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Snails from Karabi Tamchin, Buran-Kaya III and Chokurcha I

Constantine Mikhailesku

This report summarizes the results of malacological analyses at the sites of Karabi Tamchin, Buran-Kaya III, and Chokurcha I. The principal goals of this study of fossil snails and freshwater mollusk fauna are: (1) to define the species composition for each Mollusca assemblage from each cultural level, (2) to determine differences among the assemblages, and (3) to elucidate the paleoenvironments surrounding each site through time, as related to climatic fluctuations.

Traditional methods of snail sample selection were used on the sediments from each archeological horizon, as well as from archeologically sterile horizons. The sample selection began with the preliminary screening of sediments through 5 mm screens. A selected portion was then screened through 1.5 mm screens and the resulting fraction (between 1.5 and 5 mm in size) was washed, using the same 1.5 mm screens. Occasionally, if shells smaller than 1.5 mm were found, a 1 mm screen was also used. (This was the case for certain horizons at Karabi Tamchin, which contained very small shells of *Caecilioides acicula* and *Caecilioides raddei*.) After the sediments were washed and dried, the snail remnants were selected. Since snail shells are very fragile, most were selected directly from the screen during the dry or wet screening. Due to the poor recovery of fossil snails using this methodology in the 1996 Buran-Kaya III excavations, during the 2001 season, all sediments were water-screened through graduated sieves (5 mm to 1 mm).

The sampling methods, principal ecological groups of Crimean snails, as well as the environmental and morphometrical parameters of the identified species, have been described by Mikhailesku (1999). The following references and descriptions were used for the identification of fossil snails: Pusanov (1925, 1926, 1927), Lozek (1946), Likharev and Rammelmeier (1952), Akramovski (1976), Puissegur (1976), Starobogatov and Kutikov (1977), Shileico (1978), Motuz (1982), and Grossu (1955, 1981, 1983). In some cases, there are small differences between the published defining characteristics and the snails studied here. The descriptions of modern and fossil Crimean snails found in I.M. Likharev and E.S. Rammelmeier's 1952 monograph, *Continental Mollusks of the USSR*, therefore should be consulted, since it provides descriptions for most of the known Crimean snail species.

Snail Ecology and Methods of Environmental Reconstruction

Snails and fresh water mollusks are mostly sedentary creatures that are widely spread over diverse landscapes. As a rule, the shell of fossil snails and fresh water mollusks is well preserved in sediments, especially in dry areas, making them suitable material for stratigraphical correlations and environmental reconstructions. The distribution of snail associations, as well as the specific composition of each snail assemblage, closely reflect the local climatic and environmental conditions of their habitat. Thus, they are good paleoenvironmental markers for major climatic changes during the Quaternary.

The main factors that determine a snail's geographic distribution are:

(1) Weather and climatic conditions, usually reflected by the average values of air temperature, atmospheric pressure, precipitation, humidity, predominant direction of the wind, as well as some other meteorological factors;

(2) The type of vegetation that is the main source of the snail diet and also serves as a support for many snail species, making it an indispensable factor in their choice of habitation;

(3) Type of topographic relief, type of soil, and the composition (lithology) of the rocks are also important, especially for the distribution of rocky and soil associated snail species. Very favorable conditions for the latter assemblages are found on the calcareous soils that are ubiquitous on the Crimean Peninsula. These soils have a porous structure and contain the necessary elements for cockleshell construction, as well as for the nutrition of the snails;

(4) The presence of a water source is an indispensable condition for the distribution of certain groups of snails, especially the hydrophiles and rocky and soil-adapted species.

More detailed description of Crimean snail ecology and environmental classification is found in Mikhailesku (1999:99-114). The paleoenvironmental reconstructions presented here follow the ecological descriptions made by the French investigator Jean-Jacques Puissegur (1976:16), who correlated fresh water mollusk and snail assemblages with vegetation and landscapes. According to his classification, Crimean species may be attributed to six ecological groups (Table 19-1).

The ecological distribution of the snail species presented in Table 19-1 was also used to compose diagrams showing the ecological niches of snails from the archeological levels at Karabi Tamchin (Figure 19-1). These diagrams show the major changes in the ecological composition of the samples at the individual and specimen levels. These reflect major environmental fluctuations, which were caused mostly by climatic changes. Some snails are ecologically specialized, occurring only in certain habitats. This group includes most hydrophilic species and some rocky and soil species that are dependent on the presence of a water source and have an intrazonal distribution. The samples from the other sites (Chokurcha I and Buran-Kaya III) are too small and not sufficiently representative to compose such diagrams.

Table 19-1
Ecological groups of Crimean mollusks

Hydrophile
- *Vallonia pulchella*
- *Vallonia costata*

Humid forest
- *Vitrea crystallina*
- *Punctum pygmaeum*

Forest-steppe
- *Clausilia gracilicosta*
- *Clausilia canalifera*
- *Vitrea pygmaea*
- *Vitrea subeffusa*
- *Vitrea nadejdae*

Meadow steppe with small trees, bushes, and shrubs
- *Zebrina cylindricus*

Xeric steppe and semi-desert
- *Helicella dejecta*
- *Helicella striata*
- *Helicella krynickii*
- *Zebrina subulata*
- *Chondrus bidens*

Rocky and soil
- *Caecilioides acicula*
- *Caecilioides raddei*
- *Pyramidula rupestris*

Karabi Tamchin

Samples from three levels of Karabi Tamchin were selected for study: Level IV, Level III/1, and Level II/2. Twenty species of snails were identified from these levels. Table 19-2 presents the species composition and number of identified cockleshells from each cultural level. Figure 19-1 presents the percentage of each ecological group of snails within the cumulative number of species and shells in each sample.

The snails from cultural Level IV exhibit a predominance of rocky, forest, and forest-steppe species. The inhabitants of steppe landscapes are represented by only two species: *Chondrus bidens* and *Zebrina subulata*, each having a very limited number of shells (4). This suggests that near the site, the climate was

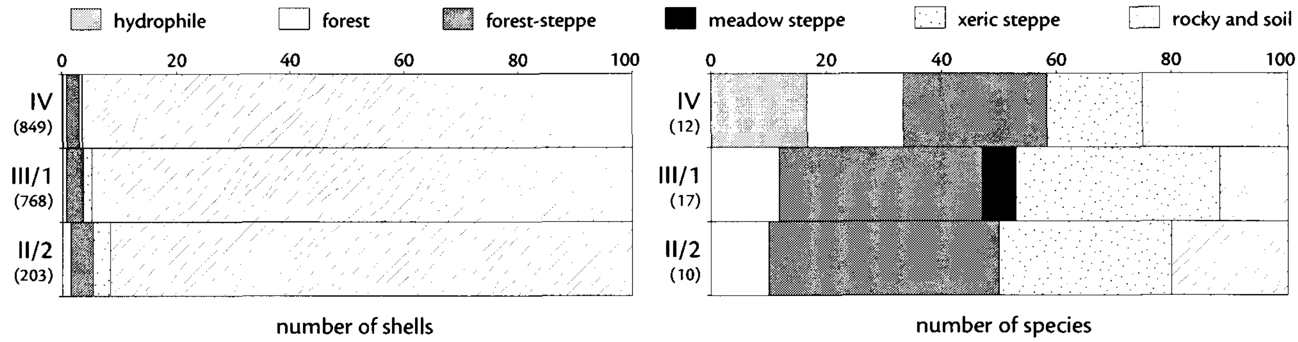

Figure 19-1—Karabi Tamchin: cumulative percentages of shells and species of fossil snails by unit (2000 excavations).

more humid and steppe landscapes were much more restricted as compared to today. Rocky and soil, forest, and forest-steppe species predominate in Level IV. There is a diverse representation of the family Vitrinidae, namely *Vitrea pygmaea*, *V. nadejdae*, *V. subeffusa*, and *V. crystallina*. The presence of *Vitrea crystallina* is interesting because it typically inhabits forests that are more humid than present-day Crimean ones. This form is specific to modern snails of the Carpathian forests, as well as forests of the central and northern parts of the Russian Plain. *Pyramidula rupestris*, *Vallonia costata*, *V. pulchella*, and *Punctum pygmaeum* are also inhabitants of forest and forest-steppe landscapes. All of these species are good indicators that forest-steppe landscapes with bushes and broad-leaved trees were near the site. The comparison of the general composition of the sample with the snail fauna found in the region today permits the supposition that, during sedimentation of Level IV, the climate was more humid and relatively colder than today.

The rock-associated species in Level IV of Karabi Tamchin are represented by *Pyramidula rupestris* and two species of *Caecilioides* (*C. raddei* and *C. acicula*), which together constitute more than 90% of the total number of shells in the sample. These species serve as reliable indicators of nearby underground water sources. *Caecilioides acicula* is represented by the variety *nodosaria*, which lives underground at a depth of 20–40 cm and prefers carbonate and humid forest soil near permanent sources of water. These remains indicate that there were some places with a very high level of underground water or, maybe, a spring or a small river in the vicinity of the site. Given the geological structure of the site and the mineral composition of the slope rocks, a nearby spring is possible. This is also confirmed by the hygroscopic nature of calcareous rocks, which absorb and preserve rain or snow water for a long time, becoming very good sources of fresh water springs. Calcareous rocks are all around the site, but some horizons evidently have finer lithological compositions and higher levels of cementation.

During the deposition of the overlying unit (Level III/1), the environmental conditions became drier and more moderate. The same kind of rocky and forest-steppe species predominated, but the number of steppic forms slightly increased. The rocky fauna was represented by the same two species, but the number of *Caecilioides raddei* dropped. The prevalence of the hydrophilic *Caecilioides acicula* serves as a good indicator that the underground water table was still very high and that a spring or stream was active close to the site. The composition of the forest-steppe fauna changes also. A few shells of Clausiliidae were found and are represented by two species: *Clausilia gracilicosta* and one shell of *Clausilia canalifera*. The preferred habitats of these are broad-leaved and coniferous forests, as well as forest-steppe landscapes with shrubs and bushes, especially junipers.

Compared with the Level IV snail assemblage, the steppe-adapted species became more numerous and more diverse in Level III/1. This involves three species of *Helicella* (*H. dejecta*, *H. striata*, and *H. krynickii*), two species of *Zebrina* (*Z. cylindricus* and *Z. subulata*), and one species of *Chondrus* (*Ch. bidens*). Such a faunal composition indicates that during sedimentation of this cultural level, there were steppe and forest-steppe landscapes around the site and that temperate climatic conditions prevailed. The large diversity of *Vitrea* and the general predominance of forest and forest-steppe species suggest that the climate was relatively more humid and probably colder than today. The condition of the assemblage, including the very thin shells and small dimensions of *Helicella* and *Chondrus* compared with their modern analogues, also confirms the hypothesis of colder conditions.

The sample from Karabi Tamchin Level II/2 numerically was much smaller than the underlying two samples, with only 203 cockleshells. The number of species was also more limited. Rocky and soil (two species) and forest-steppe (five species) fauna were still the most numerous. The presence of the hydrophilic *Caecilioides acicula* and *C. raddei* points to a nearby water source. The three species of steppe inhabitants were still present around the site in Level II/2 (*Helicella striata, Chondrus bidens*, and *Zebrina subulata*), but the total number of their shells decreased slightly compared with the underlying level. The landscape and climatic conditions appear to have been transitional between those of Level III/1 and those of today.

TABLE 19-2
Snails from Karabi Tamchin

Species	*Group*	*II/2*	*III/1*	*IV*	*Total*
Helicella (Helicopsis) dejecta Cr. et J.	xeric steppe	–	1	–	1
Helicella (Helicopsis) striata (Mull.)	xeric steppe	1	1	–	2
Helicella (Xeropicta) krynickii (Kryn.)	xeric steppe	–	2	–	2
Vitrea pygmaea Bttg.	forest-steppe	4	12	16	32
Vitrea crystallina (Mull.)	forest areas	3	4	4	11
Vitrea subeffusa Bttg.	forest-steppe	1	3	2	6
Vitrea nadejdae (Lindh.)	forest-steppe	1	2	1	4
Caecilioides raddei (Bttg.)	rocky and soil	38	106	196	340
Caecilioides acicula Mull. var. nodosaria Bttg.	rocky and soil	148	623	622	1,393
Chondrus (Buliminus) bidens (Kryn.)	xeric steppe	3	2	2	7
Chondrus (Buliminus) bidens natio *pygmaea* (Kryn.)	xeric steppe	–	1	–	1
Pyramidula rupestris (Drap.)	rocky and soil	–	–	1	1
Zebrina (Buliminus) cylindricus Mke.	meadow steppe	–	1	–	1
Zebrina (Buliminus) subulata (Rssm.)	xeric steppe	2	4	2	8
Clausilia (Mentissa) gracilicosta (Rssm.)	forest-steppe	–	4	–	4
Clausilia (Mentissa) canalifera (Rssm.)	forest-steppe	2	1	–	3
Clausilia (Mentissa) sp.	forest-steppe	–	–	–	1
Punctum pygmaeum (Drap.)	forest areas	–	1	1	2
Vallonia costata Mull.	hydrophile	–	–	1	1
Vallonia pulchella Mull.	hydrophile	–	–	1	1
Total number of shells		203	768	849	1,821
Total number of species		10	17	12	20

Buran-Kaya III

Because of the specific lithology of Buran-Kaya III, preservation of shells is very bad and their concentrations very poor. Five shells were found in Level B1 during excavations in 1996 and two shells were found in Level B during excavations in 2001 (Table 19-3). No shells were present in Level C.

The shells from Level B1 were identified as *Helicella dejecta* (2), *H. krynickii* (1), *Chondrus bidens* (1), and *Clausilia canalifera* (1). The first three species are inhabitants of xerothermic steppes and semi-deserts. These forms are typical of the arid steppes of the north coast of the Black Sea, Crimea, and Middle Asia. *Clausilia canalifera* is the only forest-steppe species in this sample. It prefers to live in relatively humid areas with stands of small trees, shrubs, and bushes on calcareous rocky slopes or close to standing water. All of these species still survive today in Crimea and those from Buran-Kaya III Layer B have the same morphometric parameters as the modern forms.

The shells from Level B are *Helicella dejecta* (1) and *Helicella krynickii* (1). Both are good indicators of arid climatic conditions and xerothermic steppe landscapes and semi-deserts.

As may be observed from Table 19-3, the xerophiles *Helicella* and *Chondrus* dominate both samples from Buran-Kaya III. They are diagnostic of Crimean Upper Pleistocene steppe landscapes. Ecologically, species of *Helicella* and *Chondrus* have a huge range of environmental adaptations, which are associated with significant variability in the morphometric parameters of their cockleshells. *Helicella dejecta, H. krynickii*, and *Chondrus bidens* are still dominant in Crimea and the most widespread in modern-day steppe landscapes. These species are also sufficiently resistant to periods of drought and cold weather conditions, so that it is not possible to assign them to a typical warm faunal assemblage. On the other hand, the presence of *Clausilia canalifera* is not typical of xerophilic fauna, since it is a forest-steppe inhabitant and prefers warmer climatic conditions and relatively more humid areas. This species may be also found among Crimean snails today, but its habitat is much more limited than the previously described three species. *Clausilia canalifera* prefers to live close to junipers or other bushes usually located near standing water, floodplains, or underground water sources.

TABLE 19-3
Snails from Buran-Kaya III Layer B

Species	*Group*	*B1*	*B*
Helicella (Helicopsis) dejecta Cr. et J.	xeric steppe	2	1
Helicella (Xeropicta) krynickii (Kryn.)	xeric steppe	1	1
Chondrus (Buliminus) bidens (Kryn.)	xeric steppe	1	–
Clausilia (Mentissa) canalifera (Rssm.)	forest-steppe	1	–
Total number of shells		5	2
Total number of species		4	2

Chokurcha I

Only two shells were collected from Chokurcha I; both were *Helicella striata* and were found in Level IV-S during the 2000 excavations. *Helicella striata* is an inhabitant of xerothermic steppe and semi-deserts, and is widely distributed in the steppe zone of the Russian Plain, as well as in modern Crimea. The morphometric parameters and surface sculpture of the fossil shells identified from Chokurcha I do not differ in modern specimens from the same area.

Correlations and Conclusions

The analyses of Quaternary snail and freshwater fauna from Eastern Europe (Russia, Ukraine, Moldova), Central Europe (Romania, Poland, the Czech Republic, Slovenia), and Western Europe (France, Germany) demonstrate that during the last million years the evolution of snails and freshwater Mollusca took place predominantly on the levels of morphs, nations, and subspecies. Analyses of the patterned composition of Crimean fossil snail assemblages, in contrast to the modern faunal composition, confirms this conclusion. The main changes in Crimean snail assemblages during the Upper Pleistocene reflect changes in paleoenvironment (primarily temperature and humidity) and less so the evolutionary transformation of fossil species.

During the Last Glacial, it is possible to recognize some interstadials or short periods of warming in Southeastern Europe and along the Northwest Coast of the Black Sea, including the Krutitsa/Amersfoort-Brörup, Odderade, Moershoofd, Bryansk/Hengelo, Arcy/Denekamp, Tursac, Laugerie/Lascaux, Bölling, and Allerød interstadials. Their number and names, as well as their geochronological associations, differ from region to region; it is therefore difficult to make reliable regional or inter-regional correlations using only the malacofaunal data. During the Late Pleistocene, Mollusca assemblages primarily reflected environmental changes rather than evolutionary ones; the studied fauna are therefore subdivided into three categories: glacial or stadial, interstadial, and interglacial. This is the first and most difficult step in faunal analysis; to do it properly there should be very large and representative samples. Although Crimean Pleistocene snail collections are large, many samples are homogenous and not truly representative.

The peculiarity of the Crimean snail composition is that during the warm (interglacial and interstadial) phases, the number of cryophilic species evidently decreased, while there was a significant increase in thermophilic species. Additionally, for freshwater assemblages that react only to temperature changes, the Crimean snail fauna are also very sensitive to changes in humidity. Thus, to correctly distinguish the type of snail assemblage (glacial, interstadial, or interglacial), the number of hydrophiles and the real proportion among the main ecological groups of snails should be analyzed. For example, interglacial and interstadial snail assemblages are recognizable not only based on larger proportions of thermophiles as compared with the glacial assemblages, but also by increased numbers of hydrophiles and a reduced percentage of xerophiles. The evaluation of changes in humidity is also very important for paleoenvironmental reconstructions in Crimea: because of its southern latitude, the temperature variations during the Last Glacial were not so marked as in the periglacial areas of the Russian Plain. The very big differences in site altitudes present another difficulty for snail fauna correlations. At times, the same climatic variations brought about different changes in the composition of snail assemblages in the upper mountain areas compared to those in the Crimean plain or intermountain valleys.

The general impression given by the Karabi Tamchin snail assemblages is that the different levels of the site reflect more humid and colder climatic conditions as compared to present day conditions. All three samples evidently represent interstadial-type fauna and may correspond to one or more interstadials of the Last Glacial. As may be observed in Figure 19-1, there are some significant changes in the specimens and the ecological group composition from assemblage to assemblage. It is not clear, however, what these faunal changes mean. They may reflect either different stages of snail assemblage evolution in the context of a single interstadial, or separate faunal assemblages of multiple interstadials.

The differences among snail assemblages at Karabi Tamchin, especially those between Levels IV and III/1, may be seen more clearly by comparing the diagrams of ecological groups and species composition of these samples. In Level IV, there is a very low proportion of xerophiles (less than 20%) and a high proportion of hydrophiles, forest inhabitants, and rocky and soil inhabitants. Also in Level IV, two species of hydrophiles, *Vallonia costata* and *Vallonia pulchella*, are present, as well as *Punctum pygmaeum* (typical of humid forest) and *Pyramidula rupestris* (typical of rocky and soil). All of these are characteristic of relatively humid forest areas and/or intrazonal landscapes close to springs, streams, or standing water. In Level III/1 in contrast, there is a higher percentage of xerophile (*Helicella dejecta*, *H. striata*, *H. krynickii*, *Chondrus bidens* natio *pygmaea*) and meadow steppe specimens (*Zebrina cylindricus*), as well as forest-steppe inhabitants, like *Clausilia gracilicosta* and *Clausilia canalifera*.

The Crimean fossil snail fauna is very poorly known and there are thus few analogues or equivalent collections for comparisons and correlations. The main environmental changes associated with the studied sites can be seen more clearly by comparing the ecological diagrams of Karabi Tamchin (Figure 19-1) and the western Crimean site of Starosele (Mikhailesku 1999:table 5-7). The compositional comparison of the Karabi Tamchin and Starosele snail assemblages demonstrates that these fauna have many similar elements. For example, the snails from Levels III/1 and IV of Karabi Tamchin are comparable to the snail assemblage from Level 2 of Starosele. Of the seventeen snail species identified in Level III/1 of Karabi Tamchin, about half are also present in Starosele Level 2. The morphometric parameters and shell sculptures of each species are also very similar. Despite these parallels, the assemblages from Karabi Tamchin appear more impoverished than the assemblage from Starosele Level 2. Both reflect relatively warm and humid conditions where the same forest-steppe, steppe, and rocky and soil species are predominant. The Karabi Tamchin fauna is a typical interstadial assemblage and represents a more humid and relatively colder climate than today. It can probably be correlated with one or more of the interstadials of the Last Glacial, including the Moershoofd.

The snail assemblage of Karabi Tamchin Level III/1 is comparable to the assemblages from Kabazi II Unit II and Kabazi V Unit II (Mikhailesku 1999: tables 5-4 and 5-5). These three sites are primarily characterized by xerophilic, meadow, and forest-steppe species (*Helicella dejecta*, *H. krynickii*, *Chondrus bidens*, *Zebrina cylindricus*, *Vitrea pygmaea*, *V. subeffusa*, and *Clausilia gracilicosta*). A comparison of the general composition of these assemblages indicates that the Karabi Tamchin snails reflect more humid and evidently more mesic conditions than do the snails of Kabazi II and Kabazi V. This may be explained by the presence of a water source near Karabi Tamchin and by the geographic location of this site. The composition of the fossil snail assemblages from Karabi Tamchin suggest that moderate climatic conditions prevailed and that a combination of broad-leaved forest and meadow steppes with bushes and shrubs grew around the site. These paleoenvironmental reconstructions are in close agreement with the pollen data of N. Gerasimenko from Unit II of Kabazi II (see pollen zone VIII in Gerasimenko 1999:131-132).

Evidently representing a warm faunal complex (thermocomplex), the Karabi Tamchin assemblages may also be correlated with the warm freshwater snail assemblages in the first terraces of the Eastern European rivers Dnieper, Dniester, Prut, and Danube (Mikhailesku 1990; Mikhailesku and Markova 1992; Markova and Mikhailesku 1994). In addition, they may be correlated with the snail assemblages of the Moershoofd stratigraphical unit ("ash horizon") from the loessic Mousterian sites of Molodova I, Molodova V, and Kormani IV in the Middle Dniester area (Motuz 1982; Ivanova 1982). The sediments from Paleolithic sites representing the Moershoofd interstadial in northern Moldova and western Ukraine are clearly recognized and well correlated because at many sites there is an ash horizon up to 10 cm thick, which serves as a formidable stratigraphical marker for regional correlations. It provides evidence for a very large fire that produced a classic thanatocoenosis. Abundant remains of fossil snails are found in this horizon, yielding adequate samples for absolute dating: the results range from 44,000 to 41,000 BP (Ivanova 1982:231).

The snail assemblage from Level II/2 of Karabi Tamchin is both homogenous and limited, representing colder and drier conditions than the snail assemblage of Starosele Level 2. In spite of the fact that about 40% of the same species are present in both assemblages, the Karabi Tamchin Level II/2 fauna look much more impoverished. This level may be correlated with the end of the same interstadial or with one of the interstadials of the Middle to Late Glacial, when the climate was significantly colder and drier than today.

Unfortunately, it is difficult to be sure of such large-scale correlations because of the high level of endemism in Crimean snail fauna and the significant distances between these sites. In spite of its geographic location, the Crimean Peninsula may possess some regional peculiarities in Quaternary climatic oscillations and may also have different trends, as compared to its analogs in the continental neighboring areas of the Eastern European Plain.