

# The Mesolithic of the northwestern Pontic region

## New AMS dates for the origin and spread of the blade and trapeze industries in southeastern Europe

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### Introduction

The scope of this paper is to discuss the radiocarbon chronology of the last hunter-gatherers of the northwestern Black Sea coast of the Ukraine and to contribute to the assessment of the absolute chronology of the Mesolithic period in the region. From a geographical point of view, this territory, which has a complex geological background,<sup>1</sup> can be subdivided into the wide, continental steppe lowlands, and the Crimean peninsula. The latter consists of three well-defined zones: a) the northern arid steppe, b) the mountainous uplands, and c) the warmer, humid seashore belt. The entire region is delimited by the Danube and Prut Rivers, in the west, the Black Sea, in the south, the Molochna River and the Azov Sea coastline, in the east, and the Podillian upland and the Ukrainian crystalline shield, in the north. It covers the area of four provinces (Odessa, Mykolaiyv, Kherson, Zaporizh'e), and the Crimean Autonomous Republic. It represents the westernmost corner of the Great Eurasian Steppes, which borders the Carpathian-Danube basin.<sup>2</sup> Contacts and interrelationships between the Balkans and the steppes have been active for millennia. They were particularly intense during the Late Palaeolithic Aurignacian culture, the Palaeolithic/Mesolithic transition, the Neolithisation process, and the Copper Age.<sup>3</sup>

The archaeology of the Late Pleistocene and Early Holocene of southwestern Ukraine is known from a few excavated sites and a large number of surface collections. One of the most intriguing problems of the prehistory of these periods, which, in the Ukraine, are represented by many cultural aspects with different types of geometric, microlithic chipped stone tools,<sup>4</sup> is radiocarbon chronology,

because many Kiev laboratory dates (Ki) have large standard deviations or are sometimes of problematic interpretation.<sup>5</sup> This is why an updated radiocarbon curve is necessary to redefine the chronology of the different cultural aspects,<sup>6</sup> in order to achieve a better understanding of the behaviour of the last hunter-gatherers who inhabited a complex landscape affected by many environmental changes during the Pleistocene-Holocene transition (ca 12000–7000 uncal BP).<sup>7</sup> This will help us fill a gap in our knowledge of the chronological framework, which is still under construction for the Near East, Anatolia, the Balkan Peninsula, Eastern and Central Europe.<sup>8</sup>

### Landscape and habitat

The palaeovegetation of the region has been studied by A. T. Artiushenko, C. V. Kremenetski, G. Pashkevich, M. Zerov and others.<sup>9</sup> These authors discussed the location of the steppe boundary around the end of the Pleistocene and the Holocene. The present-day limit is supposed to cross Kishinev, Pervomaisk, Kyrovohrad, Kremenchug and Poltava, while the southern one is represented by the Crimean foothills.<sup>10</sup> The evolution of this boundary has been reconstructed in three ways: a) according to most palaeogeographers the steppe zone was more widespread at the end of the last Glaciation. During the Preboreal and Boreal periods it covered a territory similar to that of the present, while the woodland cover spread southwards during the Atlantic, delimiting the steppe landscape

<sup>1</sup> Dolukhanov 1979, 81–83.

<sup>2</sup> Dolukhanov et al. 2009, Fig. 5.

<sup>3</sup> Childe 1925; Childe 1950; Tringham 1968; Tringham 1971; Kozłowski/Kozłowski 1986; Sherratt 1997; Ларина 1999; Kozłowski 2002; Kotova 2003; Telegin et al. 2003; Marks/Monigal 2004; Meignen et al. 2004; Skakun 2005–2008; Otte 2006.

<sup>4</sup> Нужний 1992.

<sup>5</sup> Anthony 1994.

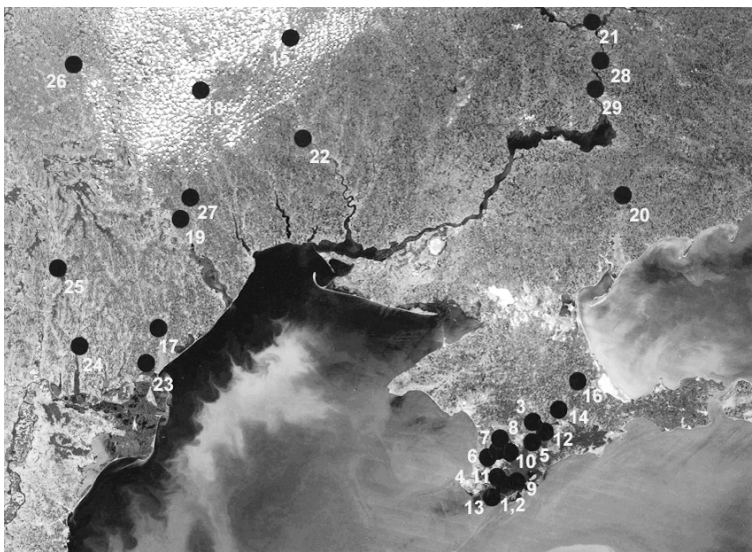
<sup>6</sup> Telegin et al. 2002.

<sup>7</sup> Korobkova 1993; Cordova 2007; Cordova/Lehmann 2005; Dergacev/Dolukhanov 2007; Dergacev/Dolukhanov 2008; Stanko 2007; Yanko-Hombach 2007; Berger/Guilaine 2009; Dolukhanov et al. 2009; Giosan et al. 2009.

<sup>8</sup> Thissen 2000; Biagi et al. 2005; Dolukhanov et al. 2005; Pinhasi et al. 2005; Bocquet-Appel et al. 2009; Berger/Guilaine 2008; <http://www.canew.org/data.html>

<sup>9</sup> Артюшенко 1970; Пашкевич 1976; Пашкевич 1982; Kremenetski 1997.

<sup>10</sup> Маринич 1982.



**Fig. 1.** Distribution map of the Mesolithic sites mentioned in the text. 1 Shan-Koba; 2 Fat'ma-Koba; 3 Kukrek; 4 Murzak-Koba; 5 Buran-Kaya; 6 Zamil-Koba; 7 Alymivs'ky; 8 Siuren' 2; 9 Vodopadny; 10 Skeliasty; 11 Kara-Koba; 12 Adzhi-Koba III; 13 Laspi 7; 14 Vys-henne I; 15 Dobryanka; 16 Ivanivka; 17 Bilolisja; 18 Tsarynka; 19 Grebenyky; 20 Kamenna Mohyla; 21 Igren' 8; 22 Abuzova Balka; 23 Myrne; 24 Zaliznychne; 25 Sarateni; 26 Soroki II; 27 Gyrzheve; 28 Vasylevka II; 29 Marjevka.

to the Black Sea coastline and the Crimean plain,<sup>11</sup> b) other environmentalists suggest that, during the Early and Middle Holocene, the steppes spread some 150–175 km to the north;<sup>12</sup> while, c) following a third group, the steppe boundary was already stabilized during the Holocene.<sup>13</sup>

Recently N. Gerasimenko<sup>14</sup> proposed a revised scheme for the Holocene climatic variations in southern Ukraine. According to this author

- 1) the Preboreal (10300–9000 uncal BP) early warming contributed to the development of the forest-steppe cover (pine forests with oak and elm, and “mixed grass-cereal” steppes) in the present-day northern steppe region, and “turf-cereal” steppes in the south. A noticeable cool event characterised the end of this period (ca. 9600–9000 uncal BP). The broadleaf woodland disappeared, xerophytic cenosises spread, a few rivers dried up, and loess deposits started to accumulate;
- 2) the Boreal (9000–8000 uncal BP) can be subdivided into two sub-periods. During the first (BO-1) the northern steppes were covered with woodlands thicker than those of the Preboreal. Oak, elm and lime were present, although birch was much more common. The second sub-period (BO-2) was dryer, with a decrease in the forest cover, the decline of broadleaf tree species, and the wide spread of “mixed grass-cereal” steppes;
- 3) M. F. Veklich<sup>15</sup> divided the Atlantic into six main sub-periods, only the first two of which are treat-

ed in this paper: hlb1-1 and hlb1-2 (ca. 7800–6900 uncal BP). The first (ca. 7800–7400 uncal BP) should correspond to the “climatic optimum”, during which the forest cover reached its maximum development and spread, while the second (ca. 7400–6900 uncal BP) is marked by a climatic worsening and aridification. In the steppes, the Atlantic sedimentation resulted in the development of grey(ish) soils heavily humified around 6000–5100 uncal BP.<sup>16</sup>

## The cultural sequence

### Crimea

The current sequence of the Crimean Mesolithic was defined by G. A. Bonch-Osmolovsky<sup>17</sup> who excavated the type-sites of Shan-Koba, Fat'ma-Koba and Kukrek (Fig. 1,1–3). Influenced by the “stage paradigm”, he attributed the finds from the above sites to the Azilian (Shan-Koba culture) and the Tardenoisian (Murzak-Koba and Kukrek cultures). Later he described the main characteristics of the Kukrek chipped stone industry, which he called Tardenoisian. In 1950 Voevodsky introduced the terms Shan-Koba and Murzak-Koba cultures,<sup>18</sup> partly supported by Formozov.<sup>19</sup> Vekilova, Kolosov and Danilenko,<sup>20</sup> described the Kukrek culture in the 1960's, while, in 1976, Telegin defined the Gornokryms'ka culture, which, according to him, resulted from both Shan-Koba and Murzak-Koba (Fig. 1,4) complexes, which had already been described by Voevodsky. He also pointed out the local evolution of the material culture, and the absence of any population change in the mountains of the Crimea.<sup>21</sup> Cohen proposed a more detailed subdivision of the Crimean Final Palaeolithic and Mesolithic into four cultures and five different complexes.<sup>22</sup>

The state of the research was summarised by Janevich, Nuzhny and Zaliznyak.<sup>23</sup> At present most authors accept the subdivision of the Crimean Mesolithic into two main periods, early and late: the first is represented by sites of the Shan-Koba culture, the second by Murzak-Koba ones, while the Kukrek culture evolved in the steppes of the Crimea during the Early Holocene.

<sup>16</sup> Гeрасименко 2004.

<sup>17</sup> Бонч-Осмоловский 1934.

<sup>18</sup> Воеводский 1950.

<sup>19</sup> Формозов 1954.

<sup>20</sup> Векилова 1951; Векилова 1966; Колосов 1964; Даниленко 1969.

<sup>21</sup> Телегин 1982.

<sup>22</sup> Cohen 1999.

<sup>23</sup> Яневич 1987; Нужный 1992; Зализняк 1998; Зализняк 2005.

<sup>11</sup> Артюшенко 1970; Сминтина 2001.

<sup>12</sup> Серебрянная 1976.

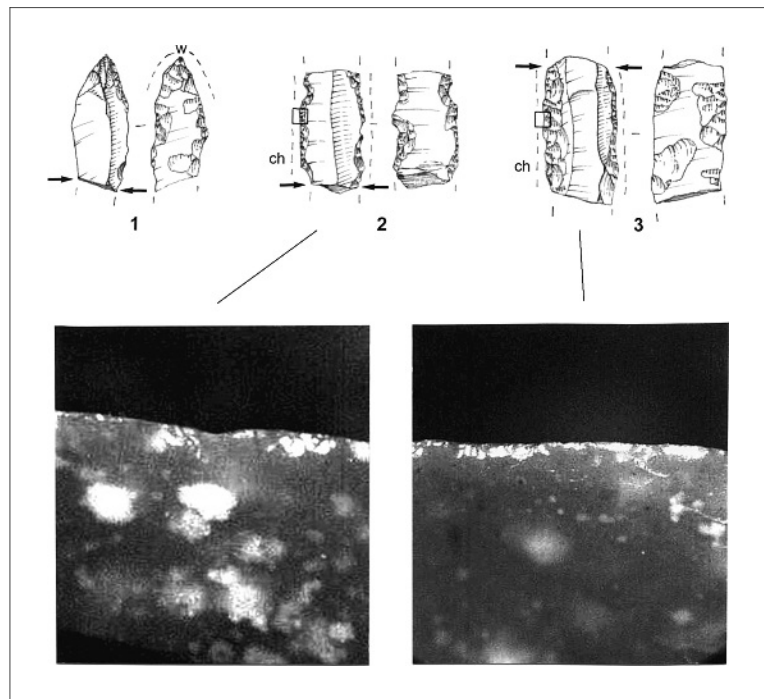
<sup>13</sup> Нейштадт 1957.

<sup>14</sup> Гeрасименко 2004.

<sup>15</sup> Веклич 1987.

The Shan-Koba culture chipped stone assemblages (Buran-Kaya, layer 5,<sup>24</sup> Fat'ma-Koba, layers 5 and 6; Shan-Koba, layers 4–6; Zamil-Koba, lower layers; Alymiv's'ky rock-shelter, Siuren' 2, upper layers; Vodopadny and Skalistiy rock-shelters (Fig. 1,5–10) and a few other sites, consist of prismatic, sub-prismatic, double and multi-platformed cores. With a few exceptions, the end-scrapers are more numerous than the burins. The characteristic tools include elongated end-scrapers on blades and shortened blades, short end-scrapers on flakes, and thumbnail end-scrapers, as well as different types of burins, although those on truncation prevail. The microliths consist of direct retouch and bipolar lunates and double truncated points. Trapezes and triangles are less common, although they were obtained by the same technique as the lunates.<sup>25</sup> This culture is thought to have originated around the end of the Pleistocene. Its first phase is known from the Crimean rock-shelter of Buran Kaya III,<sup>26</sup> layer 5 (Cultural layer 6), radiocarbon-dated to 11950 ± 130 uncal BP (OxA-4127) and 11900 ± 150 (OxA-4126),<sup>27</sup> and layer III of Skalistiy rock-shelter, radiocarbon-dated between 12820 ± 170 (OxA-4888) and 11620 ± 110 uncal BP (OxA-5164),<sup>28</sup> the last (third) stage, which most probably developed during the Holocene, is known from Shan-Koba (layer 4).<sup>29</sup> The chronological position of the second, “intermediate” phase, to which most of the sites are thought to belong, is still undefined. Some authors attribute it to the end of the Palaeolithic, others to the Early Mesolithic.

The Murzak-Koba culture<sup>30</sup> (Murzak-Koba, Fat'ma-Koba, layers 2–4, Shan-Koba, layers 2 and 3, Kara-Koba, Adzhi-Koba III, and Laspi 7) (Fig. 1,11–13) is characterised by parallel-sided bladelets, mainly detached from flat prismatic cores. Notched bladelets are typical, as are circular, semi-circular and flakelet end-scrapers. The burins are often on truncation or the angle of a broken blade/bladelet. Most of the geometric microliths consist of trapezes of varying shapes.<sup>31</sup> Although the isosceles types predominate, the scalene specimens are also numerous. A small percentage of microburins is also known. Most Soviet archaeologists believed that this culture was to be attributed to the Boreal/beginning of the Atlantic,<sup>32</sup> while, according to Zaliznyak,<sup>33</sup> it falls entirely within the Atlantic period.



The Kukrek culture is a unique tradition that finds no parallels in Western Europe. Its first stage (Vyshenne I, lower layer) (Fig. 1,14) is attributed to the Early Mesolithic or to the end of the Palaeolithic.<sup>34</sup> It is characterised by subconical, bullet and pencil-like cores for the production of parallel-sided bladelets, polyhedral flake cores, and end-scrapers on flakes. The burins are more numerous than the end-scrapers: they are often multifaceted, on a flake (“Kukrek burins”). The microliths consist of backed points adjacent to an oblique truncation (“Abuzova Balka points”); “Kukrek inserts” are also abundant (medium, wide blade fragments with trimming facets on their ventral surface, and a partial, dorsal retouch along their proximal or distal sides). According to the traceological analyses conducted by B. A. Voytek (pers. comm. 2007) on three specimens from Dobryanka (Fig. 1,15),<sup>35</sup> the ventral trimming of the Kukrek inserts is due to the re-sharpening of (thick) blades used for hard-working (cut hard) on hard material such as wood, bone or antler (Fig. 2), as previously suggested by G. O. Sapozhnikova.<sup>36</sup> The second stage (Kukrek, Ivanivka) (Fig. 1,3,16) is attributed to the Late Mesolithic. Subconical, prismatic, bullet, and polyhedral cores were knapped to obtain blades, bladelets and flakes. The end-scrapers are on flakes; there are no

**Fig. 2.** Dobryanka. Traceological analysis of three “Kukrek inserts” (after Залізняк/Манько 2004, Fig. 6), number 40 (1), 55 (2) and 54 (3). CH = cut hard on hard material (wood or antler or bone), W = worn, → = snapped edge, □ = photographs at 10× (2) and 15× (3) (drawings by P. Biagi, inking by G. Almerigogna, photographs by B. A. Voytek, with thanks).

<sup>24</sup> Janevich et al. 1996, 316 Fig. 2.

<sup>25</sup> Нужний 1992, Fig. 10.

<sup>26</sup> Janevich 1998.

<sup>27</sup> Janevich et al. 1996, 318.

<sup>28</sup> Cohen et al. 1996, 328 Tab. 1.

<sup>29</sup> Бибииков et al. 1994.

<sup>30</sup> Gimbutas 1956.

<sup>31</sup> Нужний 1992, Fig. 21.

<sup>32</sup> Телегин 1989.

<sup>33</sup> Залізняк 1998.

<sup>34</sup> Яневич 1987; Zaliznyak 2009.

<sup>35</sup> Kindly provided by Professor L. L. Zaliznyak, with thanks.

<sup>36</sup> Сапожникова/Сапожников 1992.



**Fig. 3.** Bilolisja. The site is on the riverbank, where the two people are standing (photograph by P. Biagi).

micro-end-scrapers, circular or semicircular specimens. The burins are of Kukrek type, and the most characteristic tool is the “Kukrek insert”. The microliths consist mainly of backed bladelets and points adjacent to an oblique truncation (“Abuzova Balka points”). A few double points also occur; trapezes and microburins are absent. The third stage of the culture, which is attributed to the Neolithic, yielded an identical chipped stone assemblage and a few ceramic potsherds.<sup>37</sup>

### The steppes of southern Ukraine

According to the periodisation proposed by V. N. Stanko,<sup>38</sup> the Mesolithic of south Ukrainian steppes, is represented by three cultures: a) Bilolisja (Beloles’e)<sup>39</sup> (Fig. 3), b) Tsarynka-Rogalyk, and c) Grebenyky (Grebeniki) (Fig. 1,17–19).

1) The Bilolisja culture flint industry is characterised by prismatic and sub-prismatic cores for the production of bladelets. The end-scrapers are on both flakes and technological blades. The burins are few and atypical. The lunates predominate among the geometric microliths, which also include trapezes<sup>40</sup> amongst which are specimens with three retouched sides.<sup>41</sup> Arched points are also present. The only available radiocarbon date comes from the type-site (Ki-10886: 8900 ± 190 uncal BP, from bone).

<sup>37</sup> Колосов 1964; Яневич 1987.

<sup>38</sup> Станко 1967; Станко 1972; Станко 1976; Станко 1977; Станко 1980; Станко 1982; Станко 1997.

<sup>39</sup> Станко 1985; Коробкова 1993, 163.

<sup>40</sup> Нужний 1992, Fig. 14.

<sup>41</sup> Станко 1972; Станко 1980.

2) The Tsarynka-Rogalyk culture chipped stone assemblage comprises unipolar, bipolar, prismatic and sub-prismatic cores. There is a significant percentage of end-scrapers on shortened blades and flakes. The burins are often on the angle of broken blades. The geometric microliths consist exclusively of trapezes with three retouched sides.<sup>42</sup>

3) The Late Mesolithic of southwestern Ukraine<sup>43</sup> is represented by the Grebenyky and Kukrek cultures. The Grebenyky chipped stone assemblages are characterised by a fine, regular bladelet knapping technique. Most of the cores are flat and prismatic. The end-scrapers are mainly circular and semi-circular, on flakes. The geometric microliths consist exclusively of isosceles and rectangular trapezes.<sup>44</sup> According to Stanko, and Telegin<sup>45</sup> this culture developed during the Boreal and Early Atlantic periods.

The Kukrek culture is subdivided into three local variants, which developed a) along the Azov Sea coast (Kamenna Mohyla), b) in the lower Dnieper Valley (Igren’ 8), and c) the lower southern Bug Valley (Abuzova Balka) (Fig. 1,20–22). Isolated Kukrek sites are known as far as the course of the Prut.<sup>46</sup> The bearers of this culture produced subconical, bullet and pencil-like cores for the manufacture of parallel-sided bladelets. Characteristic tools are “Kukrek inserts” and “Kukrek burins”, as well as burins on flakes. The microliths consist of a backed-retouched point adjacent to an oblique truncation (“Abuzova Balka points”) (Fig. 4).<sup>47</sup> Stanko and Telegin<sup>48</sup> suggested the presence of Early Mesolithic Kukrek sites on the basis of typical surface finds, and comparisons with characteristic tools from the Mesolithic sequences of Crimea.<sup>49</sup>

### Discussion

Each topic of this classification has been the subject of a vivid discussion. According to several authors the Tsarynka-Rogalyk culture developed around the end of the Palaeolithic,<sup>50</sup> while Telegin and Smoljaninova<sup>51</sup> accepted Stanko’s periodisa-

<sup>42</sup> Нужний 1992, Fig. 8.

<sup>43</sup> Телегин 1973.

<sup>44</sup> Kozłowski/Kozłowski 1979; Нужний 1992, Fig. 23.

<sup>45</sup> Станко 1982; Телегин 1982.

<sup>46</sup> Дворянинов 1976; Станко 1982, 113–114; Телегин 1982, 118–119.

<sup>47</sup> Kozłowski/Kozłowski 1979.

<sup>48</sup> Станко 1982; Телегин 1982.

<sup>49</sup> Бибииков et al. 1994.

<sup>50</sup> Коробкова 1989; Коробкова 1989а; Григорьева 1992; Залізняк 1995, 18.

<sup>51</sup> Телегин 1982; Смольянинова 1990.

tion. Also Bilolisja has been attributed to the end of the Palaeolithic,<sup>52</sup> although Janevich and Zaliznyak<sup>53</sup> included it into the Shan-Koba culture. Stan-ko did not agree with this attribution because of the different manufacturing technique of the lunates that characterise the two aspects.<sup>54</sup>

Sapozhnikov and Sapozhnikova<sup>55</sup> proposed another chronology of the Early Mesolithic sites, and attributed all of them to the end of the Palaeolithic. These authors did not find any difference between the Grebenyky and Kukrek cultures and the northwestern Pontic “Tardenoisian” of Romania,<sup>56</sup> and assigned all of them to a long period from the Preboreal to the Early Atlantic.

Zaliznyak still believes that the Grebenyky culture results from the migration of Early Neolithic peoples from the Balkan Peninsula,<sup>57</sup> and attributes it to the end of the Boreal, or the very beginning of the Atlantic.<sup>58</sup> This suggestion does not find any confirmation in the radiocarbon sequences currently available for the Early Neolithic in the Balkans.<sup>59</sup>

In contrast L. Domańska<sup>60</sup> suggested that the first appearance of the blade and trapeze industries in the steppes of the Ukraine was due to influences from the Caucasus, given that assemblages with isosceles trapezes and parallel-sided bladelets, detached from bullet and pencil-shaped cores, are well represented there since the Late Mesolithic.<sup>61</sup>

On the basis of the radiocarbon dates available at the time, Kozłowski,<sup>62</sup> who wrote a first synthesis of the cultural sequence of these regions, attributed the Murzak-Koba, and the beginning of the Kukrek culture, mainly to the Boreal, and the more recent Kukrek aspects, and the Grebenyky culture, to the Early Atlantic.

## Myrne

### The site and its significance

Myrne (Mirnoe) is a site of major importance for the Late Mesolithic of south Ukraine (Fig. 1,23). This large, single-layered settlement is located in the

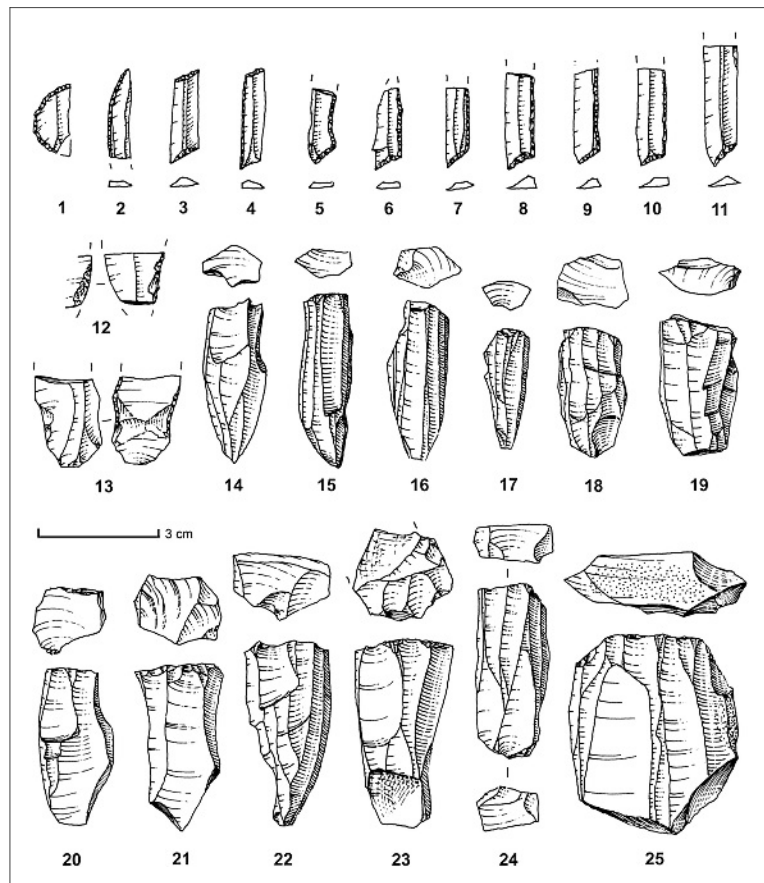


Fig. 4. Abuzova Balka. Flint artefacts: lunate (1), backed point (2), elongated rhomboid (3), backed bladelets and truncation (4-11), “Kukrek inserts” (12 and 13), cores (14-25) (drawings by P. Biagi, inking by G. Almerigogna).

southern region of the Danube-Dniester interfluvium, along the western bank of the Drakulja River, in the lowlands that lead to the wide Danube Valley (Fig. 5).

Stanko<sup>63</sup> excavated the site over an area of 1807 sq. m. It yielded more than 20,000 chipped stone artefacts (Figs. 6; 7), a rich bone and antler industry, and a rich faunal assemblage, 9800 specimens of which were identified.<sup>64</sup> The man-made structures (hearths, “baking” pits, rubbish pits and flint scatters) were discovered thanks to innovative excavation techniques, which included flotation, micro-stratigraphy and spatial analysis. The site was studied by Petrougne and Dolukhanov (geomorphology and stratigraphy), Korobkova (tracology of the chipped stone artefacts), Bibikova (archaeozoology), and Pashkevich (pollen analysis).

<sup>52</sup> Яневич 1990; Залізник 1995, 18.

<sup>53</sup> Яневич 1990; Залізник 1998.

<sup>54</sup> Stanko/Kiosak 2008.

<sup>55</sup> Сапожников/Сапожникова 2005.

<sup>56</sup> Rădulescu 1993, 209; Chirica 1996, 83.

<sup>57</sup> Stanko 2009.

<sup>58</sup> Залізник 2005а, 9–11; Залізник 2006, 3–18; Залізник et al. 2005, Fig. 10.

<sup>59</sup> Görsdorf/Bojadžiev 1996; Whittle et al. 2002; Whittle et al. 2005; Biagi/Spataro 2005; Biagi et al. 2005.

<sup>60</sup> Domańska 1990, 332.

<sup>61</sup> Бадер/Церетели 1989, 103; Korobkova 1996.

<sup>62</sup> Kozłowski 1989, 426.

<sup>63</sup> Станко 1982.

<sup>64</sup> In their papers Dergacev and Dolukhanov (2007, 499; 2008, 26) erroneously report bone percentages, which do not refer to Myrne, but to Bilolisja (Бибикова 1982, 140).



**Fig. 5.**  
Myrne. The site  
area from the south  
in 2007 (photograph  
by P Biagi).

### History of the research at Myrne

Myrne was discovered in 1963 by the field survey team of the Danube-Dniester Archaeological Expedition of the Archaeological Institute of the Academy of Sciences of the Ukrainian RSR.<sup>65</sup> A representative sample of surface finds was collected in 1964, thanks to which the site was attributed to the Late Mesolithic, like those of Grebenyky and Gyrzheve. During the opening of the first test-trench, a rich cultural layer was discovered *in situ* at the depth of 0.9–1.1 m.<sup>66</sup> From 1969 to 1976, Stanko carried out an extensive programme of excavations. The Palaeolithic team of the “I. I. Mechnikov” Odessa State University, and the Mesolithic team of the Northwestern Pontic Expedition of the Archaeological Institute excavated some three quarters of the site (1807 sq. m). Telegin<sup>67</sup> produced the first description of the chipped stone industry, which he attributed to the Grebenyky culture. Stanko<sup>68</sup> pointed out the complexity of the flint assemblages, characterised by both Grebenyky and Kukrek tools.

### Previous attempts at clarifying the chronology of Myrne

Soon after the end of the excavations, Stanko<sup>69</sup> attributed Myrne to the Boreal, on the basis of its

<sup>65</sup> Шмаглий 1965.

<sup>66</sup> Станко 1967.

<sup>67</sup> Телегин 1976.

<sup>68</sup> Станко 1982.

<sup>69</sup> Станко 1982, 100.

stratigraphic position, pollen analyses, and the typology of the flint tools.

The site sequence was described as follows<sup>70</sup> according to the profiles of the trenches opened in 1969–1976:<sup>71</sup> 1) topsoil, composed of two horizons: a) turf, b) loamy layer with Chalcolithic finds); 2) dusty, peaty loam; 3) light brownish loam, with carbonate inclusions (“buried soil?”); 4) yellowish, sandy loam, containing the cultural layer, radiocarbon-dated to 7200 ± 80 uncal BP (Le-1647) from bone; 5) heavy, dense, light brown loam with carbonate inclusions.

The Mesolithic layer was found between the Late Pleistocene loam deposit (5), and the “buried soil” that formed under mild, Atlantic climatic conditions (3). According to these data the cultural horizon belongs to the Early Holocene (Preboreal and Boreal?). The “buried soil” yielded many flint tools and a much lower quantity of faunal remains. A similar situation (“dredge cultural layer”) characterises all the Mesolithic sites of the Northwestern Pontic Region. Following Stanko’s<sup>72</sup> description, the development of the “buried soil” was interrupted by the Drakulya River, which inundated the valley during the Neoeuxinian transgression, and the Mesolithic site “was stratified beneath peat-like deposits suggesting the occurrence of a small mire at that time”.<sup>73</sup> Consequently, the sediments containing the Mesolithic occupation layer are to be attributed to the Early Holocene.

According to Pashkevich<sup>74</sup>, who studied the pollen sequence “There are no doubts that the pollen complex of lower heavy loam is dated to the end of Pleistocene, the cultural layer pollen complex was deposited in the Early Holocene, and the buried soil has Atlantic age”, while Stanko<sup>75</sup> stated “the Boreal period seems to be a most probable date” (for the Myrne Mesolithic assemblage). Since then, the Myrne sequence has been considered of basic importance for the Late Mesolithic of south Ukraine, which was thought to last from the Boreal period onwards. As a consequence Stanko and Svezhentsev<sup>76</sup> considered the first radiocarbon date obtained from the site (Le-1647: 7200 ± 80 uncal BP) too recent although, more recently, Zaliznyak<sup>77</sup> has suggested an Atlantic date for the Mesolithic occupation at the site.

<sup>70</sup> This description differs from those by Dergacev/Dolukhanov 2007, 499 Fig. 2; Dergacev/Dolukhanov 2008, 26 Fig. 2.

<sup>71</sup> Станко 1982, 8 Fig. 2.

<sup>72</sup> Станко 1982, 8.

<sup>73</sup> Stanko 2007, 377.

<sup>74</sup> Пашкевич 1976, 154.

<sup>75</sup> Станко 1982, 100.

<sup>76</sup> Станко/Свеженцев 1988.

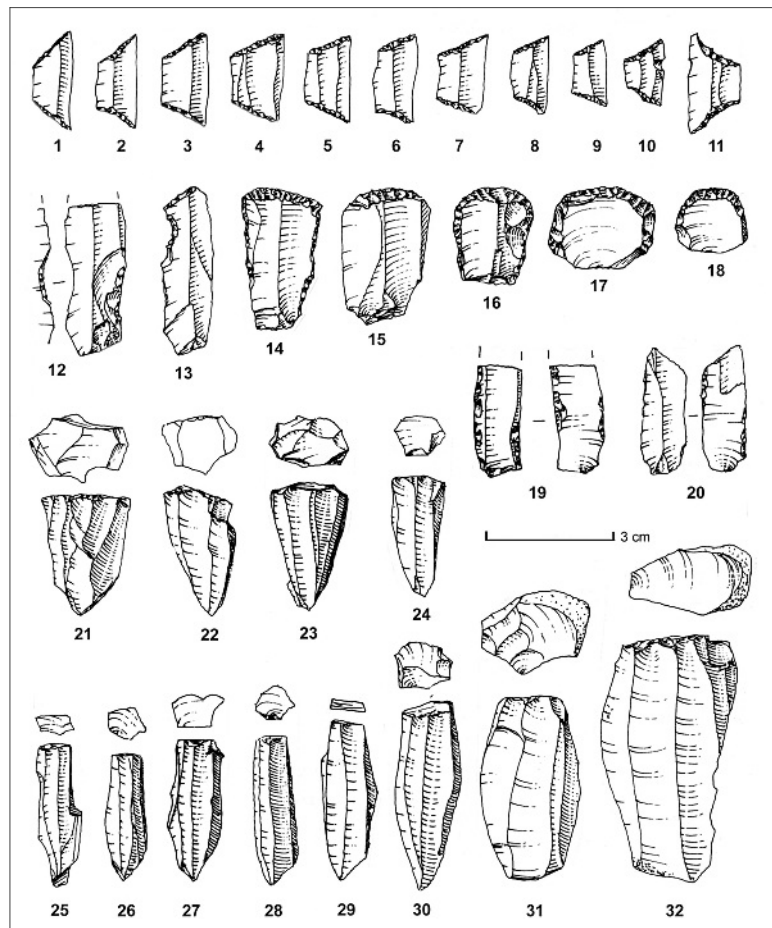
<sup>77</sup> Залізник 2005.

### The Kukrek-Grebenyky dilemma

Following Stanko<sup>78</sup> the Myrne chipped stone assemblage consists of characteristic types attributable to two different traditions. While subconical, bullet and pencil-like cores, “Kukrek inserts” and “Abuzova Balka points” are considered classical Kukrek culture types, flat prismatic cores, with negatives of parallel-sided blade and bladelet detachments, and isosceles trapezes characterise the Grebenyky culture.<sup>79</sup> Typological analysis has shown very similar percentages of typical tools of both aspects. Spatial analysis has revealed the presence of flint scatters with prevailing “Kukrek inserts” and burins, “Abuzova Balka points”, subconical, bullet and pencil-like cores, and spots with mainly flat cores and isosceles trapezes, as well as areas with typical tools of both traditions.<sup>80</sup>

Several authors consider the site “homogeneous”,<sup>81</sup> although the Kukrek and Grebenyky cultures have different technology,<sup>82</sup> typology,<sup>83</sup> subsistence economy<sup>84</sup> and geographical distribution patterns,<sup>85</sup> with the exception of a few sites.<sup>86</sup> Sorokin<sup>87</sup> hypothesized a mechanical admixture of the two cultural traditions. Although this cannot be excluded, the spatial analysis makes this observation of minor importance within the general framework of the settlement organization pattern.

Stanko developed a complex theory, according to which the migration of Grebenyky tribes westwards, across the Dniester, as far as the Carpathians, and their penetration into Dobrudja, resulted in the interaction with Kukrek culture peoples. The syncretic sites that derived from this movement (Zaliznychne, Sarateni (Fig. 1,24–25) and others) are numerous in Budjak, Myrne being the most important. Thus, according to the above data, two different communities inhabited Myrne more or less contemporaneously: Kukrek and Grebenyky. Although this interaction might have led to an exchange of ideas, it was not strong enough to eliminate differences between the two above flint technological traditions even at the syncretic sites: “the cultural borrowings are limited, and the Grebenyky



and Kukrek complexes are separated spatially in the same site”.<sup>88</sup> It is important to point out that, according to Domańska,<sup>89</sup> the assemblages from both these cultural aspects recall Near Eastern and Caucasian types, especially their “highly developed blade component”.

**Fig. 6.** Myrne. Flint artefacts: isosceles trapezes (1–9) with piquant trièdre truncations (10, 11), notched blades (12, 13), end-scrapers (14–18), “Kukrek inserts” (19, 20), different types of bladelet cores (21–32) (drawings by P. Biagi, inking by G. Almerigogna).

### The “old” radiocarbon dates

The first attempt at a <sup>14</sup>C chronology for the western Ukrainian Mesolithic, based almost exclusively on the results from Soroki II<sup>90</sup> (Fig. 1,26), Igren’ 8, Kukrek and Laspi 7, was presented by Kozłowski<sup>91</sup> in his discussion of the chronology of the earliest Holocene sites of the western part of the former USSR. More radiocarbon determinations became

<sup>78</sup> Станко 1982, 78.

<sup>79</sup> Станко 1972; Kozłowski/Kozłowski 1975; 1979.

<sup>80</sup> According to Korobkova 1993, 168 the chipped stone assemblage from this site included also “... inserts for sickle knives used in harvesting wild cereals and grasses”.

<sup>81</sup> Rădulescu 1993.

<sup>82</sup> Гиря 1997.

<sup>83</sup> Станко 1972; Kozłowski/Kozłowski 1975; Kozłowski/Kozłowski 1979; Телегін 1982.

<sup>84</sup> Нужний/Яневич 1987; Залізняк 1998.

<sup>85</sup> Kozłowski/Kozłowski 1979.

<sup>86</sup> Anthony 2007, 360.

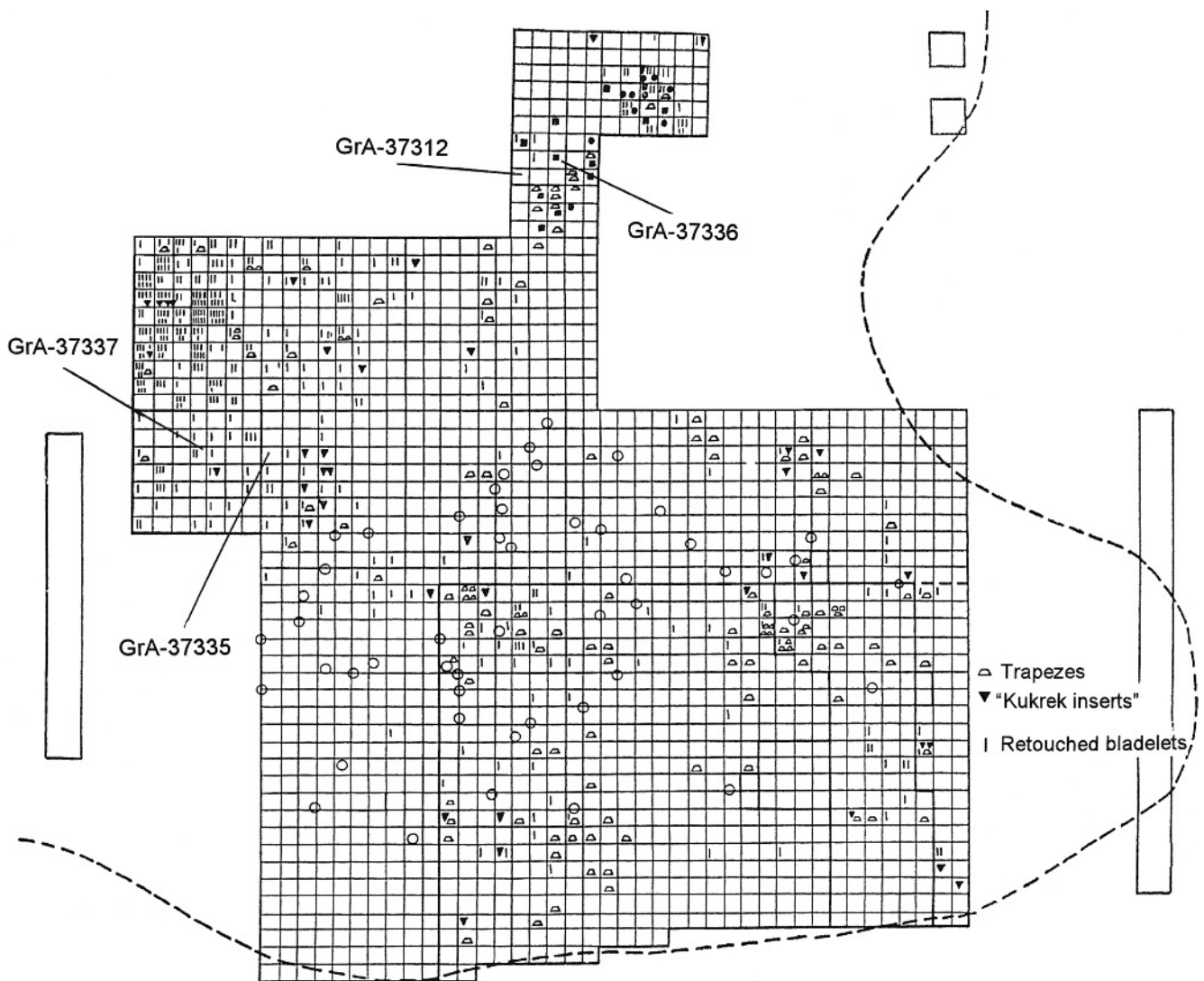
<sup>87</sup> Сорокин 2002.

<sup>88</sup> Станко 1982, 78; Stanko/Kiosak 2008.

<sup>89</sup> Domańska 1990, 329.

<sup>90</sup> Маркевич 1974.

<sup>91</sup> Kozłowski 1989, 431.



**Fig. 7.**  
Myrne. Plan of the excavated area with the location of the samples collected for radiocarbon dating (after Станко 1982, Tab. 14).

available a few years later thanks to the systematic radiocarbon dating of the Mesolithic and Early Neolithic cemeteries in the Dnieper Rapids Region,<sup>92</sup> while Zaliznyak recently published a revised list.<sup>93</sup> For the territory under study, the present situation can be summarized in the following way:

### Crimea

Telegin<sup>94</sup> published many dates from Kukrek (Kukrek culture) and Laspi 7 (Murzak-Koba culture)

while, more recently, Man'ko<sup>95</sup> promoted an extensive programme of radiocarbon determinations of the Crimean Mesolithic sites, which are still unpublished. Nevertheless the dates from this project, obtained from different laboratories, do not match. In effect, while the west European laboratory dates of the early phase of the Shan-Koba culture fall into the Allerød, most of the Ki dates yielded Preboreal results. Most of the Murzak-Koba culture Ki dates from Fat'ma-Koba and Shan-Koba should attribute this cultural tradition to the Atlantic (**Fig. 8**). These results contrast with the radiocarbon sequence from Laspi 7, which shows a very different pattern, according to which the Murzak-Koba culture, layer D, is assigned to the Boreal period (**Fig. 9; Tab. 1**).

<sup>92</sup> Potekhina/Telegin 1995; Lillie 1998, 186; Lillie 2001; Lillie et al. 2003.

<sup>93</sup> Залізняк 2005, 161–163.

<sup>94</sup> Телегин 1985; Телегин 1989.

<sup>95</sup> Манько pers. comm. 2006.



### The steppe zone

The absolute dates from the Mesolithic steppe sites are somewhat contradictory. At Gyrzheve<sup>96</sup> (Fig. 1,27; 10) the Late Mesolithic occupation has been <sup>14</sup>C-dated, from bone, to 7390 ± 100 (Ki-11240) and 7050 ± 60 uncal BP (Le-1703), while organic inclusions in two Early Neolithic potsherds yielded similar results: 7280 ± 170 uncal BP (Ki-11241) and 7200 ± 220 uncal BP (Ki-11743).<sup>97</sup>

The best-dated Mesolithic site in the steppe region is Igren' 8, a Kukrek culture settlement on the western bank of the Dnieper that Telegin excavated between 1973 and 1990.<sup>98</sup> It consists of a series of stratified "pit-dwellings", some 4–9 m in diameter and varying in depths (Fig. 11), one of which yielded a sequence of three habitation layers from the Late Mesolithic to the Middle Neolithic period.<sup>99</sup> The first series of dates, obtained from freshwater shells and charcoal samples, was published in 1982.<sup>100</sup> Most of them fall into the Boreal period, although many authors consider Ki-956 too early, and Ki-806 and Ki-850 too late. In 1990, a new series of four dates was obtained from bone samples, which attributed pit-dwelling 10 to the Atlantic, between 7080 ± 60 (Ki-6256) and 6860 ± 45 uncal BP (Ki-6259). These chronological discrepancies do not match with the material culture remains, which assign the Mesolithic horizon to the Kukrek culture. Recently Man'ko radiocarbon-dated the organic inclusions from four Early Neolithic potsherds, from the upper levels of pit-dwellings 8 and 4, all of which yielded Atlantic results between 7050 ± 140 (Ki-11685) and 6500 ± 140 uncal BP (Ki-11684) (Fig. 12; Tab. 2).<sup>101</sup> This is why Man'ko<sup>102</sup> suggested the settlement be reattributed to the Early Neolithic Surs'ka (Surskaja) culture.<sup>103</sup> Further dates come from the cemeteries excavated in the same Dnieper Rapids Region, a few of which have recently been re-dated by <sup>14</sup>C, and yielded results that assign two of them, Vasilyevka II and Marievka (Fig. 1,28.29), to the beginning of the Atlantic period.<sup>104</sup>

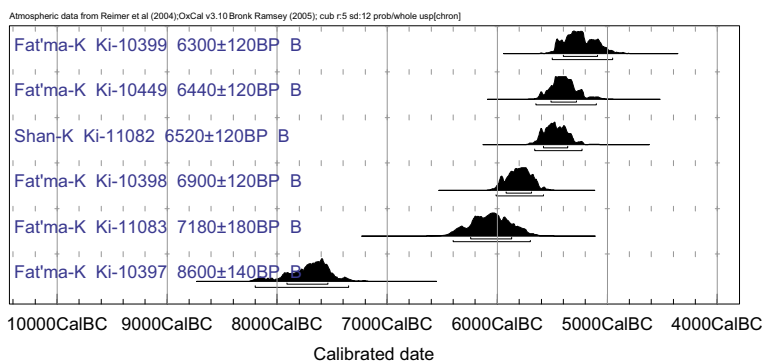


Fig. 8. Fat'ma-Koba and Shan-Koba. Plot of the radiocarbon and calibrated dates according to OxCal 3.10 (Reimer et al. 2004; Bronk Ramsey 1995). B – bone.

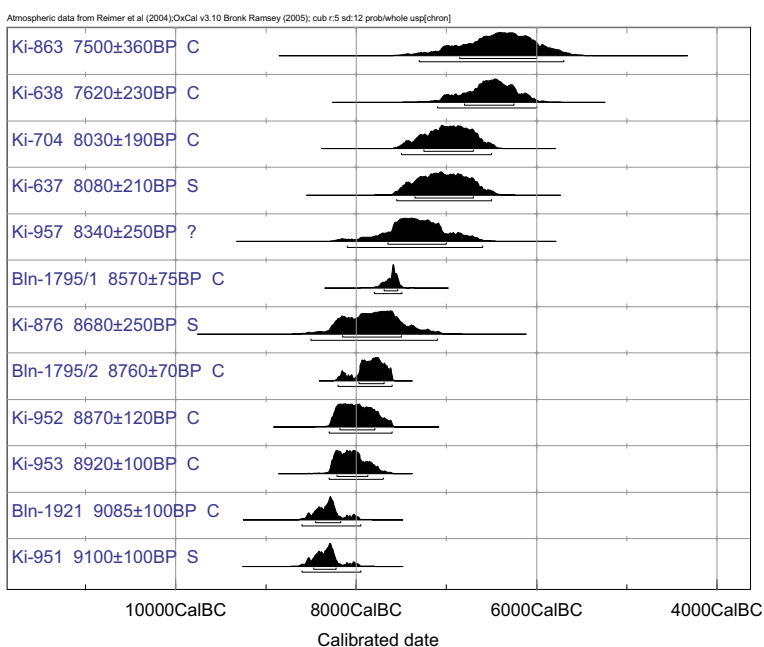


Fig. 9. Laspi 7. Plot of the "old" radiocarbon and calibrated dates according to OxCal 3.10 (Reimer et al. 2004; Bronk Ramsey 1995). C – unidentified charcoal, S – marine shells, ? – unknown.

### The "new" AMS radiocarbon dates

Eight radiocarbon dates have been obtained from three of the above sites in order to check the reliability of the previous results (Tab. 3).

Four bone samples have been AMS-dated from Myrne. The specimens were collected by Stan'ko from four different squares (Fig. 7) that were supposed to represent both Kukrek (squares ПIIБ5 and ПIIБ1, respectively dated to GrA-37337: 8385 ± 45, and GrA-37335: 8350 ± 45 uncal BP) and Grebenyky culture activity areas (ПД22 and ПГ24, respectively dated to GrA-37312: 8475 ± 45,

<sup>96</sup> Станко 1966.

<sup>97</sup> Манько 2006.

<sup>98</sup> Телегин 1985; Telegin 1996; Telegin/Potekhina 1987.

<sup>99</sup> Anthony 2007, 357.

<sup>100</sup> Телегин 1982.

<sup>101</sup> Lists of radiocarbon dates from Igren' 8 have been published in many papers, often with noticeable incongruities (Телегин 1982; Телегин 2002; Gob 1990; Манько 2005).

<sup>102</sup> Манько 2005, 119.

<sup>103</sup> Телегин 1987.

<sup>104</sup> Telegin et al. 2002, Tab. 1.

Site name	Provenance	Lab. Number	Material	Date BP	Calibration date range BC (1 sigma)	Calibration date range BC (2 sigmas)	Reference
Laspi 7	Layer ABV	Ki-863	unident. Charcoal	7500 ± 360	6850–6000	7300–5700	Телегин 1989
Laspi 7	Layer D1, D2	Ki-638	unident. Charcoal	7620 ± 230	6800–6250	7100–6000	Телегин 1989
Laspi 7	Layer D	Ki-704	unident. Charcoal	8030 ± 190	7250–6700	7500–6500	Телегин 1989
Laspi 7	Layer A	Ki-637	Marine Shells	8080 ± 210	7350–6700	7550–6500	Телегин 1989
Laspi 7	Layer D	Ki-957	unpublished	8340 ± 250	7650–7000	8100–6600	Телегин 1989
Laspi 7	Layer D	Bln-1795/1	unident. Charcoal	8570 ± 75	7690–7540	7800–7490	Телегин 1989
Laspi 7	Layer D1	Ki-876	Marine Shells	8680 ± 250	8150–7500	8500–7100	Телегин 1989
Laspi 7	Layer D1	Bln-1795/2	unident. Charcoal	8760 ± 70	7970–7690	8200–7600	Телегин 1989
Laspi 7	Layer D1	Ki-952	unident. Charcoal	8870 ± 120	8180–7790	8300–7600	Телегин 1989
Laspi 7	Layer B	Ki-953	unident. Charcoal	8920 ± 100	8210–7870	8300–7700	Телегин 1989
Laspi 7	Layer D	Bln-1921	unident. Charcoal	9085 ± 100	8450–8170	8600–7950	Телегин 1989
Laspi 7	Layer V	Ki-951	Marine Shells	9100 ± 130	8500–8090	8650–7850	Телегин 1989

**Tab. 1.**

Laspi 7. List of the “old” radiocarbon and calibrated dates. Bln-1975/1 and Bln-1975/2 are from the same charcoal sample (after Телегин 1989, 109).



**Fig. 10.** Gyrzheve. A view of the valley below the Mesolithic site (photograph by P. Biagi).

and GrA-37336: 8280 ± 45 uncal BP) to control any eventual chronological discrepancy between the two aspects.<sup>105</sup> The results are quite homogeneous given that they all fall into the second half of the Boreal period, and cover a time-span of some 200 radiocarbon years. It can be suggested that they indicate subsequent or repeated habitation episodes within the same settlement area. Furthermore the “new” dates neatly contrast with Le-1647, according to which the site had previously been attributed to the Atlantic period. This latter result may be in

<sup>105</sup> Бiаджи et al. 2008.

error, caused by the texture of the deposit from which the bone sample was collected for dating that is rich in carbonate inclusions. In light of the new dates the site’s chronological attribution to the second half of the Boreal is more reliable, and fits better into Stanko’s<sup>106</sup> early field observations. It is interesting to point out that, already at the beginning of the 1990’s, similar considerations had been put forward by Domańska<sup>107</sup> for the Grebenyky culture, which, according to this author, developed “most probably at the end of the Boreal period”.

From Laspi 7, layer D, two arboreal species from the same charcoal sample<sup>108</sup> were AMS-dated. They yielded identical results (GrA-37503: 8620 ± 40 uncal BP, and GrA-37504: 8625 ± 40 uncal BP), which confirm the attribution of this part of the sequence to the second half of the Boreal period, as indicated by most of the Ki and Bln dates from the same layer D (**Tab. 3**).<sup>109</sup>

Two further animal bone samples were AMS-dated from the lowermost occupation layer of two Mesolithic structures at Igren’ 8, respectively pit-dwelling 4 (GrA-33112: 8695 ± 45 uncal BP) and 8 (GrA-33113: 8880 ± 45 uncal BP).<sup>110</sup> They both confirm the attribution of the Kukrek occupation at the site to the second half of the Boreal, as already suggested by three Ki radiocarbon dates from pit-dwellings 1 and 2, and one Bln result from the Mesolithic cultural layer (**Fig. 8; Tab. 2**).<sup>111</sup> It is important to

<sup>106</sup> Станко 1982, 100.

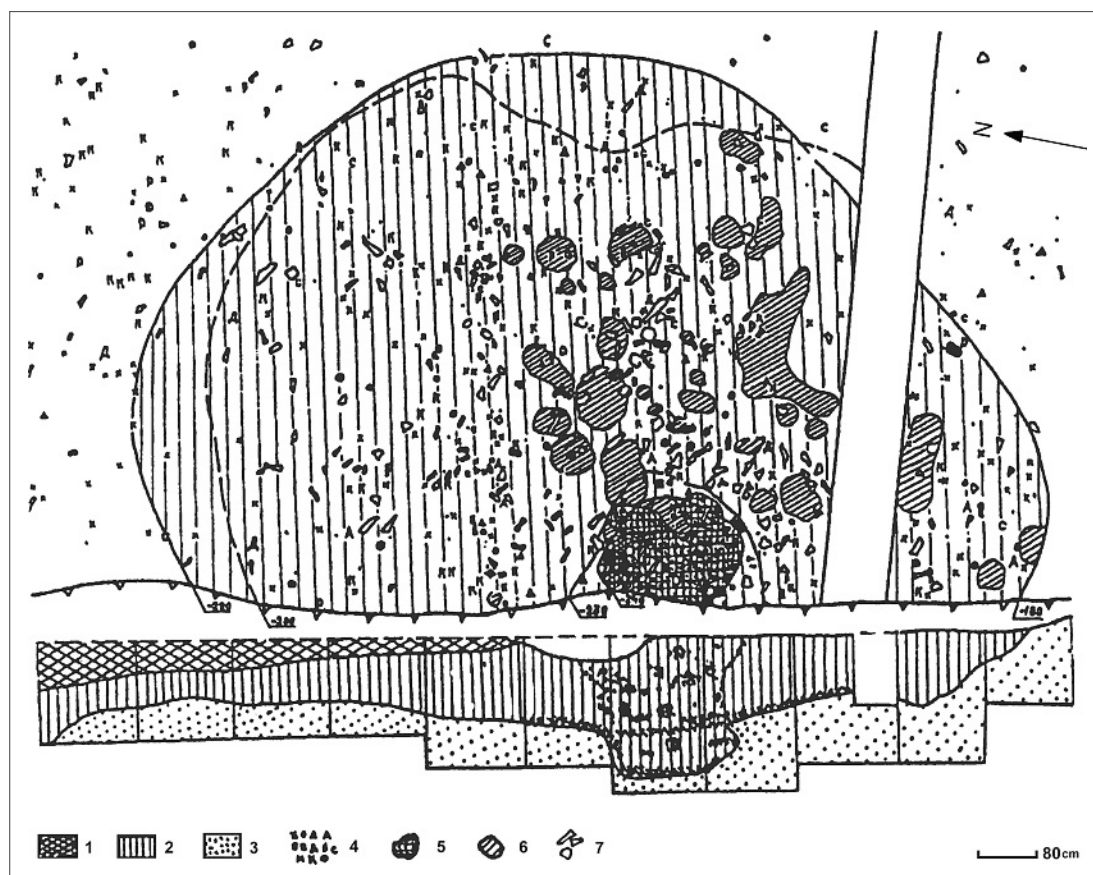
<sup>107</sup> Domańska 1990, 329.

<sup>108</sup> The authors are grateful to Professor L. L. Zaliznyak who provided the sample for radiocarbon dating.

<sup>109</sup> see also Kozłowski 1989, Fig. 5.

<sup>110</sup> Biagi et al. 2007, 27.

<sup>111</sup> see also Kozłowski 1989, Fig. 5.



**Fig. 11.** Igren' 8. Plan of pit-dwelling 8 (after Tenger 2002, Fig. 18). 1 Humus; 2 pit filling; 3 sand; 4 different types of flint, bone, polished stone, and ochre finds; 5 hearths; 6 ash lenses; 7 bones and pebbles. Sample GrA-33113 comes from the structure depression, from the depth of 2.20 m.

point out that GrA-33113 is identical to that recently obtained from a *Cervus* sp. bone sample from the same pit-dwelling 8 (OxA-17489:  $8885 \pm 40$  uncal BP)<sup>112</sup> (Fig. 11).

## Discussion

All the “new” AMS radiocarbon dates from Myrne, Laspi 7 and Igren' 8 fall into the ninth millennium uncal BP, and contradict some of the results already available for the Grebenyky and Kukrek cultures. The new dates show that the above cultures are (at least partly) older than previously suggested given that they attribute these Mesolithic complexes to the second half of the Boreal period. Furthermore they pose the question of the origin of the assemblages with microlithic isosceles trapezes, not only in the north Pontic region, but also in whole of southeast Europe. In western Europe, the

appearance of the Mesolithic blade and trapeze industries is generally considered to have occurred at the very end of the Boreal/beginning of the Atlantic period.<sup>113</sup> It probably marks the introduction of new hunting techniques,<sup>114</sup> favoured by new environmental landscapes, which formed as a consequence of the climatic changes that affected Europe at the Boreal/Atlantic transition.<sup>115</sup> This is the case for the Grebenyky and Murzak-Koba cultures, for which a similar, though not identical, absolute chronology can now be suggested. The chipped stone assemblages of these two cultures show noticeable similarities owing to the occurrence, at both aspects, of isosceles trapezes with completely retouched truncations, obtained with the microburin technique, notched bladelets and similar bladelet cores.<sup>116</sup>

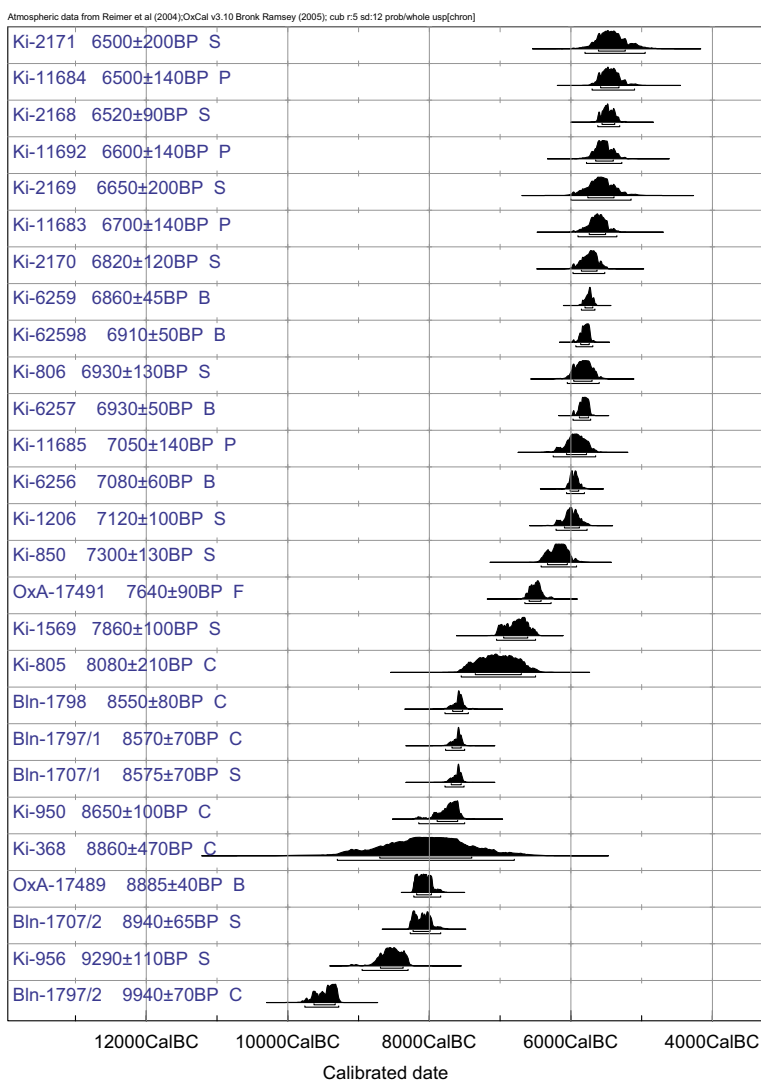
<sup>113</sup> Kozłowski/Kozłowski 1979, 68.

<sup>114</sup> Нужний 1992.

<sup>115</sup> Clarke 1978, 23.

<sup>116</sup> Бибииков et al. 1994.

<sup>112</sup> Lillie et al. 2009, Tab. 2.



**Fig. 12.** Igren' 8. Plot of the radiocarbon and calibrated dates according to OxCal 3.10 (Reimer et al. 2004; Bronk Ramsey 1995). B – bone, C – unidentified charcoal, F – fishbone, P – pottery organic inclusions, S – freshwater shells.

Two outstanding problems concern a) the origin of these complexes,<sup>117</sup> and b) the definition of the Kukrek culture assemblages. While the first can be interpreted, at least in Crimea, as an internal development that started around the beginning of the Holocene, as the Shan-Koba cave sequence would indicate,<sup>118</sup> the second is far more complicated. The available data suggest that the Kukrek culture

lasted the entire early Atlantic period.<sup>119</sup> Its definition is based not only on the typology of the chipped stone tools, among which are geometric microliths, including isosceles and rectangular trapezes,<sup>120</sup> but also on the high percentage of functional tools, or “Kukrek inserts”,<sup>121</sup> which often occur at the sites of this culture, whose ventral “retouches” are in effect detachments to re-sharpen the blade after hard work on hard materials (wood or antler or bone) (Fig. 2). This methodological confusion between typology and function in the analysis of the flint tools, may have caused related problems in the cultural attribution of the Ukrainian Mesolithic assemblages.

## Conclusion

The radiocarbon chronology of the Ukrainian Mesolithic has recently improved thanks to new series of AMS dates obtained from the cemeteries of the Dnieper Rapids Region,<sup>122</sup> and a few sites distributed between Crimea, in the east, and the most north-western Pontic territory, in the west.<sup>123</sup> Although these results have shed some new light on the chronology of the last hunter-gatherers of the region, many problems, which need to be clarified with the help of further series of radiocarbon dates, are still open to question. They regard:

- 1) the chronological relationships between cemeteries and settlements. Although we know that the Dnieper Rapids Region cemeteries were in use for millennia, roughly from the beginning of the Holocene (early Preboreal), as the radiocarbon dates from Vasilyevka III indicate, to the copper Age,<sup>124</sup> the evidence for Mesolithic camps in the same territory is poor. The best-excavated settlement is Igren' 8, which, according to the available radiocarbon determinations, except for Bln-1797/2 (Tab. 2), seems to have been settled from the Boreal period to, at least, the Middle Neolithic. The new radiocarbon dates, obtained from animal bone samples from the lowermost layer of Pit-dwellings 4 (GrA-33112) and 8 (GrA-33113 and OxA-17489), show that the site was already inhabited during the Boreal period by Kukrek culture peoples;

<sup>119</sup> Залізняк 2005, 128–146.

<sup>120</sup> Kozłowski/Kozłowski 1979, Fig. 67; Залізняк 1998, Fig. 67.

<sup>121</sup> Kozłowski 1989, Fig. 8.

<sup>122</sup> Potekhina/Telegin 1995; Lillie 2001; Lillie 2003; Telegin et al. 2002; Lillie et al. 2003; Lillie et al. 2009.

<sup>123</sup> Biagi et al. 2007; Біаджи et al. 2008. Another incomplete list has been published recently by Dolukhanov 2008, Tab. 11.1.

<sup>124</sup> Lillie et al. 2003, 743.

<sup>117</sup> It is interesting to point out that, in the Crimean Peninsula, the first geometric microlithic tools of isosceles, trapezoidal shape make their appearance at Buran-Kaya, Level C (Marks/Monigal 2004, Fig. 5.4), radiocarbon-dated between 36700 ± 1.500 uncal BP (OxA-6868) and 32350 ± 700 uncal BP (OxA-6672) (Pettitt 1998, 331; Marks/Monigal 2004, Tab. 5.1).

<sup>118</sup> Janevich 1999, 44.

Site name	Provenance	Lab. Number	Material	Date BP	Calibration date range BC (1 sigma)	Calibration date range BC (2 sigmas)	Reference
Igren' 8	Pit-dwelling 7	Ki-2171	Freshwater shells	6500 ± 200	5610–5230	5800–4950	Zaitseva et al. 2000
Igren' 8	Pit-dwelling 4, D1	Ki-11684	Pottery inclusions	6500 ± 140	5580–5320	5700–5100	Манько 2005
Igren' 8	Trench 8	Ki-2168	Freshwater Shells	6520 ± 90	5560–5380	5620–5310	Zaitseva et al. 2000
Igren' 8	Pit-dwelling 8, D	Ki-11692	Pottery inclusions	6600 ± 140	5650–5400	5780–5280	Манько 2005
Igren' 8	Square 21	Ki-2169	Freshwater Shells	6650 ± 200	5760–5390	6000–5150	Zaitseva et al. 2000
Igren' 8	Pit-dwelling 8, E	Ki-11683	Pottery inclusions	6700 ± 140	5740–5510	5900–5350	Манько 2005
Igren' 8	Square 3	Ki-2170	Freshwater Shells	6820 ± 120	5850–5630	5970–5520	Zaitseva et al. 2000
Igren' 8	Pit-dwelling 10	Ki-6259	Bone	6860 ± 45	5800–5690	5850–5660	Zaitseva et al. 2000
Igren' 8	Pit-dwelling 10	Ki-6258	Bone	6910 ± 50	5860–5740	5930–5690	Zaitseva et al. 2000
Igren' 8	Pit-dwelling 3	Ki-806	Freshwater Shells	6930 ± 130	5960–5700	6050–5600	Zaitseva et al. 2000
Igren' 8	Pit-dwelling 10	Ki-6257	Bone	6930 ± 50	5880–5750	5970–5720	Zaitseva et al. 2000
Igren' 8	Pit-dwelling 8, D2	Ki-11685	Pottery inclusions	7050 ± 140	6060–5780	6250–5650	Манько 2005
Igren' 8	Pit-dwelling 10	Ki-6256	Bone	7080 ± 60	6010–5890	6060–5810	Zaitseva et al. 2000
Igren' 8	Pit-dwelling 7	Ki-1206	Freshwater Shells	7120 ± 100	6090–5880	6210–5770	Zaitseva et al. 2000
Igren' 8	Pit-dwelling 4, D1	Ki-850	Freshwater Shells	7300 ± 130	6330–6050	6420–5920	Zaitseva et al. 2000
Igren' 8	Pit-dwelling 8	OxA-17491	Fish bone	7640 ± 90	6590–6420	6650–6280	Lillie et al. 2009
Igren' 8	Trench IV	Ki-1569	Freshwater Shells	7850 ± 100	6940–6600	7050–6450	Zaitseva et al. 2000
Igren' 8	Pit-dwelling 2	Ki-805	unident. Charcoal	8080 ± 210	7350–6700	7550–6500	Zaitseva et al. 2000
Igren' 8	Pit-dwelling 4	Bln-1798	unident. Charcoal	8550 ± 80	7670–7530	7780–7450	Telegin 2002
Igren' 8	Pit-dwelling 2	Bln-1797/1	unident. Charcoal	8570 ± 70	7680–7550	7770–7500	Telegin 2002
Igren' 8	Layer D2	Bln-1707/1	Freshwater Shells	8575 ± 70	7890–7550	7780–7510	Zaitseva et al. 2000
Igren' 8	Pit-dwelling 1	Ki-950	unident. Charcoal	8650 ± 100	7890–7600	8150–7500	Zaitseva et al. 2000
Igren' 8	Pit-dwelling 1	Ki-368	unident. Charcoal	8860 ± 470	8700–7400	9300–6800	Zaitseva et al. 2000
Igren' 8	Pit-dwelling 8	OxA-17489	<i>Cervus</i> bone	8885 ± 40	8180–7970	8220–7840	Lillie et al. 2009
Igren' 8	Archaeological layer	Bln-1707/2	Freshwater Shells	8940 ± 65	8230–7990	8270–7840	Telegin 2002
Igren' 8	Pit-dwelling 5, D2	Ki-956	Freshwater Shells	9290 ± 110	8690–8370	8950–8300	Zaitseva et al. 2000
Igren' 8	Pit-dwelling 2	Bln-1797/2	unident. Charcoal	9940 ± 70	9630–9330	9760–9280	Telegin 2002

**Table 2.**

Igren' 8. List of the “old” radiocarbon and calibrated dates. Three more dates are not included in the list because they are considered unreliable: Ki-122: 6710 ± 150 uncal BP, from unspecified material (Gob 1990), Ki-3613: 7600 ± 80 uncal BP and Ki-3034: 8600 ± 120 uncal BP, from freshwater shells (after Тенерін 2002).

Site Name	Provenance	Lab. Number	Material	Date BP	Calibration date range BC (1 sigma)	Calibration date range BC (2 sigmas)	Reference
Myrne	PI Г24	GrA-37336	<i>Bos primigenius</i> matatarsal	8280 ± 45	7430–7220	7480–7160	Біаджі et al. 2008
Myrne	PIII B1	GrA-37335	Large ungulate (?) long bone	8350 ± 45	7490–7350	7550–7250	Біаджі et al. 2008
Myrne	PII Б5	GrA-37337	<i>Equus</i> sp. long bone	8385 ± 45	7520–7380	7550–7340	Біаджі et al. 2008
Myrne	PI Д22	GrA-37312	<i>Equus</i> sp. long bone	8475 ± 45	7570–7510	7590–7470	Біаджі et al. 2008
Laspi 7	Layer D, Square 18, cm 170	GrA-35703	Promoideae charcoal	8620 ± 40	7685–7590	7730–7580	unpublished
Laspi 7	Layer D, Square 18, cm 170	GrA-35704	<i>Ulmus</i> sp. charcoal	8625 ± 40	7690–7595	7740–7580	unpublished
Igren' 8	Pit-dwelling 4, lowermost layer	GrA-33112	Long bone flake	8695 ± 45	7770–7620	7910–7600	Biagi et al. 2007
Igren' 8	Pit-dwelling 8, lowermost layer	GrA-33113	Long bone flake	8880 ± 45	8180–7960	8220–7820	Biagi et al. 2007

**Table 3.**

List of the “new” radiocarbon and calibrated dates from Myrne, Laspi 7 and Igren' 8.

- 2) The  $^{14}\text{C}$  results from four animal bone samples from Myrne (**Tab. 3**) show that this site was settled during the second half of the ninth millennium uncal BP, that is the second half of the Boreal period. The samples for dating were selected by Stanko from locations with either typical Grebenyky isosceles trapezoidal armatures, or “Kukrek inserts” (**Fig. 2**). Given that the new results cover a time-span of some 200 years, and that the supposed Grebenyky and Kukrek culture results overlap, it is possible to suggest that, at least at this site, the two Mesolithic traditions are more or less contemporaneous. These dates suggest that Myrne consists of a sequence of several habitation episodes, which were impossible to recognise during excavation;
- 3) The new results from Laspi 7, layer D, in the Crimea, which help us refine the radiocarbon sequence from this site (**Fig. 9; Tab. 2; 3**), from which several Ki dates were already available, although with larger standard deviations. As mentioned above it is important to point out the occurrence of isosceles trapezoidal armatures from this layer, which can be attributed to the second half of the Boreal period. From a radiometric point of view, the Laspi 7 Murzak-Koba culture layer slightly predates the Grebenyky site of Myrne;
- 4) The new radiocarbon determinations show that a) microlithic trapezoidal armatures were already manufactured both in the Crimean Peninsula (Laspi 7: Murzak-Koba culture) and in the north-western Pontic region (Myrne: Grebenyky culture) during the second half of the Boreal period. This fact contributes to the understanding of the origin and dispersal of these specific tool types, whose production is most probably related to new hunting techniques, perhaps consequent upon the opening of new environmental landscapes; b) according to the new results, the Grebenyky, and the so-called Kukrek cultures, are partly contemporaneous, although, based on present evidence, the time-span covered by the second is undoubtedly much longer, most probably up to the Middle Atlantic period (?). Nevertheless it is important to point out that, while the definition of the Grebenyky culture is based mainly on the typology of a few characteristic implements,<sup>125</sup> that of the Kukrek culture is mainly based, apart from the presence of pencil-like cores, on the occurrence of “Kukrek inserts”, “Kukrek burins” and “Abuzova Balka points”. Given that some of these tools can be defined according to their function, because of characteristic traces of wear
- (e.g. “Kukrek inserts”), others on typological grounds (e.g. “Abuzova Balka points”), that they do not always recur together at the same site, or are known with variable percentages, and that the time-span covered by this latter culture is supposed to be very long, its definition is far from being clear, and it is used in different ways by the authors. Furthermore it is still unclear whether the occurrence of bullet and subconical cores from sites of both the above two traditions is cultural, or, simply, because they represent different manufacturing reduction stages for the detachment of (narrow) bladelets and microbladelets;<sup>126</sup>
- 5) The fact that most of the Crimean and north-western Pontic Mesolithic cultures are still difficult to attribute to any of the three climatic periods that characterise the beginning of the Holocene, mainly, but not exclusively, because of the absence of a sufficient number of radiocarbon-dated complexes. Given the scarcity of data, it is currently impossible to assign most of the cultural aspects to any specific climatic period, and accurately define the cultural sequence of the last hunter-gatherer sites of the two regions. All the new Mesolithic dates from Myrne, Laspi 7 and Igren’ 8, although they are not contemporary, fall into the second half of Boreal. This is also the case for Bilolisja, although the chipped stone assemblage from this site, as well as that from Tsarynka, show sensible differences from those of the above-mentioned sites, also as regards the typology of the microlithic armatures;
- 6) The absence of ( $^{14}\text{C}$ -dated) Preboreal sites and their cultural attribution.<sup>127</sup> This fact is difficult to explain given both the presence of cemeteries of this period in the Dnieper Rapids Region,<sup>128</sup> and the discovery of several Epigravettian open-air sites along the Ukrainian northern shores of the Black Sea and its immediate hinterland,<sup>129</sup> a few of which have been radiocarbon-dated, although with variable results;<sup>130</sup>
- 7) The Late Mesolithic/Early Neolithic transition and the role played by the blade and trapeze industries<sup>131</sup> of the first farmers who inhabited the region around the second half of the eighth millennium uncal BP.<sup>132</sup>

<sup>126</sup> Гиря 1997.

<sup>127</sup> With the exception of Vyazivok 4A, along the western bank of the Sniporod River, from which seven radiocarbon dates have been so far obtained from both Kiev and Groningen laboratories. They span from the Allerød interstadial (Biagi et al. 2007, 28) to the Preboreal period (Zaliznyak/Gavrilenko 2002, 10; Zaliznyak 2009, 454).

<sup>128</sup> Lillie et al. 2009.

<sup>129</sup> Оленковський 1991; Olenkovskiy 2004.

<sup>130</sup> Оленковський 2000; Кюсак 2006.

<sup>131</sup> Clark 1958; Tringham 1968.

<sup>132</sup> Telegin 1987; Jacobs 1993; Anthony 1994; Telegin et al. 2002.

<sup>125</sup> Станко 1972; Kozłowski/Kozłowski 1975; Kozłowski/Kozłowski 1979.

At present the absolute chronology of the last hunter-gatherers of southern Ukraine is very fragmentary. Although the new AMS dates might help understand a few important issues in their cultural behaviour and development, especially as regards part of the Boreal, many uncertainties still remain, mainly for the Preboreal and Early Atlantic periods. This problem is due also to the scarcity of material culture remains from most of the Mesolithic and Neolithic cemeteries of the Dnieper Rapids Region,<sup>133</sup> the absence of Late Pleistocene/Early Holocene vertical sequences, except for those, mainly undated, in the Crimean Peninsula,<sup>134</sup> and a too limited knowledge of the final Pleistocene archaeology of the study region.<sup>135</sup>

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<sup>133</sup> Telegin/Potekhina 1987; Lillie 2003, 629

<sup>134</sup> Бибиков et al. 1994; Janevich et al. 1996.

<sup>135</sup> Смольянинова 1990; Korobkova 1993, 161–163; Svezhentsev 1993, 29–39; Саложникова et al. 1995; Krasnokutsky 1996; Cohen/Gorelik 1999.

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## Summary

The new AMS dates from Myrne (Northwestern Pontic Region), Laspi 7 (Crimea) and Igren' 8 (Dnieper Rapids Region) show that all these Mesolithic sites were inhabited during the second half of the Boreal period. These results contribute to the understanding of the chronology of the Mesolithic settlement of the Ukraine, and the origin and

spread of the blade and trapeze assemblages in southeast Europe. Although the new dates do not help us clarify the sequence of the Preboreal and Early Atlantic archaeology in the above regions, they nevertheless greatly improve our knowledge of the relationships between the Grebenyky and Kukrek cultures, which, according to the new <sup>14</sup>C dates from Myrne, seem to have coexisted, at least at this site.

## Резюме

Статья посвящена публикации и интерпретации восьми новых радиоуглеродных дат для мезолитических стоянок Юго-Западной Украины и Крыма (Мирное, Игрень 8, Ласпи 7). Датировки указывают на их существование уже во второй половине бореала. Эти результаты важны для понимания абсолютной хронологии мезолита Украины и появления и распространения пластинчатых индустрий с трапециями в Юго-Восточной Европе. Хотя новые сведения и не могут пролить свет на более ранний и более поздний периоды мезолита (пребореал и ранний атлантический период) в регионе, все же они дают возможность утверждать, что кукрекская и гребениковская культуры сосуществовали определенный промежуток времени, хотя бы на стоянке Мирное.

## Zusammenfassung

Die neuen AMS Daten aus Mirnoe (nordwestliches Schwarzmeergebiet), Laspi 7 (Krim) und Igren' 8 (Dnepr) zeigen, dass all diese mesolithischen Fundstellen während der zweiten Hälfte des Boreal benutzt wurden. Diese Ergebnisse tragen zum Verständnis der Chronologie der mesolithischen Besiedlung der Ukraine, und der Entstehung und Verbreitung der Klingentechnik und der Herstellung trapezförmiger Geräte in Südosteuropa bei. Obwohl die neuen Daten nicht dabei helfen, die Abfolge von Präboreal und Frühatlantikum in den genannten Regionen zu klären, erweitern sie dennoch unser Wissen über Beziehungen zwischen der Grebenikovskaja- und der Kukrekskaja-Kultur, die, laut den neuen  $^{14}\text{C}$  Daten aus Mirnoe, zumindest an dieser Stelle gleichzeitig existierten.