

## THE r- AND K-STRATEGY SOCIETIES OF LEPENSKI VIR IN EARLY NEOTHERMAL PERSPECTIVE

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The great diversity of settlement which has been revealed within the last fifteen years, by the work of Romanian and Yugoslav archaeologists in the Danube Gorges, now provides the major sequence of dated material against which to set the whole of Early Neothermal development in south-east Europe. The material itself is very rich, in some cases quite novel, and forces us to look outside the old explanatory framework of stadial development. This postulated a directional change, from a mesolithic hunting-and-gathering stage, to one of neolithic farmers introduced from outside. But in open sciences dealing with living systems<sup>1</sup> causality is inadequately expressed by linear causal chains and single-factor explanations.

The present intention is not to describe the archaeological material from the Danube Gorge sites but to examine the explanatory framework with which it is surrounded, and to suggest a new one. Concepts introduced for this purpose will be explained as early as practicable in the course of the text. It is the ideas behind the definitions which are important.

The terminology of «Mesolithic» and «Neolithic» is itself jargon, albeit familiar jargon. The idea of mesolithic and neolithic stages, and of hunter-fisher and farming economies, as successive independently defined developments, has proved somewhat of an intellectual dead-end, from which European prehistoric archaeology has to free itself. This has to be done gradually, and cannot be done simply by substituting a new terminology, however closely defined.

Even the terminology of Glacial and Post-Glacial has little meaning over much of south-east Europe, which was never glaciated. The Neothermal scheme of climatic and vegetational history is more universally applicable, at least over the northern hemisphere. Especially in Europe the Neothermal is a unitary period which saw momentous and irreversible developments.<sup>2</sup>

What we know of the Early Neothermal in south-east Europe, from the ninth millennium b.c.

(Mbc) up to the beginning of the Altithermal c. 500 b.c., now seems to indicate that there is substantial continuity in settlement and in the exploitation of a whole spectrum of plant, animal and other natural resources, along with the technology and the culturally transmitted premisses for their exploitation. Much of the novelty observable in the record of the 6th and 5th Mbc., with the emergence of the Greek Early Neolithic and the First Temperate Neolithic (FTN), must be considered to derive from emergent properties of the system. This is characteristic of biological systems, and since the archaeological evidence in large part relates to the exploitation of the environment it is surely appropriate to adopt biological modes of thought at least initially, even if we hope in the long run to be able to make other statements about human society.

The First Temperate Neolithic eventually replaced the Hunter-fisher Climax of Vlasac, Lepenski Vir and the Schela sites in the Danube Gorges: as it did those of the Bug and Dniestr in which Early Neothermal settlement and exploitation of the large rivers of Bessarabia and the Ukraine is very closely related to that of the Danube Gorges.

There was a considerable degree of contemporaneity and interaction between these human groups, as is particularly evidenced at Lepenski Vir or Padina. They were exploiting the same environment, very often in the same ways, at the same time, and from the same sites. If there is a distinction between them it must be looked for over a whole behavioural spectrum and not simply in the economic sector, which is in any case only one aspect of that behaviour. They are not convincing as economic stages, succeeding one another as in the old mesolithic and neolithic stages of European archaeological mythology. Ethnoarchaeological work suggests that it is not in any case the fundamentals of subsistence which constitute the real distinction between human groups, but rather the inessentials with they chose to display their individuality — and these relate to a whole range

of behaviour other than the purely economic. Even in the economic sector attention has usually been directed to defining the relationship between 'mesolithic' and 'neolithic' economies. There are however no such entities. As Daryll Forde long ago pointed out, people do not live at economic stages — they possess economies: and those economies are regionally adapted, as well as culturally defined.<sup>3</sup>

Premises of Exploitation can be defined as the culturally transmitted premisses which are embedded in any traditional society, and which define what species of plants and animals, or what sorts of natural resources, shall be exploited — and in what ways this shall be done. This definition in effect already outlines some research objectives, and corresponds with some of the basic questions to be asked of the archaeological evidence. For example one must first identify what species are present at a site: and then go on to ask questions of the plant remains and animal bones about the ways in which they were exploited, by quantitative analyses of the evidence in terms of morphology, are or sex composition. The concept of premisses of exploitation also has the value of emphasising that ways of exploiting the environment are embedded in culturally transmitted presuppositions. They may be subject to technological, environmental or — quite as importantly — to conceptual limitations, but this does not mean that they are determined by them. The very fact that coeval 'mesolithic' and 'neolithic' societies in Europe were exploiting the same environment excludes environmental determinism.

That societies so defined were coeval is quite clear on the basis of radiocarbon determinations. The fact that inconsistencies can appear in the stratigraphical succession of dates is sometimes used to cast doubt on the physical method as a whole: but it is not so easily to be disposed of as this. Its statistical limitations are closely defined, and allow for the existence of aberrant dates. The range of processes which may disrupt archaeological stratigraphies themselves is quite large. It does not seem to be considered that radiocarbon dates can just as readily cast doubt on an archaeological stratigraphy as *vice versa*. The pattern created by the dates for the Danube Gorge sites can best be appreciated by plotting them irrespective of stratigraphy, on the premiss that, whether or not other factors have affected the stratigraphical

succession, the dates do define the cultural material to which they are assigned. On this basis (Fig. 1) there is no doubt that « mesolithic » hunter-fishers and « neolithic » farmers were contemporary in the Danube Gorges, as they were elsewhere over Europe.

There are distinctions to be drawn not only *between* the hunter-fishers' and the farmers' premisses of exploitation, but also distinctions *within* the developing neolithic, and within the mesolithic, as these entities are archaeologically defined. One way in which some of these ideas can be expressed is in terms of the continuum between r- and K-forms of selection. The concept will be explained immediately below. It is important to realise that the dichotomy between r- and K-strategies is not absolute, but lies along this continuum. In this it contrasts with the idea of a Mesolithic and a Neolithic seen as discrete stages of development. If the approach is to have some value it should be possible to test its correlates against archaeological data. To apply these ideas to the archaeological situation it is first necessary to have an understanding of their background in biological theory.

### *The Ecological Niche*

Archaeology can be seen as analogous to modern ecology insofar as its task is to explain the spatial and temporal structure of organic diversity and, in the human context, of cultural diversity. Ecological succession has been claimed to have « many parallels in the developmental biology of organisms, and also in the development of human society ».<sup>4</sup> Concepts such as « carrying capacity » have frequently been invoked in archaeology, whether by those seeking some single factor such as « population pressure » as prime mover, or by those who see basic archaeological data such as site distributions as the outcome of resource zonations and their economic exploitation. The concept of carrying capacity is itself open to criticism. With reference to human behaviour, carrying capacity is at any given period mediated by current premisses of exploitation, which are in turn culturally transmitted. These premisses define what species shall be exploited and in what ways, so that they thus effectively define an exploitative niche.

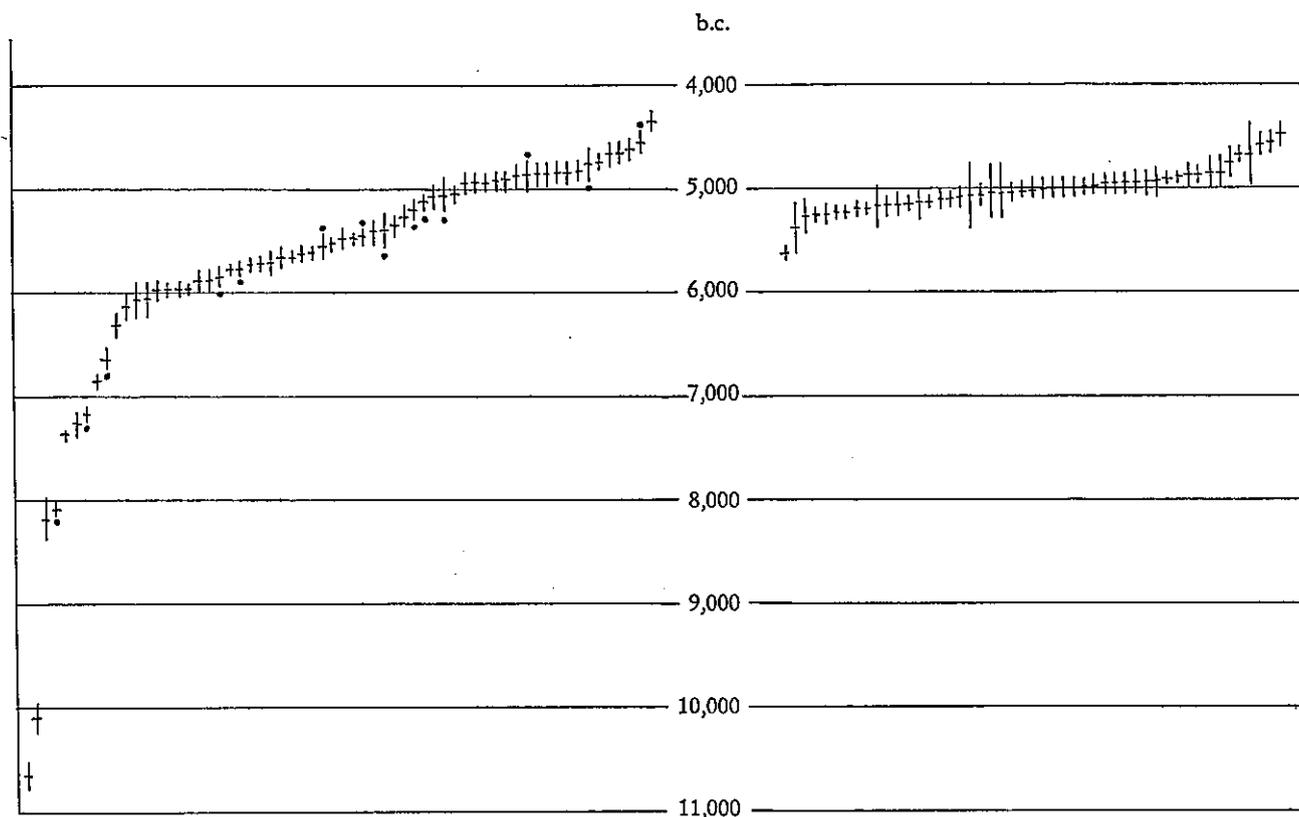


FIG. 1.

Romanellian, Schela, Lepenski Vir & Bug-Dniestr Dates  
 — irrespective of stratigraphy ( · below = Odmut)  
 ( · above = Bug-Dniestr)

FTN (First Temperate Neolithic) Dates  
 — irrespective of stratigraphy.

There exists the opportunity, in animal species at least, to quantify the concept of a niche. This was the basis of G. Evelyn Hutchinson's revolution of theoretical ecology which established a workable and quantifiable concept of the ecological niche.<sup>5</sup> In ecological terms the niche expresses the location and function of the species in the habitat. The problem resolved by Hutchinson was whether the niche was an environmental space which existed independently of whether it was occupied by an organism or not; or whether it was itself created and defined by the range of behaviour of an individual species performing uniquely. Another way in which this distinction has been formulated is to ask whether the niche represents the organism's «address» or its «profession». His solution combined elements of both these views. He defined a niche as the exploitation of measured segments of the graded environmental components required for survival — for example temperature, food-particle size, nesting heights of

bird species (at different levels, from the the ground itself up to the tree canopy), or the feeding limits of herbivores (adapted to graze or browse different levels of the vegetation). He depicted these as mathematical axes at right angles to each other, in any number of dimensions, giving a quantified basis for the study of diversity and its limits. It thus became apparent that organisms do create ecospace through their activities, and by their behaviour establish the diversity of the areas in which they settle. At the same time the nature of the external physical space and its resources sets important limits to organic diversity, with changes in the habitat through space and time.

The analogy with archaeological processes is not difficult to draw. In human societies the section of graded environmental components being exploited is defined by the premisses of exploitation, and these should be accessible through the archaeological data. In coeval Early Neothermal societies occupying closely related environments, as in the

case of the Danube Gorges, the degree of overlap between their premisses of exploitation will define the competitive or collaborative social relationships between them, and even the evolutionary relationship, better than any preconceived stadial scheme of development from hunter-fisher to farming stages. The classification of prehistoric societies must rest on a whole range of correlates. The question is whether we can gain access to measurable data in the archaeological situation. Let us now examine one possible solution to this problem, by defining the distinction between the r- and K-strategies open to Early Neothermal societies.

#### *The Distinction Between r- and K-Strategies.*

It is possible to classify organisms along the spectrum from r to K according to the proportion of their energy expended on reproduction. The idea of the r - K continuum was put forward by MacArthur 1960.<sup>6</sup> The basic distinction to be drawn in applying this idea archaeologically is between prehistoric societies whose behavioural strategies range over the spectrum from r-strategist or opportunistic, to K-strategist or stable; where K is the carrying capacity of an environment, and r is the intrinsic rate of increase of a population.

In general r-strategist species are adapted to make use of or colonise a fluctuating or rapidly developing environment and to exploit ephemeral resources by discovery, rapid reproduction (r), and dispersal. Change is effectively directional, and r-selection operates for rapid growth. The r-strategy produces large numbers of offspring, small in size and living a relatively short time. Among animals the parents take little or no care of the young, and the opportunism of the species might be said to consist in getting in before the competition. Populations of r-strategy species have a tendency suddenly to crash (r-extinction). The emphasis is on production, growth, and quantity.

K-strategist species on the other hand adapt to stable environments at or near carrying capacity (K). They can compete in crowded circumstances, and are exclusive (in contrast to the opportunist strategy), showing an ability to monopolise the extraction of energy from a particular sector of the environment. In this section of the behavioural spectrum change effectively fluctuates about a mean value, and K-strategists produce offspring of larger

size, and relatively few in number, because of a larger energy investment in reproduction. They usually live longer, and more care is expended on their upbringing. The emphasis lies with protection, stability and quality. The elephant could be taken as an example of a K-strategist, with its low reproductive rate, exploitation of a fairly constant environment with a high carrying capacity, and a close adaptation to its habitat.

The Early Neothermal was a period in which directional changes of great importance were taking place, following the large-scale processes associated with the retreat of glaciation from northern Europe. This almost certainly involved rapid growth and increased environmental production, developing towards climax in the relative vegetational stability of the Altithermal European forest — the Atlantic period of north-west European terminology.<sup>7</sup>

Premises of exploitation associated with the Neolithic mode of behaviour certainly spread in this environmental situation. They cannot be taken in isolation but must be considered in relation to the energetics of succession in the developing Neothermal environment.<sup>8</sup> As Odum<sup>9</sup> points out, in the pioneering society as in the pioneering ecosystem, high birth-rates, rapid growth, high economic profits and the exploitation of accessible and unused resources are advantageous. This can be seen as the r-strategy, and its correlates could be sought in eg., First Temperate Neolithic societies. The distribution of these cultures of Starčevo, Körös, Criş and their relations, which for the first time adapted the neolithic mode of behaviour to the conditions of temperate Europe, was extensive rather than intensive. As the saturation level is approached their pioneering drives have to be translated into considerations of symbiosis, birth control, and recycling of resources. This is the K-strategy, and we could look for its correlates in Climax societies (for the application of the concept of Climax to archaeological material see footnote 7) — whether of the Neolithic (eg., Gumelnița) or of the Early Neothermal hunter-fisher populations, as eg., in the Danube Gorges at Lepenski Vir and other Schela sites.

The Climax stages of Early Neothermal hunter-fisher culture (such as the Vlasac, Schela and Lepenski Vir sites) were seeking to exploit the early stages locally of an Altithermal environment, using

K-strategies appropriate to their position as the culmination of those societies. It may be that one of the distinctions between this mode of behaviour and that of the FTN is that for all their achievements within that framework, — whether in art, technology (among which the remarkable red floors of Lepenski Vir should not be forgotten) or house-building — the hunter-fisher mode did not contain within itself the possibilities for significant further developments. This is consistent with the notion that it was the climax of the hunter-fisher mode, and that to have created those possibilities, — whether in response to changes in environmental, demographic or other factors — would have necessitated changes which meant that it must cease to be defined as an Early Neothermal hunter-fisher society. This may have been precisely what happened. The evidence for it lies in sites such as Padina, as well as Lepenski Vir, where a close relationship is apparent between the hunter-fisher mode and the neolithic one.

FTN cultures, whether they are seen as deriving from the native populations of south-east Europe or not, can be seen as pioneering and opportunist societies, employing r-strategies. From the faunal evidence at least these overlapped to a very great extent in the local situation of the Danube Gorges with those of the hunter-fishers, who may indeed have themselves made the change. It is the degree of overlap that makes the Danube Gorge situation so especially interesting. This constitutes a difficulty for proponents of the stadial model, giving rise to more or less meaningless concepts such as « conservatism », « retardation » or « transition », and all the misconceptions associated with the idea of a pre-pottery neolithic in Europe, with « semi-ceramic » phases in Thessaly, and in general with the idea that change always takes place somewhere else. In contrast with this an element of overlap (which must be more closely defined, as premisses of exploitation held in common) is integral to the idea of a spectrum spanning the range from r to K behaviour.

What both these societies were doing was taking advantage of the high net production of the developing Altithermal environment. They are not stages of development or of chronology. They are alternative strategies for tracking environmental change, and as appears from the record they were equally successful in their own ways. It is the

strategic differences between their premisses of exploitation which effectively modify the carrying capacity of one and the same environment, relative to each mode of behaviour. Ultimately it is the evolutionary success of the Neolithic mode in the Neothermal context which is conspicuous. These are the distinctions between the societies, and not the fact that one was « Mesolithic » and one « Neolithic ». They cannot be so distinguished on economic grounds for example, if we recall the identity between the faunal assemblages of Lepenski Vir I, II and III.

Environmental, demographic, or economic reconstructions are only single components of what is in any event going to be a multi-factor explanation of long-term processes of change. It does not become any easier to derive such reconstructions from the archaeological data, but the model proposed here does give them a context in which they can be related to all the other factors involved. In every case there are both internal and external constraints on the strategy adopted; for example environmental changes to which a response is necessary, or the social restrictions common enough in traditional societies on the exploitation of particular resources.

The two forms of r and K selection are not mutually exclusive, which may be a helpful idea in the context of European societies existing side by side during the Early Neothermal. Nor are they absolute: an organism is more or less of an r-strategist only relative to another organism.<sup>10</sup> As is implied by Hutchinson's solution to the problem of « address or profession? », the position of a population on the evolutionary r-K continuum should depend upon both the properties of the ecosystem and the ecological role of the population in it.<sup>11</sup>

#### *Correlates of the Theory.*

It appears so far that we might represent the Hunter-fisher Climax sites of Vlasac, Lepenski Vir, Padina, or the Schela stage as K-strategists, living in the Danube Gorges during the 7th, 6th and 5th Mbc (= millennia b.c.). Relative to them the Greek Early Neolithic and the First Temperate Neolithic represent r-strategists, emergent in south-east Europe during the 6th and 5th Mbc. The neolithic mode of behaviour itself came to

Climax during the 4th Mbc in such cultures as Gumelnița and Cucuteni. These, like the Hunter-fisher Climax cultures, were K-strategists, representing a culmination of the neolithic mode of behaviour beyond which it was not possible to go without altering its premisses beyond recognition.

When seeking measurable correlates it is necessary to distinguish between what is causally and what is functionally associated. The use of copper for example is certainly functionally associated with what is going on in Gumelnița and Cucuteni society during the fourth millennium. It is less easy to be certain what the effects of that use are — in other words what it «causes». Although these fourth millennium cultures have been labelled «Chalcolithic» the mere use of copper is not sufficient to explain their status among European prehistoric societies, and the label is really a relict of the stadial notion gained through hindsight, that they form a «transition» to the Bronze Age, since this was known by archaeologists to follow. If we think about this however we can see that it is a form of teleology, for the ensuing Bronze Age can have had no sort of influence on the antecedent late Neolithic. The idea of transitional stages is, like the existence of Mesolithic and Neolithic stages itself, a form of Archaeological Literalism.

Literalist archaeology takes literally the relationships between stratigraphic facts or archaeological distributions; it sees changes always taking place elsewhere, explains change in terms of events (eg., «invasions») rather than processes, of revolution and diffusion rather than evolution and differentiation; it classifies typologically rather than statistically, favours «either/or» explanations (eg., «autonomy» or diffusion), and in general fails to look behind the archaeological data to the relationships which created them. It fails to take account of the role of the observer; or of the taphonomic processes operating on archaeological material. It is also prone to reversible causality; that is to say to causal statements which can just as readily be reversed (for example that «technology determines socio-economic structure»). There must be some good reason why precedence is to be given to one or other member of a causal chain.

From the definitions of the r-and K-strategies given above it is possible to see that there are a large number of possible correlates, but some of these are more accessible than others from the archaeo-

logical data. This is not after all a biological or ecological situation, in which they might be tested experimentally. On the other hand if the explanatory framework is as suggestive as this one appears to be, then new relationships should become apparent. Their many possible correlates might fall under such headings as Environment, Premises of Exploitation, Survivorship, Social Behaviour, Colonising Ability, Population Size, Energy Utilisation Emphasis, Competition, or Mortality. Some of these topics are more accessible than others from archaeologically recovered data, especially those related to the environment, and premisses of exploitation (economic data), to which most archaeological energy has been devoted. This might be seen as a good reason for exploring the others more fully.

The environmental context of the FTN was a rapidly developing one, changing and perhaps unpredictable, with high net production, moving towards the establishment of Altithermal conditions. (See footnote 7). That of the Hunter-fisher Climax overlapped to a large extent with it. That of the Gumelnița/Cucuteni Climax Neolithic was associated with the well-established climax conditions, constant and predictable, of the second half of the Altithermal in the fourth Mbc.

The Hunter-fisher premisses of exploitation of woodland species especially *Cervus*, as well as those of fish and dog, were substantially continued in those of the FTN (eg. at Lepenski Vir) which also saw the exploitation of new species of cereals and legumes, and domestic animals. Sheep economies (A Pattern) and cattle economies (B Pattern) are distinguishable within the FTN.<sup>12</sup>

The neolithic climax sites of the fourth Mbc had specialised and stereotyped premisses of exploitation, showing an intensive development of all the basic features of the neolithic mode of behaviour. Exemplifying this is tell settlement, for which a satisfactory explanation has long been sought. Talk of «permanent» settlement and the use of pisé (daub) building materials has not advanced the problem: an explanation in terms of an overall K-strategy of behaviour may suggest better correlates for the growth of tells.

Survivorship, and some of the other demographic correlates, might conceivably be approached through the evidence of cemeteries and burials

which we have. Survivorship is described in terms of three types: I with most mortality in senescence, II with an equal probability of death at every age, and III with the highest mortality at a very early age.<sup>13</sup> In man variation through all three types is found. The survivorship of the Hunter-fisher Climax K-strategists is not really known but we might expect it to be I or II. Adult cemeteries are known as well as infant burials. There is every indication that that of the FTN is type III, with high infant mortality indicated (as also in the Greek Early Neolithic of eg., Nea Nikomedeia which may also be taken as r-strategist); there are no adult cemeteries, only isolated burials. The K-strategist Neolithic Climax societies have very highly developed cemeteries, and again while their survivorship is not known it is probably I or II. The mortality of the first (Hunter-fisher) group should be directed and density-dependent and may have been catastrophic; while that of the Neolithic Climax would again be expected to be directed and density-dependent. Population size would be expected in the first case (Hunter-fishers) to be high, probably near local saturation under these premises of exploitation, probably in equilibrium, with a mandatory seasonality. The FTN should be unsaturated, not in equilibrium, and below the carrying capacity of the environment under those premises. Recolonisation is probable, seasonality certain but the option of perennial occupation is more feasible now, and may indeed be one of the features distinguishing level III of Lepenski Vir from the preceding levels. In the third case (Neolithic Climax) we must look for saturated communities with little possibility of recolonisation (fixed mound settlements) and less emphasis on seasonality, near and perhaps ultimately beyond the carrying capacity of the environment.

The colonising ability of the three cases would also vary, being highly restricted in the first case and specialised at least seasonally to the exploitation of the riverine environment of the Danube Gorges and the closely related cultures of the rivers of Bessarabia and the Ukraine. The FTN on the other hand was extremely flexible and adaptable colonising a whole range of environments over south-east Europe, and able to adapt and adopt its premises of exploitation as easily for the Danube Gorges as for the Hungarian plain, the Sofia basin, Moldavia or Serbia. The third mode of the fourth

Mbc was yet again restricted in colonising ability by its specialisation in the mound settlement of wide agricultural lands of good quality.

Competition in the three societies may be postulated as in the first case intraspecific and probably intense; the establishment of a settlement such as Lepenski Vir so demonstrably developed beyond any other is itself one indication of this. Interspecific relations (for example with the FTN) were demonstrably more symbiotic. Competition in the FTN was probably lax both inwards and outwards. That of the fourth millennium societies such as Vinča, Gumelnița or Cucuteni may well have been rigid, formalised and intense, if we judge by the indications of status from the Varna cemeteries, the standardisation, abundance and importance of figurine material, and from other indications. The related characteristics of social behaviour might also be approached as in the first case (the Hunter-fishers) well developed, with remarkable art and settlements such as Lepenski Vir, and unprecedented human representations for hunter-fisher cultures in the European context. In the FTN social behaviour was weak, in the sense of small non-intensive units, flexible and dispersed as hamlets, farms and tiny villages, with figurine material rare (though constant) and little direct evidence of highly organised social behaviour. This is not to say that social relationships were not complex, but that their formalisation is not much in evidence. The third case on the other hand shows them highly developed (in Gumelnița & c.) to a degree which is only beginning to be fully appreciated, with large numbers of figurines and the evidence of the Varna cemeteries. Finally we should expect to find the emphasis on utilisation of energy in the three cases to be respectively on efficiency, productivity, and then in the fourth Mbc on efficiency.

The picture is complexified in human societies by the existence of fully self-reflective consciousness, with its powers of discrimination and choice, being at once the subject and object of study. It is precisely where he transcended the limitations imposed by the habitat on plants and animals that man achieved his greatest impact.

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## APPENDIX

*The Bug - Dniestr Group as Homologue for the Danube Gorge sites during the Early Neothermal.*

The sites of the Bug-Dniestr group in Bessarabia and the Ukraine have many analogies with those of the Schela stages, including Lepenski Vir, on both the Romanian and Yugoslav banks of the Danube Gorges. Especially on the southern Bug, as opposed to the Soroca group on the Dniestr, the sites are situated in narrow gorges with rapids, where the river cuts the crystalline rocks of the Kazatino structure. The Soroca sites, which lie below the big bluff of the forest of Trifaut on the Dniestr, are also very similar in location to sites in the Danube Gorge such as Vlasac and Lepenski Vir. Of these sites Soroca I, II, and III are the contemporaries of Lepenski Vir I and II.

In both regions the sites are low-lying and subject to seasonal flooding, with implications as to seasonality of occupation. The equipment of perforated antler tools, boar tusk plaques with highly specific wear patterns, bone points &c. found on Bug-Dniestr sites is strikingly similar, even identical, to that found in the Danube Gorges, but does not on the whole date so early. However the somewhat earlier Grebeniki culture, dating to the sixth Mbc. has perforated antler tools. The art of the Bug-Dniestr culture, whether on bone, stone, or equally on pottery, strikingly resembles that of the Schela culture and Lepenski Vir sites in its insistence on meandroid designs and scratched reticulate motifs. The reticulate grid clearly representing a net is equally present in the FTN, notably in the white-on-red painting, with an example of this from Lepenski Vir which even represents the knots of the net. The emphasis on fishing, with fish-hooks, bone gorges, weights, lines and nets, would seem to be common to all three cultures. This is especially marked in the Körös group of the FTN.

As a further analogy, the Bug-Dniestr sites visibly emerge out of a background of local Early Neothermal settlement, and take up certain characteristics of the contemporary FTN (First Temperate Neolithic) from

Criş sources in Moldavia while retaining their continuity of development and their Early Neothermal flint technology. The high scraper index of the Moldavian Early Neothermal flint industries, as well as some of their most characteristic technological features such as conical «bullet cores», recur immediately thereafter in the Notenkopf Bandkeramik of Moldavia and in other succeeding neolithic groups in Romania. This has interesting implications for the ancestry of these groups, which are chronologically well into neolithic times, yet remain in this respect apparently related to the Early Neothermal cultures. The FTN on the other hand shows a break in the composition of its lithic industries from those of the Early Neothermal in that it has a very low scraper index, which could conceivably be the result of an emphasis on woven textiles in this earliest temperate European Neolithic, rather than on the preparation of skins.

The analogies between Bug-Dniestr and Danube Gorge sites are surely worth pointing out as exemplifying a highly specific east European adaptation to certain productive ecotypes on the big rivers of the Dniestro-Danubian province during the sixth and fifth Mbc. Two European groups which display a homotaxial and somewhat ambiguous relationship to the local emergence of the neolithic mode of behaviour and its associated plants and animals — namely the Bug-Dniestr and the Ertebølle — both exercised choice and rejected the premiss of exploiting sheep/goat, although it was available to them as a component of the neolithic economies with which they were in contact. As regards the art of the Bug-Dniestr the analogies with the Danube Gorge art, and the relation of both of these to the art of the FTN need emphasis, for example the meandroid designs on stamp seals and pottery, the zig-zag hair on decorated FTN Rod Head figurines, the lattice designs of the painted wares etc... These are in addition to all the functional traits common to Schela and FTN assemblages (eg., bone types, shared premisses of exploitation etc.), and to such well-attested evidence as the presence of FTN pottery in the trapezoidal houses.

- <sup>1</sup> K. PANTIN, *The relations between the Sciences*, Cambridge 1969.
- <sup>2</sup> J. G. NANDRIS in CARTER F. (ed.), *An Historical Geography of the Balkans*, London 1977, pp. 25-57.
- <sup>3</sup> D. FORDE, *Habitat, Economy and Society*, London 1934.
- <sup>4</sup> E. P. ODUM, in *Science*, 164, 1969, pp. 262-270.
- <sup>5</sup> G. E. HUTCHINSON, in *American Naturalist*, 93, 1959. G. E. HUTCHINSON, in *Cold Spring Harbour Symposium on Quantitative Biology*, 22, 1957, pp. 415-427.
- <sup>6</sup> In *American Naturalist*, 94, 1960, pp. 24-36; see also E. R. PIANKA, in *American Naturalist*, 104, 1970, pp. 592-597 and E. O. WILSON, in *Sociobiology, the New Synthesis*, Harvard 1975.
- <sup>7</sup> J. G. NANDRIS, in *Studia Praehistorica* (Sofia), 1/2, 1978, pp. 198-211.
- <sup>8</sup> J. G. NANDRIS, in CARTER F. (ed.), *An Historical Geography of the Balkans*, London, 1977, pp. 25-57. J. G. NANDRIS, in *Studia Praehistorica* (Sofia), 1/2, pp. 198-211.
- <sup>9</sup> In *Science*, 164, 1969, p. 269.
- <sup>10</sup> M. GADGIL and O. T. SOLBRIG, in *American Naturalist*, 106, 1972, pp. 14-31.
- <sup>11</sup> S. J. McNAUGHTON, in *American Naturalist*, 109, 1975, pp. 251-261.
- <sup>12</sup> J. G. NANDRIS, in *Studia Praehistorica* (Sofia), 1/2, 1978, pp. 198-211.
- <sup>13</sup> E. O. WILSON, in *Sociobiology, the New Synthesis*, Harvard 1975, p. 9.