

Middle and Late Pleistocene terrestrial snails from the Middle Dniester area, Ukraine (based on Mykola Kunytsia's collections)

Yana POPIUK¹, Bogdan RIDUSH¹, * and Tatiana SOLOVEY²

¹ Yuriy Fed'kovych Chernivtsi National University, Kotsubynskogo 2, 58012 Chernivtsi, Ukraine

² Polish Geological Institute – National Research Institute, Rakowiecka 4, 00-975 Warszawa, Poland



Popiuk, Y., Ridush, B., Solovey, T., 2021. Middle and Late Pleistocene terrestrial snails from the Middle Dniester area, Ukraine (based on Mykola Kunytsia's collections). *Geological Quarterly*, **65**: 6, doi: 10.7306/gq.1575

Extensive collections of land molluscs from the many sections of Middle and Late Pleistocene deposits in the region of the Middle Dniester River were made by Professor Mykola Kunytsia (1925–2002). These collections, now at the Natural Museum, Yuriy Fedkovych Chernivtsi National University, were for the most part analysed, but remained partially unpublished. M. Kunytsia used them for regional reconstructions of palaeolandscapes during various stages of the Pleistocene. In our study, we used these collections to assess the land snail diversity in the region during consecutive stages of the Middle and Late Pleistocene. Our analysis of faunas of cold and warm stages showed that the latter were more diverse. While all or most of the cold stages had many species in common, the faunas of the warm stages were more heterogeneous. Such a feature may play an essential role in Quaternary biostratigraphy.

Key words: Middle Dniester, terrestrial molluscs, biodiversity, Pleistocene.

INTRODUCTION

Due to its numerous well-explored Quaternary sequences, the Middle Dniester region can be regarded as on one of the key territories for Quaternary studies in Eastern Europe. The region covers the canyon-like part of the Dniester River valley, approximately between towns of Halych and Rybnysia, including canyon-like sections of the Dniester tributaries. In this region, the Dniester valley is quite deep (270–300 m), and wide, with a well-developed succession of ancient river-terraces. Most of the Late and Middle Pleistocene terraces are located inside the deep and narrow canyon-like part of the valleys; however, some high terraces of the Early Pleistocene and Pliocene are wide and developed outside the canyon (Ridush and Marchuk, 2018).

Different authors have identified various numbers of terraces in the Dniester valley, from 6 to 13 (Tomeniuk, 2010). Based on a palaeopedological method, Veklich (1982) distinguished 16 terraces above the modern floodplain. His approach was adopted by the State Geological Survey of Ukraine.

The general pattern of the Dniester valley looks like a series of huge, deeply incised meanders. As a rule, the inner-canyon Pleistocene terraces, numbered from 1st to 10th, and from 10 to 100 m high above the modern water table, are preserved on

the convex sides of the meanders, while the concave bank of the river is usually steep. Overall, these terraces have a two-fold structure, consisting of an alluvial suite, resting on the bedrock basement, and a sub-aerial suite, comprising slope and aeolian deposits. Both alluvial and sub-aerial suites contain rich faunas of terrestrial snails.

The middle section of the Dniester River valley is famous for its numerous Palaeolithic sites associated with the Pleistocene loess-palaeosol sequences of the ancient river terraces (e.g., Goretsky and Tzeitlin, 1977; Goretsky and Ivanova, 1982; Ivanova and Tzeitlin, 1987; Anisyutkin, 2013; Kulakovska et al., 2015; Łanczont and Madeyska, 2015). Almost all strata of these sequences contain shells of terrestrial molluscs which have traditionally been used for the palaeoecological reconstructions. A number of scholars have studied the Pleistocene snail faunas since 1880 (Dunikowski, 1880; Bąkowski, 1880, 1881, 1884, 1885, 1891; Łomnicki, 1886, 1887, 1900, 1908; Teisseyre, 1900; Friedberg, 1906; Wiśniewski, 1908; Rogala, 1907; Rychlicki, 1913; Polianskyi, 1925; Petrbok, 1930; Ambrozewicz, 1932, 1938; Lungersgauzen, 1933, 1938; Bondarchuk, 1933, 1959; Danilovskyi, 1940, 1961; Berg, 1946; Radzijeviskyi, 1957, 1959; Veklich, 1961, 1968; Ivanova, and Popov, 1961; Kunytsia, 1964, 1965, 1966, 1968, 1969, 1971, 1974, 1975, 1978; Melnychuk, 1972, 1984, 2004; Motuz, 1977, 1982, 1987; Dmytruk, 1998, 2000, 2001).

The greatest contribution to the study of the Pleistocene malacofauna of the region was made by prof. Mykola Kunytsia (1925–2002). His summarising research, which covered almost all the territory of Ukraine, was published a few years after his death. He collected and studied molluscs of the different Pleistocene lithological-stratigraphic units, identified the species, provided a palaeontological-stratigraphic correlation and traced

* Corresponding author, e-mail: b.ridush@chnu.edu.ua

Received: July 6, 2020; accepted: November 8, 2020; first published online: January 25, 2021

CONCLUSIONS

Analysis of mollusc faunas from different stages of the Pleistocene in the Middle Dniester area shows that the species and ecological composition of the assemblages vary from stage to stage. The differences in the assemblages' species composition reflect the spatial and temporal changes of the palaeolandscapes and as well as global and local climate changes. Accordingly, each stage of the Pleistocene has its own individual taxonomic and ecological set of species.

The mollusc assemblages of those stages in which the environmental conditions were particularly changeable are more varied. The changes involved two factors – air temperature (warm/cold phases) and humidity (wet/dry). Such changes, in the first place, led to landscape changes and, consequently, affected the species composition and ecology of the mollusc faunas, which now makes it possible to interpret those changes.

Analysing the fauna of the cold and warm stages of the Pleistocene, we found that the latter were more diverse. While

during the cold stages there were many species in common for all or most stages, the faunas of the warm stages were more varied. Such a feature can play an important role in Quaternary biostratigraphy.

The biodiversity and specific features of the Middle Dniester mollusc assemblages facilitate understanding of the evolution of environmental conditions during the Pleistocene and make it possible to identify individual environmental events reflected by responses among the mollusc communities. These results can serve as a powerful instrument in regional palaeogeographic analysis.

Acknowledgements. This work was partly supported by INQUA project 1606P “Ground squirrels on the march: expansion and speciation in the Quaternary of the Circum-Pontic area and surroundings”. We thank two anonymous reviewers for their constructive review of the manuscript. We extend our gratitude to B. Pokryszko for proofreading the text.

REFERENCES

- Alexandrowicz, S.W., Alexandrowicz, W.P., 2011.** Analiza malakologiczna. Metody badań i interpretacji (in Polish). Rozprawy Wydziału Przyrodniczego PAU, **3**.
- Alexandrowicz, W.P., 2015a.** The application of malacological analysis in the study of slope deposits: late Pleistocene and Holocene of the Podhale Basin (Carpathians, Poland). *Acta Geologica Polonica*, **65**: 247–263.
- Alexandrowicz, W.P., 2015b.** Malakofauna stanowisk paleolitycznych strefy pery- i metakarpackiej (in Polish). In: *Paleolityczna ekumena strefy pery- i metakarpackiej* (eds. M. Łanczont and T. Madeyska): 577–595. Wyd. UMCS, Lublin.
- Alexandrowicz, W.P., Lanczont, M., Boguckij, A.B., Kulesza, P., Dmytruk, R., 2014.** Molluscs and ostracods of the Pleistocene loess deposits in the Halych site (Western Ukraine) and their significance for palaeoenvironmental reconstructions. *Quaternary Science Reviews*, **105**: 162–180.
- Ambrojevici, C., 1932.** Zur Landenshenkenfauna des nordbessarabischen Endneolithikums. *Buletinul Facultății de Științe din Cernăuți*, **1**: 251–256.
- Ambrojevici, C., 1938.** Materialien zur Molluskenfauna der pleistozän und holozänen Ablagerungen Nordrumaniens. *Buletinul Museului Regional al Basarabiei din Chisinau*, **9**: 40–100.
- Anisyutkin, N.K., 2013.** Mustierskaya stoyanka Kietrosy v kontekstie srednego paleolita Vostochnoy Evropy (in Russian). *Nestor-Historia*, Sankt-Petersburg.
- Bąkowski, J., 1880.** Mięczaki zebrane na Podolu w lipcu i sierpniu r.1879 (in Polish). *Sprawozdanie Komisji Fizjograficznej*, **14**: 62–76.
- Bąkowski, J., 1881.** Mięczaki zebrane na Podolu na stepie Pantalichy i w Toutrach w r. 1880 (in Polish). *Sprawozdanie Komisji Fizjograficznej*, **15**: 220–232.
- Bąkowski, J., 1884.** Mięczaki galicyjskie (in Polish). *Kosmos*, **9**: 190–197, 275–283, 376–391, 477–490, 604–611, 680–697, 761–789.
- Bąkowski, J., 1885.** Utwór dyluwialny między Koropcem a dolnym biegiem Strypy na Podolu (in Polish). *Kosmos*, **10**: 398–405.
- Bąkowski, J., 1891.** Mięczaki (Mollusca) (in Polish). *Wyd. Muzeum im. Dzieduszyckich, Lwów*.
- Berg, L., 1947.** Klimat i zhyzn' (in Russian). *Gosudarstvennoe izdatelstvo geograficheskoy literatury, Moscow*.
- Bogucki, A., Dmytruk, R., Dumas, I., 2011.** Pryrodni umovy chasu formuvannya dubnivs'kogo vykopnogo gruntu Halyts'kogo Prydnisteria (in Ukrainian). *Visnyk Lvivskogo Universytetu. Seria Geografichna*, **39**: 35–43.
- Bogucki, A., Jacyshyn, A., Dmytruk, R., Tomeniuk, O., Zavalij, D., Lanczont, M., 2012.** High terraces of the Dniester river at environs of the village Dovhe (in Ukrainian with English summary). *Visnyk Lvivskogo Universytetu. Seria Geografichna*, **40**: 123–131.
- Bondarchuk, V., 1933.** Do kharakterystyky kopalnykh miakuniv z chetvertynnykh pokladiv Ukrainy (in Ukrainian). *Chetvertynnyi Period*, **5**: 15–33.
- Bondarchuk, V., 1969.** Lessovyve komplekсы yugo-zapadnoy chasti Vostochno-Evropeyskoy ravniny (in Russian). In: *Materialy po Chetvertichnomu Periodu Ukrainy* (ed. V. Bondarchuk): 9–20. *Naukova Dumka, Kyiv*.
- Carobene, D., Harzhauser, M., Mandic, O., Gatto, R., 2018.** Taxonomy and paleoecology of continental Gastropoda (Mollusca) from the late Pleistocene mammoth-bearing site of Bullendorf in NE Austria. *Rivista Italiana di Paleontologia e Stratigrafia*, **124**: 509–534.
- Danilovsky, I., 1940.** Rukovodiashchiye chetvertichnyye molluski zapadnoy polosy Evropeyskoy chasti SSSR (in Russian). *Sovetskaya Geologia*, **5–6**: 103–111.
- Danilovsky, I., 1961.** Istoriya chetvertichnykh molluskov SSSR i ikh znacheniy dlia stratigrafii chetvertichnykh otlozheniy (in Russian). *Informatsionnyi Sbornik VSEGEI*, **47**: 75–96.
- Dmytruk, R.Y., 2001.** Reconstruction of conditions of accumulation of the lower subhorizon of the upper horizon of the Upper Pleistocene forests of Volyn-Podillya (according to malacofauna) (in Ukrainian with English summary). *Naukovi Zapysky Vinnytskogo Universytetu*, **2**: 38–42.
- Dmytruk, R.Y., 2002.** The nature of changes in the quantitative composition of the malacofauna and its relationship with climatic conditions (in Ukrainian with English summary). *Visnyk Zhytomyrskogo Universytetu imeni Ivana Franka*, **10**: 206–209.
- Dmytruk, R., 2004.** Hight Pleistocene fauna of molluscs of the Palaeolithic site Molodove V and its paleogeographic interpretation (in Ukrainian with English summary). *Visnyk Lvivskogo Universytetu, Seria Geografichna*, **30**: 104–110.
- Dunikowski, E., 1880.** Przyczynek do znajomości galicyjskiego dyluwium (in Polish). *Kosmos*, **5**: 6–28.
- Friedberg, W., 1906.** Tekst do zeszytu 19. Sambor. *Atlas geologiczny Galicji* (in Polish). *Kraków*.
- Gerasimenko, N.P., 2010a.** Korelatsiya korotkoperiodychnykh etapiv pleistotsenu za paleolandshavnymy danymy (in Ukrainian). In: *Prostorovo-chasova korelatsiya paleogeografichnykh umov chetvertynnogo periodu na terytoriyi Ukrainy* (ed. Zh. Matvijishyna): 104–129. *Naukova Dumka, Kyiv*.

- Gerasimenko, N.P., 2010b.** Korotkoperiodychna etapnist rozvytku landshaftiv u golotseni (in Ukrainian). In: Prostorovo-chasova koreliatsiya paleogeografichnyh umov chetvertynnoho periodu na terytoriyi Ukrainy (ed. Zh. Matvijishyna): 159–165. Naukova Dumka, Kyiv.
- Ivanova, I., Popov, G., 1961.** Novyye dannyye o vozrastie vysokikh dnestrovskikh teras v svyazi s nakhodkami fauny molluskov (in Russian). Doklady AN SSSR, **136**: 1425–1427.
- Ivchenko, A.S., 2010.** Mizregionalna koreliatsiya paleogeografichnyh umov za paleontologichnymy danymy (in Ukrainian). In: Prostorovo-chasova koreliatsiya paleogeografichnyh umov chetvertynnoho periodu na terytoriyi Ukrainy (ed. Zh. Matvijishyna): 76–94. Naukova Dumka, Kyiv.
- Kulakovska, L., Usik, V., Haesaerts, P., Ridush, B., Uthmaier, Th., Hauk, Th., 2015.** Upper Paleolithic of Middle Dniester: Doroshivtsi III site. Quaternary International, **359–360**: 347–361.
- Kunytsia, M.O., 1965.** Do pytannia pro budovu i umovy utvorennia terasovykh vidkladiv Seredniogo Dnistra (in Ukrainian with English summary). In: Geomorfologia richkovykh dolyn Ukrainy (ed. M.F. Veklich): 69–77. Naukova Dumka, Kyiv.
- Kunytsia, M.O., 1966.** Zminy fauny moliuskiv pleistotsenu i kholotsenu Ukrainy ta yiyi stratygraficzne znachennia (in Ukrainian). In: Paleogeografichni umovy terytoriyi Ukrainy v pliotsemi ta antropogeni (eds. M.F. Veklich and G.I. Moliavko): 38–48. Naukova Dumka, Kyiv.
- Kunytsia, M.O., 1971.** Ranniepleistotsenovaya fauna nazemnykh i presnovodnykh molluskov Sredniogo Dniestra (in Russian). Paleontologicheskii Sbornik, **8**: 34–41.
- Kunytsia, M.O., 1974.** Stratigrafia i malakofauna pleistotsena Ukrainy (in Russian with English summary). Chernivtsi Univ., Chernivtsi.
- Likharev, I.M., 1962.** Clausiliidae Ukrainy. Fauna SSSR. Molluski. **3** (4) (in Russian). Izdatelstvo AN SSSR, Moskva–Leningrad.
- Limondin-Lozouet, N., Preece, R.C., 2014.** Quaternary perspectives on the diversity of land snail assemblages from northwestern Europe. Journal of Molluscan Studies, **80**: 224–337.
- Lisiecki, L.E., Raymo, M.E., 2005.** A Pliocene-Pleistocene stack of 57 globally distributed benthic ¹⁸O records. Paleoceanography, **20**, PA 1003, doi:10.1029/2004PA001071
- Łomnicki, M., 1886.** Mięczaki znane dotychczas z pleistocenu galicyjskiego (in Polish). Kosmos, **11**: 276–299.
- Łomnicki, A., 1887.** Żwiry starodyluwialne na Podolu galicyjskiem (in Polish). Kosmos, **12**: 436.
- Łomnicki, A., 1900.** Atlas geologiczny Galicyi. Text do zeszytu. **12** (in Polish). Kraków.
- Łomnicki, A.M., 1908.** Mięczaki ilu pleistocenijskiego, wydobyte ze szybu mamutowego w Staruni (in Polish). Kosmos, **33**: 73–76.
- Ložek, V., 1964.** Quartärmollusken der Tschechoslowakei. Rozprawy Ustředního Ústavu Geologického, Praha.
- Ložek, V., 1986.** Quaternary malacology and fauna genesis in Central Europe. Proceedings 8th International Malacology Congress; 1983. Budapest, 143–145.
- Lungersgauzen, G., 1933.** Novyi poverkh lesu na Ukraini (in Ukrainian). Chetvertynnyi Period, **7**: 99–121.
- Lungersgauzen, G., 1938.** Fauna Dnestrovskikh terass (in Russian). Geologicheskii zhurnal AN USSR, **5**: 199–236.
- Maltz, T.K., 1999.** Ślimaki (Gastropoda) Kotliny i Pogórza Wałbrzyskiego (in Polish). Folia Malacologica, **7**: 51–72.
- Melnichuk, I., 1984.** Novyye dannyye o faunie molluskov lessovo-pochvennoi tolshchi nizhnego Pridnestrovia i yeyo paleogeograficheskoye znacheniye (in Russian). In: Obshchaya i regionalnaya paleogeografia (ed. M.F. Veklich): 131–139. Naukova Dumka, Kyiv.
- Melnichuk, I., 2004.** Paleolandshafty Ukrainy v antropogeni (in Ukrainian). Obrii, Kyiv.
- Meng, S., Hoffmann, M.H., 2009.** *Pupilla loessica* Ložek 1954 (Gastropoda: Pulmonata: Pupillidae) – “A Living Fossil” in Central Asia? Eiszeitalter und Gegenwart. Quaternary Science Journal, **58**: 55–69.
- Moine, O., Rousseau, D.-D., Antoine, P., 2005.** Terrestrial molluscan records of Weichselian Lower to Middle Pleniglacial climatic changes from the Nussloch loess series (Rhine Valley, Germany): the impact of local factors. Boreas, **34**: 363–380.
- Motuz, V.M., 1977.** O faunie kontinentalnykh molluskov rayona stoyanki Korman IV (in Russian). In: Mnogosloinaya paleoliticheskaya stoyanka Korman IV na Srednem Dniestre (eds. G.I. Goretski and S.M. Tzeitlin): 119–125. Nauka, Moscow.
- Motuz, V.M., 1982.** Fauna molluskov iz rayona paleoliticheskoy stoyanki Molodova I (in Russian). In: Molodova I. Unikalnoe mustierskoye poselenie na Srednem Dniestre (eds. G.I. Goretski and I.K. Ivanova): 173–188. Nauka, Moscow.
- Motuz, V.M., 1987.** Nazemnyye molluski iz chetvertichnykh otlozheniy stoyanki Molodova V (in Russian). In: Mnogosloinaya paleoliticheskaya stoyanka Molodova V (eds. I.K. Ivanova and S.M. Tzeitlin): 162–168. Nauka, Moscow.
- Nekola, J.C., Chiba, S., Coles, B.F., Drost, Ch.A., Proschwitz, T., Horskak, M., 2018.** A phylogenetic overview of the Genus Vertigo O.F. Muller, 1773 (Gastropoda: Pulmonata: Pupillidae: Vertigininae). Malacologia, **62**: 21–161.
- Petrbok, J., 1930.** Zur Kenntnis der quartären und rezenten Mollusken Bessarabien und Galatz. Archiv für Molluskenkunde, **62**: 198–200.
- Pokryszko, B.M., Cameron, R.A.D., 2005.** Geographical variation in the composition and richness of forest snail faunas in northern Europe. Records of the Western Australian Museum, **68**: 115–132.
- Pokryszko, B.M., Maltz, T.K., 2007.** Rare and endangered terrestrial gastropods of Lower Silesia (SW. Poland) – current status and perspectives. Acta Universitatis Latviensis. Biology, **723**: 7–20.
- Pokryszko, B.M., Cameron, R.A.D., Maltz, T.K., 2004.** *Cochlodina costata* (C. Pfeiffer, 1828) (Gastropoda: Pulmonata: Clausiliidae) (in Polish). Folia Malacologica, **12**: 189–192.
- Pokryszko, B.M., Cameron, R.A.D., Mumladze, L., Tarkhnishvili, D., 2011.** Forest snail faunas from Georgian Transcaucasia: patterns of diversity in a Pleistocene refugium. Biological Journal of the Linnean Society, **102**: 239–250.
- Polianskyi, Y., 1925.** Geologichno-morfologichni pomichannia v rayoni Novosilky Kostiukovoyi (Zalishchyky) i diliuvialna tsyklichna skhema poludneвого Podillia (in Ukrainian). Zbirnyk Fiziografichnoi komisii Naukovogo Tovarystva Shevchenka, **1**: 3–24.
- Radzievskyi, V., 1957.** Nova znachidka davniochetvertynnykh moliuskiv na Sredniomu Dnistri (in Ukrainian). Dopovidi AN URSR, **6**: 591–593.
- Radzievskyi, V., 1959.** Do kharakterystyky lesovykh porid Seredniogo ta Nyzhniogo Prydnistrovia (in Ukrainian). Geologichnyi Zhurnal AN URSR, **19**: 99–103.
- Ridush, B., Marchuk, L., 2018.** Development of the Dniester valley within Tovtry zone during Pliocene and Early Pleistocene (in Ukrainian with English summary). Naukovi Visnyk Chernivetskogo Universytetu, Geografia, **803**: 96–102.
- Rogala, W., 1907.** Przyczynek do znajomości dyluwialnych utworów Galicji (in Polish). Kosmos, **32**: 350–363.
- Rousseau, D.-D., 2001.** Loess biostratigraphy: new advances and approaches in mollusk studies. Earth-Science Reviews, **54**: 157–171.
- Rychlicki, J., 1913.** Przyczynek do znajomości dyluwium (in Polish). Kosmos, **38**: 769–770.
- Teisseyre, W., 1900.** Atlas geologiczny Galicyi. Tekst do zeszytu **8** (in Polish). Kraków.
- Tomeniuk, O., 2010.** Yuriy Polianskyi as a researcher of terraces of Dniester River (in Ukrainian with English summary). Visnyk Lvivskogo Universytetu, Ser. Geogr., **38**: 340–356.
- Veklich, M.F., 1961.** Molluski chetvertichnykh kontinentalnykh otlozheniy USSR (in Russian). Materialy Vsesoyuznogo soveshchaniya po izucheniyu chetvertichnogo perioda, **1**: 341–346.
- Veklich, M.F., 1982.** Paleoetapnost' i stratotipy pochvennykh formatsiy verkhniogo kainozoya (in Russian). Naukova Dumka, Kyiv.
- Velichko, A.A., Faustova, M.A., Pisarea, V.V., Gribchenko, Yu.N., Sudakova, N.G., Lavrentiev, N.V., 2011.** Glaciations of the East European Plain: distribution and chronology. Developments in Quaternary Science, **15**: 337–359.
- Wiśniewski, T., 1908.** Atlas geologiczny Galicji. Tekst do zeszytu **21** (in Polish). Kraków.