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Late Cenozoic fluvial development within the Sea of Azov and Black Sea coastal plains

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ABSTRACT

Late Cenozoic terrestrial deposits are widespread across the northern coastal regions of the Black Sea and the Sea of Azov and represent diverse fluvial, estuarine and deltaic environments. The dating and correlation of these deposits rely on stratigraphically-associated marine index beds, mammalian and molluscan faunas and magnetostratigraphy. In detail the geometries of these sediment bodies are extremely complex, typically varying between localities and representing many cycles of incision and aggradation. However, the overall disposition of the sediments reflects the transition from the uplifting sediment source region to the north and the subsiding depocentre in the interior of the Black Sea to the south. Since the Middle Miocene the area of the Paratethys/Black Sea depocentre has decreased significantly, but since the Middle Pliocene the hinge zone between uplift and subsidence has been located close to the modern coastline. A combination of regional and local differential crustal movements has given rise to the great variety of fluvial sediment bodies, to the erosion–aggradation cycles, different phases and river activity and to the various fluvial landforms that have all been important in landscape development in this region during the past 12 Ma. The fluvial erosion–accumulation cycles (during the upper Serravillian–Messinian, the Zanclean–late Gelasian, and the Pleistocene) and corresponding cycles of relief dissection and planation are reconstructed against a background of local sea-level changes and climatic variations determined from palaeobotanical data. The maximum fluvial incision occurred in the early Zanclean time with alluvial coastal plains, unique in this area, developing in the Gelasian. Increased climatic aridity during the Pleistocene caused a reduction of fluvial activity in comparison with the Late Miocene and Pliocene. The sea-level oscillations and Pleistocene glaciations affected fluvial processes in different ways. The most remarkable events were the substantial reduction of fluvial activity during the Messinian dessication in the Black Sea and drainage of the shelf, with intensive dissection, coeval with the Last Glaciation.

1. Introduction

The chronology and disposition of the Late Cenozoic fluvial deposits of the main rivers of Eastern Europe, the Don, Dniester, Dnieper and Volga, have been reviewed by Matoshko et al. (2002, 2004). The present study extends that review to the buried fluvial deposits around the Black Sea and Sea of Azov, including areas beyond the valleys of the above-mentioned rivers (Fig. 1). This report presents a brief summary of the vast amount of material held by national geological surveys, most of which is unpublished, along with data from published sources and results of the authors' own investigations.

The study region forms part of the Paratethys Basin and its terrestrial surroundings. This basin was a large landlocked former sea that became isolated from the global marine environment during the Middle Miocene and therefore developed unique endemic faunas. Palaeosalinity inferred from foraminifera, ostracods, and calcareous nannofossils indicates a variety of marine, brackish, and freshwater environments within the basin (Jones and Simmons, 1997). In accordance with local custom, sediments deposited in the Paratethys Sea and its modern remnants, the Black Sea and Sea of Azov, are classified as marine, although during much of the Late Cenozoic these water bodies have more closely resembled lacustrine environments. The isolation of the Paratethys Basin means that, from the late Middle Miocene onwards, stratigraphic correlation with global chronology is problematic, because the marine taxa that define the global chronology are typically absent. However, magnetostratigraphy and mammalian and molluscan biostratigraphy can be used for stratigraphic correlation, as the present study illustrates.

The local stratigraphic nomenclature in the study region has reflected the conceptions of many different authors over more than a century and is thus complex. This nomenclature is expressed in terms of 'beds', 'suites' and 'series' (NSCU, 1997). A suite is a mappable stratigraphic unit that is broadly equivalent to a formation; a series, which may comprise a number of designated suites, is broadly equivalent to a group. In this paper preference is given to the present regional Ukrainian stratigraphical scale (NSCU, 1997) for the Miocene and Pliocene, which is correlated with subdivisions of the Gradstein et al. (2004) global time scale. Some historic terminology is also used, and some new nomenclature is proposed. The resulting interpretation

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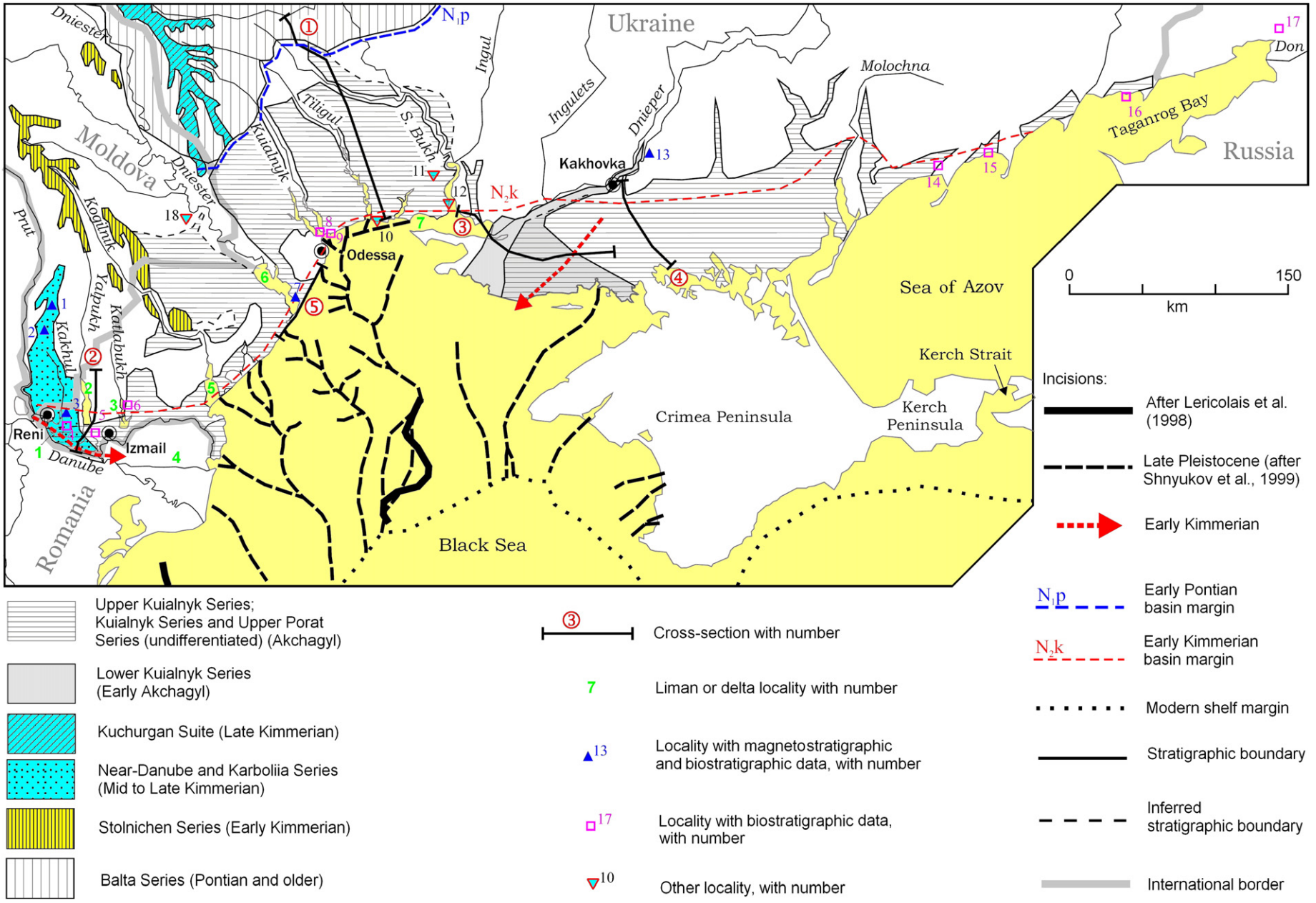

Fig. 1. Map of the study region, showing the locations of sediments, landforms, and localities discussed in the text, based on data from Zamorii (1940), Moliavko (1960), Mulika and Vyrvyklenko (1966), Goretsky (1970), Chirka (1974), Matsui et al. (1981), Bilinkis (1992), Lericolais et al. (1998), Rekovets (1994), Shnyukov et al. (1999) and new data. Liman and delta localities are: 1, Kakhul Liman; 2, Yalpukh Liman; 3, Katlabukh Liman; 4, Danube Delta; 5, Sasyk Liman; 6, Dniester Liman; and 7, Dnieper Liman. Localities with palaeontological and magnetostratigraphic data are: 1, Baimakliia; 2, Teteresht; 3, Yetuliia Nuoe; 7, Roksolany; and 13, Kairy. Localities with palaeontological data are: 4, Nagorne; 5, Ozerne; 6, Suvorovo; 8, Kuialnyk; 9, Kryzhanivka; 14, Obitochnaya; 15, Urzuf or Kulikovskoe; 16, Shirokino; and 17, Khapry. Other localities are: 10, Cape Karabush; 11, Polovinka; 12, Parutino; and 18, Parkan. The coastline during the maximum transgressions in the Early Kuialnyk stage appears to have typically been near the modern coastline (Semenenko, 1975) and so is not illustrated in this figure.