precariousness, and panarchy) which can be observed in nature within the framework of ecosystems as a whole as well as within those of their individual

4 C.S. HOLLING, "Resilience and stability of ecological systems", *Annual Review of Ecology and Systematics* 4, 1973, 14.

5 C.S. HOLLING, "The resilience of terrestrial ecosystems: Local surprise and global change", W.G. CLARK, R.E. MUNN, (Eds.), *Sustainable Development of the Biosphere*, Cambridge 1973, 296.

6 D.R. NELSON, W.N. ADGER, K. BROWN, "Adaptation to environmental change: Contributions of a resilience framework", *Annual Review of Environment and Resources* 32, 2007, 395.

components[7]. At the very beginning of the twenty-first century the resilience theory in ecology was enriched by the detection of its close links with the concept of adaptive capacity, which in socio-ecological systems refers to the ability of humans to deal with change in their environment by observation, learning and altering their interactions[8].

This understanding has led to the spread of the climatic resilience concept, which is generally defined as the capacity for a socio-ecological system to: "(1) absorb stresses and maintain function in the face of external stresses imposed upon it by climate change and (2) adapt, reorganize, and evolve into more desirable configurations that improve the sustainability of the system, leaving it better prepared for future climate change impacts"[9].

In cultural and social anthropology, social sciences (particularly in psychology and psychopathology, behavioural studies, organizational studies, pedagogy, etc.), and culture studies, the first applications of the resilience concept were synchronous with its dissemination in environmental sciences and were referred to in the mid-1970s[10]. Cultural resilience refers to a culture's capacity to maintain and develop cultural identity and

7 B. WALKER, C.S. HOLLING, S.R. CARPENTER, A. KINZIG, "Resilience, adaptability and transformability in social-ecological systems", *Ecology and Society* 9 (2), 2004, 5; L.H. GUNDERSON, "Ecological resilience in theory and application", *Annual Review of Ecology and Systematics* 31, 2000, 424.

8 C. FOLKE, S. CARPENTER, B. WALKER, M. SCHEFFER, T. ELMQVIST, L. GUNDERSON, C.S. HOLLING, "Regime shifts, resilience, and biodiversity in ecosystem management", *Annual Review of Ecology, Evolution, and Systematics* 35, 2004, 559.

9 C. FOLKE, "Resilience: The emergence of a perspective for social-ecological systems analyses", *Global Environmental Change* 16, 2006, 256; D.R. NELSON, W.N. ADGER, K. BROWN, "Adaptation…", 406.

10 A.P. VAYDA, B.J. MCCAY, "New directions in ecology and ecological anthropology", *Annual Review of Anthropology* 4, 1975, 293-306; D. CICCHETTI, N. GARMEZY, "Milestones in the development of resilience [Special issue]", *Development and Psychopathology* 5(4), 1993, 497-774

critical cultural knowledge and practices; it considers how cultural background (including customs and traditions) helps individuals and communities overcome adversity[11]. It is "both the capacity of individuals to navigate their way to health-sustaining resources, including opportunities to experience feelings of well-being, and a condition of the individual's family, community and culture to provide these health resources and experiences in culturally meaningful ways"[12].

The conceptualization of connections between resilience and adaptation (including adaptive capacity) has become the starting point for the detection of links between resilience and the broad range of concepts coined on the border of the twentieth and twenty-first centuries for the conceptualization of humans and nature interaction in the past and present; the most widespread (fruitful and thus important for such correlation) were vulnerability, redundancy, sustainability and mitigation, stresses, and adjustment[13]. As a result, a series of new concepts have been introduced, and one of the most viable is "culturally-focused resilient adaptation" which describes how culture and the sociocultural context have an effect on resilient outcomes[14].

In fact, during the last decade the concept of resilience has become a transdisciplinary one, and its application requires engaging recent achievements in the complex study of interactions between the different agencies of environmental and

11 C.S. CLAUSS-EHLERS, "Cultural resilience", C.S. CLAUSS-EHLERS (Ed.), *Encyclopedia of Cross-Cultural School Psychology*, Springer 2015, 324.

12 M. UNGAR, "Resilience across cultures", *British Journal of Social Work* 38, 2008, 225.

13 B. SMIT, J. WANDEL, "Adaptation, adaptive capacity and vulnerability," *Global Environmental Change* 16 (3), 2006, 282-292; W.N. ADGER, "Social and ecological resilience: Are they related?", *Progress in Human Geography* 24 (3), 2000, 347, 349; D.F. DINCAUZE, *Environmental Archaeology: Principles and Practice*, Cambridge 2000, 73.

14 C.S. CLAUSS-EHLERS, "Re-inventing resilience: A model of "culturally-focused resilient adaptation", C.S. CLAUSS-EHLERS, M.D. WEIST (Eds.), *Community Planning to Foster Resilience in Children,* New York 2004, 27.

anthropogenic origin. As a result, as said by R. Fox Vernon[15], the origin of resilience science has gained many supporters despite the scepticism previously expressed by many researchers[16].

It is therefore possible to conclude that today, resilience theory emphasizes ideas of management, integration, and utilization of change to catalyse the evolution in the social-ecological system under study rather than simply describing reactions to change (as the adaptation theory does, for example).

The application of environmental, cultural and social resilience theory for studies of past human responses to global climate change is a very recent phenomenon. In relation to the Stone Age, in particular, this concept has only just been adopted (see for example, recent reconstruction of the Chert network based on complex multidisciplinary excavations at Çatalhöyük, Turkey[17]), and this understanding would also be applied within the framework of the current contribution.

3. Resilience in human response to the Black Sea level at the Pleistocene-Holocene boundary: case of North-Western Black Sea shelf.

Environmental, cultural, social and historical consequences of global climate changes on the Pleistocene-Holocene boundary accompanied with the Black Sea level raise are subject of alluring discussions since the Black Sea deluge

15 R.F. VERNON, "A brief history of resilience: From early beginnings to current constructions", C.S. CLAUSS-EHLERS, M.D. WEIST (Eds.), *Community Planning to Foster Resilience in Children*, New York 2004, 13.

16 See, for example, detailed argumentation in: H.B. KAPLAN, "Toward an understanding of resilience: A critical review of definitions and models", M.D. GLANTZ, J.L. JOHNSON (Eds.), *Resilience and Development: Positive Life Adaptations*, New York 1999, 17-83.

17 A.J. NAZAROFF, A. BAYSAL, Y. ÇIFTÇI, K. PRUFER, "Resilience and redundance: Resource networks and the Neolithic chert economy at Çatalhöyük, Turkey", *European Journal of Archaeology* 18 (3), 2015, 402-428.

hypothesis (known also as the 'Black Sea Noah Flood' concept) was put forward by W. Ryan and W. Pittman in 1997. According to them, 7.2 kyr BP (or 11 kyr BP, as in their later version) the saline Mediterranean waters, flowing at a rate of 50 miles per hour, had broken through the hypothetical dam on the border of Bosporus and the Black Sea and reached the Neoeuxinian freshwater basin like a fast-flowing torrent 200 times larger than the Niagara Falls[18]. They estimate the sea level rise would have been in the region of 15cm per day and suggest that over 100,000km^2 of the Black Sea shelf had been flooded in two years; in order to survive, the local population would have had to run away to the inner territories of Central and Eastern Europe. This hypothesis, which was sharply criticized by most marine geologists, archaeologists and representatives of the broad spectrum of environmental sciences during subsequent years[19], was at the same time disseminated by the media as well within the R&D community[20], triggering the intensification of multidisciplinary field studies in the region as well as substantial updates of theoretical frames of empirical data interpretation and

[18] W.B.F. RYAN, W.C. PITMAN, C.O. MAJOR, "An abrupt drowning of the Black Sea shelf", *Marine Geology*, 138, 1997, 119–126; W.B.F. RYAN, "Status of the Black Sea flood hypothesis", V. YANKO-HOMBACH, A.S. GILBERT, N. PANIN, P.M. DOLUKHANOV (Eds), *The Black Sea Flood Question: Changes in Coastline, Climate and Human Settlement,* Springer 2007, 63-88.

[19] For more detail see: V. YANKO-HOMBACH, "Controversy over Noah's Flood in the Black Sea: geological and foraminiferal evidence from the shelf", V. YANKO-HOMBACH, A.S. GILBERT, N. PANIN, P.M. DOLUKHANOV (Eds). *The Black Sea Flood Question: Changes in Coastline, Climate and Human Settlement,* Springer 2007, 149-203; N. GÖRUR, M. N. ÇAĞATAY, Ö. EMRE, B. ALPAR, M. SAKINÇ, Y. ISLAMOĞLU, O. ALGAN, T. ERKAL, M. KEÇER, R. AKKÖK, AND G. KARLIK, "Is the abrupt drowning of the Black Sea shelf at 7150 yr BP a myth?", *Marine Geology*, 176, 2001, 65-73; A.E. AKSU, R.N. HISCOTT, P.J. MUDIE, A. ROCHON, M.A. KAMINSKI, T. ABRAJANO, D. YAŞAR, "Persistent Holocene outflow from the Black Sea to the Eastern Mediterranean contradicts Noah's Flood hypothesis", *GSA Today*, 12, 5, 2002, 4–10.

[20] See, for example, G. LERICOLAIS, I. POPESCU, F. GUICHARD, S.M. POPESCU, L. MANOLAKAKIS, "Water-level fluctuations in the Black Sea since the Last Glacial Maximum", V. YANKO-HOMBACH, A.S. GILBERT, N. PANIN, P.M. DOLUKHANOV (Eds), *The Black Sea Flood Question: Changes in Coastline, Climate and Human Settlement,* Springer 2007, 437-452.

prehistoric reconstructions of methodological, regional and disciplinary peculiarities of conceptualization of different forms of human responses to global climate change in the Black Sea–Mediterranean Corridor on the Pleistocene–Holocene boundary.

Peculiarities of climate change, shoreline dynamics, and landscape transformations in the North-Western Pontic region at the Pleistocene-Holocene boundary, as well as specific features of the modes of life, subsistence systems, and flint knapping techniques of the local populations were subjected to detailed analysis in the framework of a series of Plenary sessions of IGCP 521 Project "Black Sea–Mediterranean corridor during last 30 kyr: sea level change and human adaptation" (2006-2010) and its successor, IGCP 610 project "From the Caspian to Mediterranean: Environmental Change and Human Response during the Quaternary" (2013-2017). It allowed me to sum up ecological and historical processes that happened here during the Dryas III-Boreal period of the Holocene very briefly skipping details of previous discussions in this field[21].

The Dryas III - Preboreal in North-Western Black Sea region was characterized by significant deterioration of the paleogeographic situation caused by climate aridization and reduction of overall biomass density in the region in comparison with the previous period, the Allerød. In the central part of the region under study (Lower Dnister-Pivdenny Bug interfluves, Fig. 1), large group segmentation, local population dispersion, increase in population mobility, and decrease in population density became the effective measures with the help of local populations

[21] For the detailed discussion see V. YANKO-HOMBACH, O.V. SMYNTYNA, S.V. KADURIN, E.P. LARCHENKOV, I.V. MOTNENKO, S.V. KAKARANZA, D.V. KIOSAK, "Kolebania urovnya Chernogo moria i adaptatsionnaya strategia drevnego cheloveka za poslednie 30 tysyach let [Oscillations of the Black Sea level and adaptive strategy of ancient man during last 30 thousand years]", *Geologia i poleznye iskopaemye mirovogo okeana* [*Geology and Mineral Resources of the World Ocean*] 2(24), 2011, 61-94. (In Russian)

- representatives of the Anetivka Late Paleolithic flint knapping technology (Fig. 2) – had managed to survive and progressively evolve during Dryas III-Preboreal with no substantial changes to their traditional basis of tool production[22].

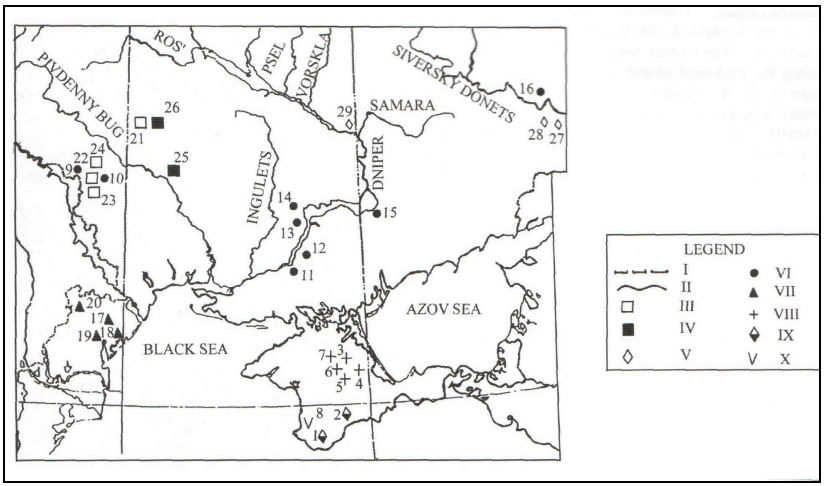

Fig. 1. *Archaeological sites of North-Western Black Sea region at Dryas III – Preboreal- I - state frontier of contemporary Ukraine; II - rivers; III - Anetivka Late Palaeolithic flint knapping tradition; IV - Anetivka Early Mesolithic flint knapping tradition; V - Zymivnyky industry; VI - Tsarinka-Rogalik industry; VII - Bilolissya flint knapping; VIII – Vishenne industry; IX - Shan-Koba industry; X - Syuren II (lower layer) industry.*

Moreover, this adaptive strategy appears to have been so effective, that in the following stage - during the Boreal period of the Holocene – the Anetivka population would become the substrate for the formation of a new phenomenon – the Kukrek tradition. Nevertheless, it should be mentioned, that some groups

[22] O.V. SMYNTYNA, "Mezolithization of Lower Dniester-Pivdennyi Bug region: An environmental interpretation", A.S. GILBERT, V. YANKO-HOMBACH (Eds.), *Extended Abstracts of the 5th Plenary Meeting and Field Trip of Project IGCP 521 -Black Sea-Mediterranean Corridor During the Last 30 ky: sea level change and human adaptation,* Rhodes 2010, 202-205

of this flint knapping tradition moved to the north following their main hunting species (*Bison priscus*), and some of them probably penetrated also into the steppe areas of the Crimean Peninsula in search of new foraging territory. At the same time, transmitters of the Tsarinka flint knapping tradition (Fig. 3) – characterized by peculiar high trapezes and attributed to the Early Mesolithic – appeared in the region for the first time. Their successful survival in a difficult environmental situation was guaranteed by the invention of a new flint tool production strategy based on geometric inserts, which allowed hunters to intensify their preparation and enlarge the spectrum of prey species by the inclusion of small and non-gregarious game[23].

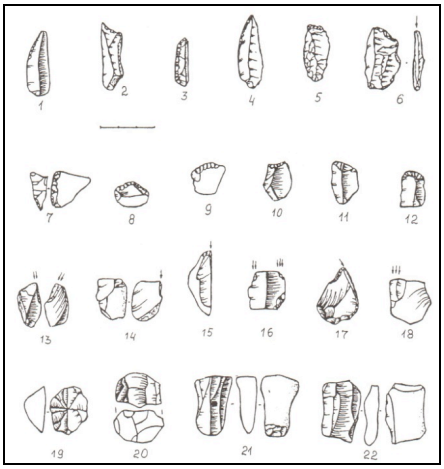

Fig. 2. *Anetivka fling knapping tradition*

The first typically Mesolithic flint knapping tradition – Bilolissya (Fig. 4) - appeared at the Dryas III-Preboreal boundary

[23] O.V. SMYNTYNA, "An attempt at living space delineation: The case for Early Mesolithic of Steppe Ukraine", *British Archaeological Report, International Series* 1224, 2004, 88-99.

in the Lower Danube region as the result of direct migration of this population from Dobrudja following aurochs, their main hunting species. The migrants preserved their traditional tool kits with peculiar big trapezes, as well as their subsistence and livelihood systems in the new territory during the short period of their existence here (until the beginning of the Preboreal period of the Holocene)[24].

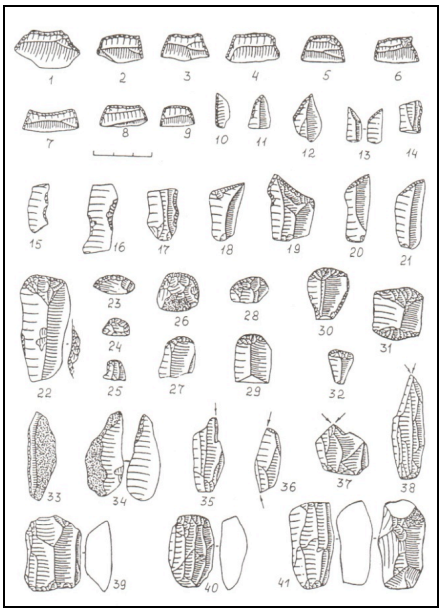

Fig. 3. *Tsarinka-Rogalik flint knapping tradition*

[24] O.V. SMYNTYNA, "Transmigrations as a mechanism of living space exploration in the Northwestern Black Sea region at the Pleisticene-Holocene boundary", A.S. GILBERT, V. YANKO-HOMBACH (Eds.), *Extended Abstracts of the 4th Plenary Meeting and Field Trip of Project IGCP 521 "Black Sea-Mediterranean Corridor During the Last 30 ky: sea level change and human adaptation"*, Bucharest-Sofia, 2008, 167-169.

The transition to the Boreal period of the Holocene was marked by considerable increase in climatic humidity, and a general diversification of the flora and fauna brought an overall growth of biomass density accompanied by a population density increase (Fig. 5).

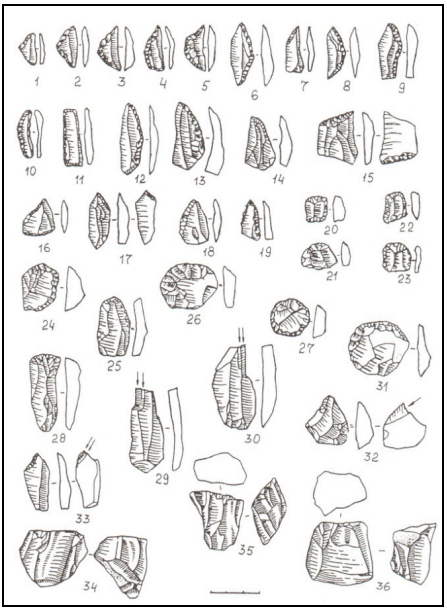

Fig. 4. *Bilolissya flint knapping tradition*

Representatives of two basic flint knapping traditions - the non-geometric Anetivka (which continued traditions of previous times, Fig. 6) and the new geometric Grebenyki (the offspring of the Early Mesolithic Tsarinka, Fig. 7) - jointly exploited the North-Western Pontic region with no clear separation of their settlements. Two basic cultural inventions are referred to during this period: the first attempts at aurochs domestication (traced at the Late Mesolithic site Myrne in the Lower Danube region, which was inhabited by representatives of

both traditions) and significant intensification of use of wild plants, fish, and other river resources[25].

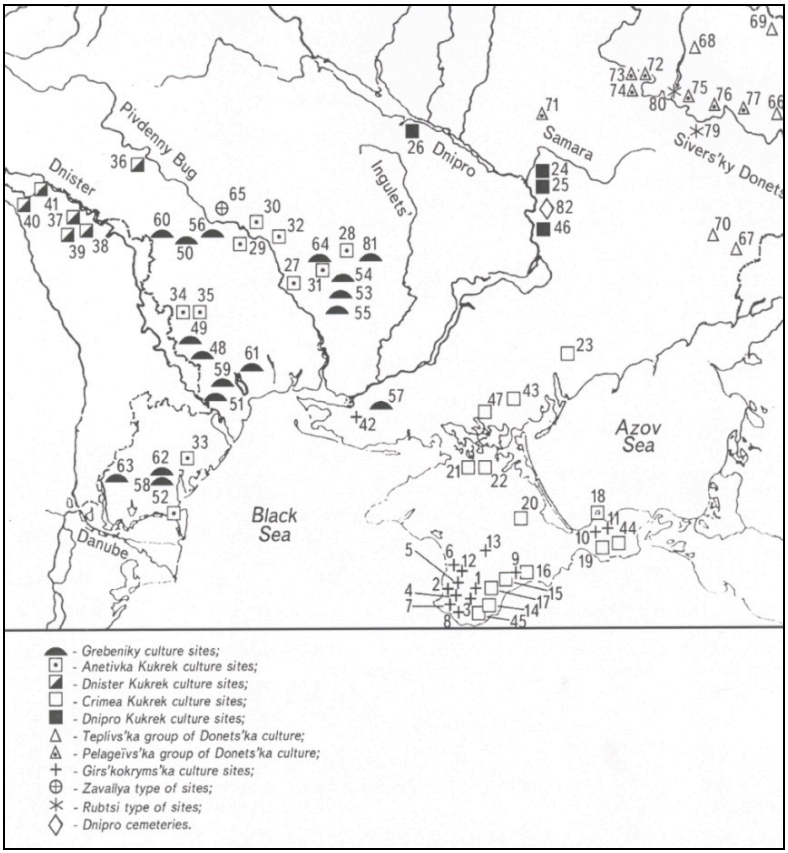

Fig. 5. *Archaeological sites of North-Western Black Sea region at Boreal*

[25] O.V. SMYNTYNA, "The Lower Dniester-Lower Dnieper region during the Boreal period of Holocene: human adaptation to environmental changes", A.S. GILBERT, V. YANKO-HOMBACH (Eds.), *Proceedings of the 1st Plenary Conference of IGCP 610 "From the Caspian to Mediterranean: environmental change and human response during Quaternary"*,Tbilisi, 2013, 130-132.

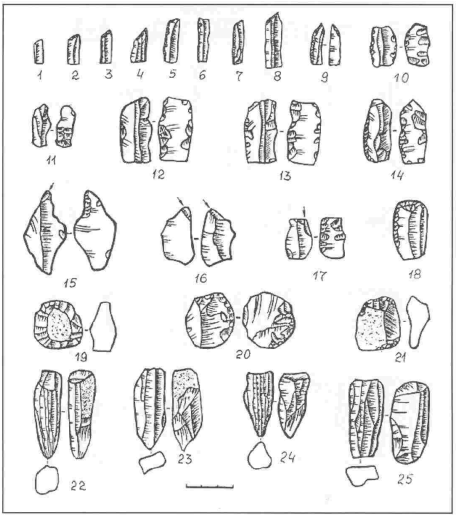

Fig. 6. *Late Mesolithic Anetivka flint knapping tradition*

Conclusions

This brief analysis of the diversity of forms and displays of human response to global climate change in the North-Western Pontic region at the Pleistocene-Holocene boundary testifies that some displays of cultural behaviour in Final Palaeolithic and Mesolithic populations here can be interpreted as resilient ones. They are observed mainly in the form of human activities which were practiced daily by most of the people: flint knapping technology (introduction of geometric inserts in the Tsarinka and Bilolissya flint knapping traditions), and food procurement strategy (transition to hunting for aurochs and prevailing procurement of small and non-gregarious game in Bilolissya, Tsarinka, Grebeniki, and Kukrek traditions, as well as attempts at aurochs domestication at Myrne and intensification of plant utilization). Transmigrations which brought changes to the traditional living space in the case of the Bilolissya and Early Mesolithic Anetivka traditions can also be discussed in the context of resilience.

These changes in human behaviour were real catalysts of evolution in the social-ecological systems of the North-Western Pontic region at the Pleistocene-Holocene boundary, and they brought not only simple survival to this population, but also triggered a transition to a new historical stage (first in the context of mesolithization at the Dryas III-Preboreal boundary, later to neolithization during the Late Boreal and beginning of the Atlantic) and brought about the origin of new cultural traditions in the region under study.

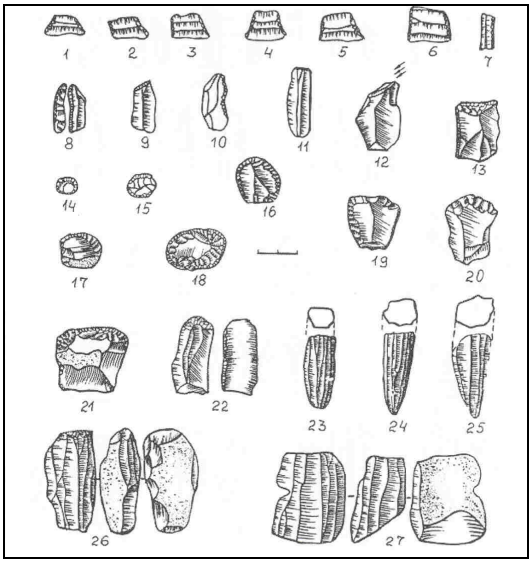

Fig. 7. *Grebeniki flint knapping tradition*

At the same time, changes in settlement system and mobility of all population groups inhabiting the North-Western Pontic region at the Pleistocene-Holocene boundary should be interpreted as adaptive ones: being caused by climatic and landscape changes, they simply allowed groups to survive under the new conditions and did not produce any new cultural or historical phenomenon. The most illustrative example of such

adaptation is the Anetivka flint knapping tradition, the durable development of which in the North-Western Pontic region during Late Palaeolithic-Late Mesolithic times could be simply interpreted as an evolutionary one, with no principal transformation of its basic features.

Bibliography.

W.N. ADGER, "Social and ecological resilience: Are they related?", *Progress in Human Geography* 24 (3), 2000, 347-364.

A.E. AKSU, R.N. HISCOTT, P.J. MUDIE, A. ROCHON, M.A. KAMINSKI, T. ABRAJANO, D. YAŞAR, "Persistent Holocene outflow from the Black Sea to the Eastern Mediterranean contradicts Noah's Flood hypothesis", *GSA Today*, 12, 5, 2002, 4–10.

D. CICCHETTI, N. GARMEZY, "Milestones in the development of resilience [Special issue]", *Development and Psychopathology* 5(4), 1993, 497-774.

C.S. CLAUSS-EHLERS, "Re-inventing resilience: A model of "culturally-focused resilient adaptation", C.S. CLAUSS-EHLERS, M.D. WEIST (Eds.), *Community Planning to Foster Resilience in Children,* New York, 2004, 27-41.

C.S. CLAUSS-EHLERS, "Cultural resilience", C.S. CLAUSS-EHLERS (Ed.), *Encyclopedia of Cross-Cultural School Psychology*, Springer 2015, 324-326.

D.F. DINCAUZE, *Environmental Archaeology: Principles and Practice*, Cambridge, 2000.

C. FOLKE, "Resilience: The emergence of a perspective for social-ecological systems analyses", *Global Environmental Change* 16, 2006, 253–267.

C. FOLKE, S. CARPENTER, B. WALKER, M. SCHEFFER, T. ELMQVIST, L. GUNDERSON, C.S. HOLLING, "Regime shifts, resilience, and biodiversity in ecosystem management", *Annual Review of Ecology, Evolution, and Systematics* 35, 2004, 557-581.

N. GÖRUR, M.N. ÇAĞATAY, Ö. EMRE, B. ALPAR, M. SAKINÇ, Y. ISLAMOĞLU, O. ALGAN, T. ERKAL, M. KEÇER, R. AKKÖK, G. KARLIK, "Is the abrupt drowning of the Black Sea shelf at 7150 yr BP a myth?", *Marine Geology*, 176, 2001, 65-73.

L.H. GUNDERSON, "Ecological resilience in theory and application", *Annual Review of Ecology and Systematics* 31, 2000, 421-427.

C.S. HOLLING, "Resilience and stability of ecological systems", *Annual Review of Ecology and Systematics* 4, 1973, 1–23.

C.S. HOLLING, "The resilience of terrestrial ecosystems: Local surprise and global change", W.G. CLARK, R.E. MUNN (Eds.), *Sustainable Development of the Biosphere*, Cambridge 1973, 292-317.

H.B. KAPLAN, "Toward an understanding of resilience: A critical review of definitions and models", M.D. GLANTZ, J.L. JOHNSON,

(Eds.), *Resilience and Development: Positive Life Adaptations*, New York 1999, 17-83.
G. LERICOLAIS, I. POPESCU, F. GUICHARD, S.-M. POPESCU, L. MANOLAKAKIS, "Water-level fluctuations in the Black Sea since the Last Glacial Maximum", V. YANKO-HOMBACH, A.S. GILBERT, N. PANIN, P.M. DOLUKHANOV, (Eds). *The Black Sea Flood Question: Changes in Coastline, Climate and Human Settlement,* Springer 2007, 437-452.
A.J. NAZAROFF, A. BAYSAL, Y. ÇIFTÇI, K. PRUFER, "Resilience and redundance: Resource networks and the Neolithic chert economy at Çatalhöyük, Turkey", *European Journal of Archaeology* 18(3), 2015, 402-428.
D.R. NELSON, W.N. ADGER, K. BROWN, "Adaptation to environmental change: Contributions of a resilience framework", *Annual Review of Environment and Resources* 32, 2007, 395-419.
W.B.F. RYAN, W.C. PITMAN, C.O. MAJOR, "An abrupt drowning of the Black Sea shelf", *Marine Geology*, 138, 1997, 119–126.
W.B.F. RYAN, "Status of the Black Sea flood hypothesis", V. YANKO-HOMBACH, A.S. GILBERT, N. PANIN, P.M. DOLUKHANOV, (Eds). *The Black Sea Flood Question: Changes in Coastline, Climate and Human Settlement,* Springer 2007, 63-88
B. SMIT, J. WANDEL, "Adaptation, adaptive capacity and vulnerability", *Global Environmental Change* 16(3), 2006, 282-292.
O. SMYNTYNA, "The Environmental approach to Prehistoric studies: approaches and theories", *History and Theory: Studies in the Philosophy of History* 42, 4, 2003, 44-59.
O.V. SMYNTYNA, "An attempt at living space delineation: The case for Early Mesolithic of Steppe Ukraine", *British Archaeological Report, International Series* 1224, 2004, 89-99.
O.V. SMYNTYNA, "Transmigrations as a mechanism of living space exploration in the Northwestern Black Sea region at the Pleisticene-Holocene boundary", A.S. GILBERT V. YANKO-HOMBACH (Eds.), *Extended Abstracts of the 4th Plenary Meeting and Field Trip of Project IGCP 521 - Black Sea-Mediterranean Corridor During the Last 30 ky: sea level change and human adaptation,* Bucharest-Sofia, 2008, 167-169.
O.V. SMYNTYNA, "Mezolithization of Lower Dniester-Pivdennyi Bug region: An environmental interpretation", A.S. GILBERT, V. YANKO-HOMBACH (Eds.), *Extended Abstracts of the 5th Plenary Meeting and Field*

Trip of Project IGCP 521- Black Sea-Mediterranean Corridor During the Last 30 ky: sea level change and human adaptation, Rhodes 2010, 202-205.
O.V. SMYNTYNA, "The Lower Dniester-Lower Dnieper region during the Boreal period of Holocene: human adaptation to environmental changes", A.S. GILBERT, V. YANKO-HOMBACH, (Eds.), *Proceedings of the 1st Plenary Conference of IGCP 610 - From the Caspian to Mediterranean: environmental change and human response during Quaternary,* Tbilisi, 2013, 130-132.
O. SMYNTYNA, "Environment in Soviet and Post-Soviet archaeology", M.I.J. DAVIS, F. NKIROTE M'MBOGORI (Eds.), *Humans and environment: new archaeological perspective for the twenty-first century*, Oxford, 2013, 27-44.
M. UNGAR, Resilience across cultures, *British Journal of Social Work* 38, 2008, 218-235.
A.P. VAYDA, B.J. MCCAY, "New directions in ecology and ecological anthropology", *Annual Review of Anthropology* 4, 1975, 293-306
R.F. VERNON, "A brief history of resilience: From early beginnings to current constructions", C.S. CLAUSS-EHLERS, M.D. WEIST, (Eds.), *Community Planning to Foster Resilience in Children*, New York 2004, 13-26.
B. WALKER, C.S. HOLLING, S.R. CARPENTER, A. KINZIG, "Resilience, adaptability and transformability in social-ecological systems", *Ecology and Society* 9(2), 2004, 5.
V. YANKO-HOMBACH, "Controversy over Noah's Flood in the Black Sea: geological and foraminiferal evidence from the shelf', V. YANKO-HOMBACH, A.S. GILBERT, N. PANIN, P.M. DOLUKHANOV (Eds). *The Black Sea Flood Question: Changes in Coastline, Climate and Human Settlement,* Springer 2007, 149-203
V.V. YANKO-HOMBACH, O.V. SMYNTYNA, S.V. KADURIN, E.P. LARCHENKOV, I.V. MOTNENKO, S.V. KAKARANZA, D.V. KIOSAK, "Kolebania urovnya Chernogo moria i adaptatsionnaya strategia drevnego cheloveka za poslednie 30 tysyach let [Oscillations of the Black Sea level and adaptive strategy of ancient man during last 30 thousand years]". *Geologia i poleznye iskopaemye mirovogo okeana* [*Geology and Mineral Resources of the World Ocean*] 2(24), 2011, 61-94. (In Russian).