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REGIONAL STRATEGY: SETTLEMENT STRUCTURE AND ECONOMIC POSSIBILITIES OF THE PRZEWORSK CULTURE IN THE NIEMCZA-STRZELIN HILLS AREA

ABSTRACT

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The Niemcza-Strzelin Hills area was settled by Przeworsk culture groups uninterruptedly since they first appeared in Lower Silesia in the 2nd century BC until the collapse of this society in the second half of the 5th century AD. The discussed region is a part of the larger Przeworsk settlement grouping known as the Bystrzyca-Oława area. The main goal of this work is to illustrate the network of sites, and to determine the settlement strategies employed here over the course of the development of the Przeworsk culture. GIS methods are applied in this work in order to investigate the relationship between the settlement structure and economic potential of this region.

Keywords: Przeworsk culture, prehistoric land-use, settlement strategy, GIS, landscape
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INTRODUCTION

Archaeological evidence shows that the Niemcza-Strzelin Hills area was invariably attractive for settlement throughout prehistory. During the process of the appearance of the Przeworsk culture population in Lower Silesia, this region was one of the first to be settled and domesticated, and one of the last to be forsaken. Good quality soils, a well-developed

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river network, the characteristic terrain, and the mineral abundance so typical for this area, create a foundation for sustainable settlement, which in the case of the Przeworsk culture lasted continuously over nearly seven centuries.

The main aim of this paper is to present settlement strategies that accompanied the development process in this region. A detailed settlement network for each chronological phase of the Przeworsk culture will be depicted, as well as its relationship with the environment and landscape. Another goal is to show the correspondence between the site network and the economic potential of the region, as well as to establish its economic basis. To achieve the research goals described above, GIS software and methods will be used.

Beyond addressing the objectives above, this research utilized new approaches to analyze old archaeological data in order to obtain information that could not previously be gathered without complicated mathematical calculations, and cannot be visualized by analogue map. The applied methodology imparts new quality data collected during the 20th and early 21st centuries.

MATERIALS AND METHODS

The archaeological sites investigated in this paper are located in the Niemcza-Strzelin Hills. The region in question is described as hummocky territory, located in the western part of the Sudeten Foreland, which is one of the physiographic macroregions of the Sudeten Mountains. Boundaries of this region are marked by so-called morphological thresholds: the northen Jordanów – Łagiewniki – Kondratowice – Biały Kościół line, the southern Otmuchów – Kamieniec Ząbkowicki line, the western Bielawa – Dobrocin – Jaźwina line, and the Krynka river, which is the boundary on the east (Migoń 2014, 2014a). The hills range in altitude from 350 to 472 meters above sea level, and are mostly composed of igneous and metamorphic rocks, where vertical intrusions of granite in the vicinity of Strzelin draw attention (Kondracki 2009, 218-219). Together, they form a small granite upland divided by wide valleys in long, parallel units (Stuczyński *et al.* 2004, 21). The topography is connected with a favorably extended river network.

This research focuses on society of the Przeworsk culture, which existed in this region from the 2nd century BC until the mid-5th century AD. The population living in the Niemcza-Strzelin Hills area is part of the biggest aggregation of this culture in Lower Silesia: the Bystrzyca-Oława area settlement grouping (Pazda 1980). Characteristic for this cluster is its occurrence on two different landscapes: a lowland part situated on the Wrocław Plain, and an upland part, located in the region discussed in this article.

The database for this paper is a selected catalogue of 622 archaeological sites acquired from AZP resources (Fig. 2). Each of the sites belongs to the Niemcza-Strzelin Hills area. Owing to the fact that terminology and categorisation in AZP data is ambiguous and carried out by multiple authors, a new categorization was implemented. Sites with a quantity

of pottery greater than 10 sherds – whether they were fully excavated, known from surface surveys, or simply archival, prewar sites – are acknowledged as settlements. Sites with fewer than 10 potsherds are known only from surface surveys. Those with a quantity of pottery between 10 and 6 sherds are classified as potential settlements. Settlement points are sites with between 2 and 5 sherds, whereas locations with only one potsherd are marked as settlement traces. Despite the inaccuracies inherent in trying to establish settlement site functions based only on material collected during surface surfaces, AZP resources provide exceedingly valuable data about space in prehistory. The location of sites as far as this research is concerned has an imperative role in relation to their function. On that account, all traces of the existence of the Przeworsk culture in this region that have a precise placement were factored in. Furthermore, the catalogue of sites was complemented by mapping the locations of 5 quartzite and quartzite schist quarries, potential locations of the extraction of schist in the Late Iron Age (Lisowska 2017). Quartzite schists, especially quartzite-sericite ones, were used in tool production – mostly whetstone – and distributed throughout the whole Silesian region (Pazda and Sachanbiński 1991).

The analysis carried out below using GIS software also required data describing the geography of the region. A Digital Elevation Model as well as Land Cover, both acquired from the USGS site, were used. The river network was obtained via Open Street Map servers. The soil map and database were sourced from the Regional Surveying and Cartographic Documentation Centre in Wrocław. Contemporary environmental data cannot be viewed uncritically with regard to prehistoric settlement research. Throughout the history of agricultural land-use, soil cover has undergone many changes. In some areas, soils became overcropped, but it is very important to note at this point that manuring has been applied since the Neolithic, and has continued throughout prehistory (Dreslerová *et al.* 2013; Bell 1992; Bakels 1997; 2009). Modern soils, therefore, are the result of both their natural development as well as anthropogenic factors, which include degradation and manuring. Thus, there is no unambiguous data on the character of soil cover in prehistory. For the reasons set out above, some papers on the subject of paleoenvironment or agriculture in prehistory rely also on contemporary geographical resources. However, this paper also adopts the assumption that although there may have been local changes in climate and soil properties over the years, relative differences between broadly defined climate and main soil units would have remained the same (Dreslerová *et al.* 2013, 1991; Dreslerová *et al.* 2017, 516).

DATA ANALYSIS

Each archaeological site taken into consideration was digitalized, allowing for the possibility of carrying out analyses using Geographical Information Systems software. In the first step of the analysis, the sites were classified according to chronological phases. The

Fig. 1. Niemcza-Strzelin Hills extent, based on Kondracki (2009) after P. Migoń (2014). Edited by the author

next step focused on the site distribution structure. This task was performed using the Average Nearest Neighbour algorithm, which indicates the degree to which settlement in the region takes a clustered or dispersed form. By applying this method, a definitive result is obtained. The compilation of these results for all chronological phases gives valuable insight into changes in the concentration and dispersion of settlement over time, without relying on the subjective evaluation of the researcher (Wheatley and Gillings 2002, 117). In the next stage of study, the density of settlement for each chronological phase was exami-

ned. For the fulfilment of this task, the Kernel Density function was used. In addition to the above analysis, the Median Center tool was used to designate the center for each investigated set of sites. This function aims to show changes in the general tendency of settlement network distribution. Comparison of the central points for each investigated phase allowed for the creation of a map of culminant centres in relation to time. The results of these analyses give a preliminary estimate of the settlement network of the Przeworsk culture in the following study. A key finding from the above is the existence of "settlement stabilizers" – significant locations in the settlement structure of the region, serving as the focus of attention of settlers over long periods of time. After the initial assessment of settlement structure, relationships between archaeological sites and their surroundings were investigated. A settlement-environment analysis was conducted with the aim of picking up certain repetitive patterns, showing villages built in select places, which provided optimal conditions according to the knowledge of the inhabitants. This step helped to establish patterns and settlement strategies of the Przeworsk culture communities in this region. Finally, Cost Distance, Least Cost Path and Viewshed analyses were conducted in an attempt to answer questions connected with the economy and land-use in the area of research. Potential locations of schist extraction were also incorporated into this last analysis.

RESULTS

As an introduction to the analysis, an integrated map for all Przeworsk Culture sites in the region was made. It shows that a significant concentration of settlement is strongly connected with the river network (Fig. 2). The first chronological-settlement map for the Pre-Roman Period was created. All sites with precise dating, as well as those generally described as "Pre-Roman," were included (Fig. 3). The resulting map presents three explicit settlement concentrations: one in the area surrounding the Oleszna and Ślęza Rivers, another in the Mała Ślęza River basin, and a third located in the south among minor tributaries of the Oława River (Złotnik, Dopływ w Henrykowie, Czerna).

The second chronological-settlement map displays sites from the Early Roman Period. Only locations with precise dating from the beginning of the period up to 160 AD were taken into consideration. Sites with the general chronological description "Roman Period" were intentionally disregarded. Their multitude, as well as the considerably long timespan subsumed under the label "Roman Period" (without any further divisions), could disrupt and skew the settlement picture for this phase. The map thus obtained shows the further settlement of the northern areas mentioned above, as well as in the surroundings of the Złotnik River. Settlement in the whole region is reduced (Fig. 4). A settlement peak is visible in the Krynka River area, in comparison to the previous phase.

The next map concentrates on sites dated between 160 AD and 375 AD, which corresponds to the Late Roman Period. In this phase, significant settlement development and

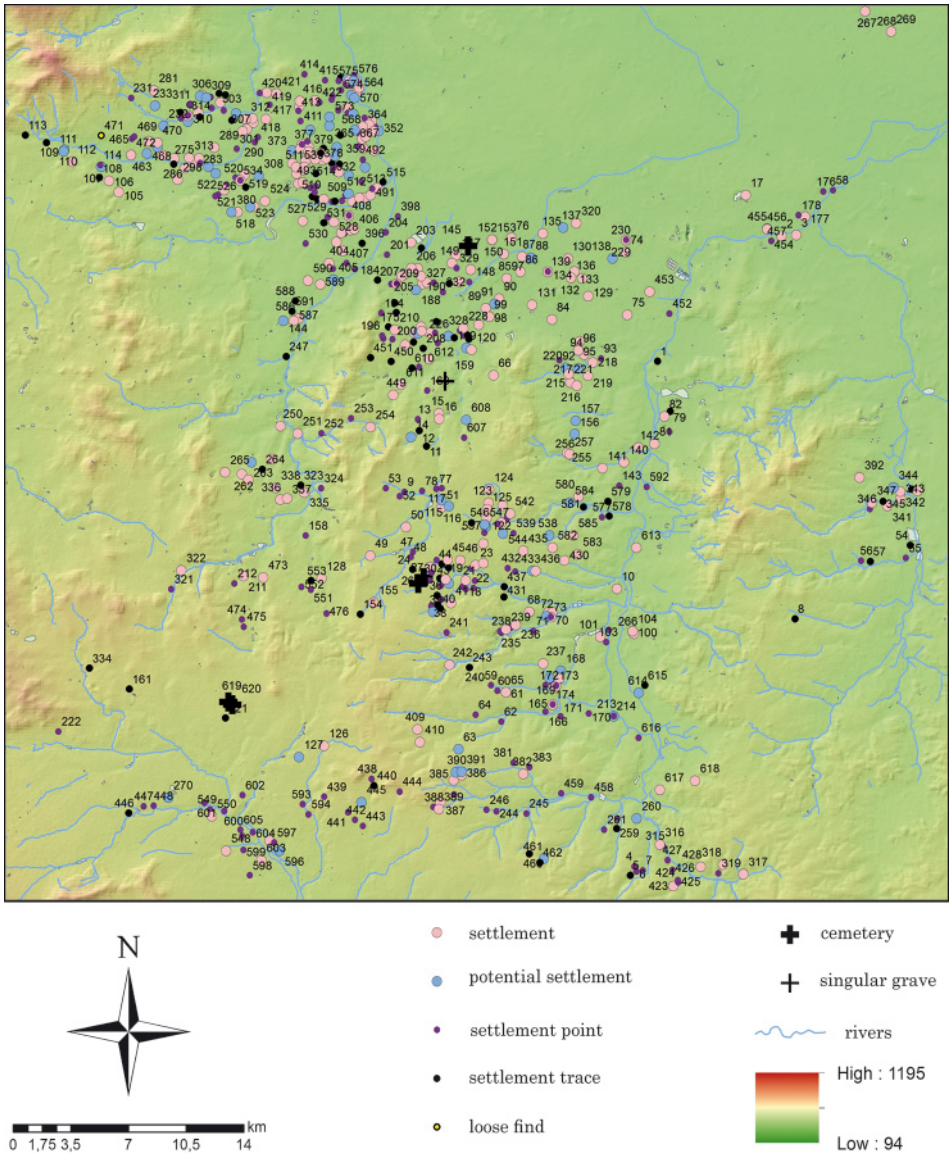


Fig. 2. Przeworsk culture sites within the Niemcza-Strzelin Hills area represented all chronological periods. List of sites (* – site location collected from pre-war maps; lack in AZP data):
1 – Biały Kościół 8, 2 – Biedrzychów 1, 3 – Biedrzychów 2, 4 – Biernacice 8, 5 – Biernacice 4, 6 – Biernacice 6, 7 – Biernacice 7, 8 – Bożnowice 2, 9 – Brochocin 5, 10 – Brukalice 2, 11 – Błotnica 13, 12 – Błotnica 1, 13 – Błotnica 6, 14 – Błotnica 3, 15 – Błotnica 21, 16 – Błotnica 22, 17 – Chociwel 7, 18 – Cienkowice 16, 19 – Cienkowice 1, 20 – Cienkowice 11, 21 – Cienkowice 6, 22 – Cienkowice 15, 23 – Cienkowice 4, 24 – Ciepłowody 8, 25 – Ciepłowody 35, 26 – Ciepłowody 6, 27 – Ciepłowody 39, 28 – Ciepłowody 34, 29 – Ciepłowody 84, 30 – Ciepłowody 69, 31 – Ciepłowody 70, 32 – Ciepłowody 73, 33 – Ciepłowody 26, 34 – Ciepłowody 27, 35 – Ciepłowody 83, 36 – Ciepłowody 7, 37 – Ciepłowody 30, 38 – Ciepłowody 82, 39 – Ciepłowody 81, 40 – Ciepłowody 80, 41 – Ciepło-

wody 9, 42 – Ciepłowody 14, 43 – Ciepłowody 33, 44 – Ciepłowody 60, 45 – Ciepłowody 37, 46 – Ciepłowody 31, 47 – Ciepłowody 92, 48 – Ciepłowody 93, 49 – Ciepłowody 16, 50 – Ciepłowody 10, 51 – Ciepłowody 1, 52 – Ciepłowody 23, 53 – Ciepłowody 124, 54 – Cierpice 3, 55 – Cierpice 4, 56 – Cierpice 8, 57 – Cierpice 9, 58 – Częszyce 3, 59 – Czernczyce 9, 60 – Czernczyce 8, 61 – Czernczyce 18, 62 – Czernczyce 6, 63 – Czernczyce 25, 64 – Czernczyce 23, 65 – Czernczyce 18/1, 66 – Czerwiniec 10, 67 – Czesławice 7 , 68 – Czesławice 6 , 69 – Czesławice 8, 70 – Czesławice 8/22, 71 – Czesławice 10, 72 – Czesławice 7, 73 – Czesławice 8/1/22, 74 – Dobrogoszcz 3, 75 – Dobrogoszcz 1, 76 – Dobrogoszcz 4, 77 – Dobrzenice 1, 78 – Dobrzenice 24, 79 – Gębice 3, 80 – Gębice 11, 81 – Gębice 18, 82 – Gębice 19, 83 – Gołostowice 30, 84 – Gołostowice 38, 85 – Gołostowice 2, 86 – Gołostowice 4, 87 – Gołostowice 32, 88 – Gołostowice 21, 89 – Gołostowice 25, 90 – Gołostowice 5, 91 – Gołostowice 23, 92 – Gołostowice 28, 93 – Gołostowice 11, 94 – Gołostowice 13, 95 – Gołostowice 8, 96 – Gołostowice 8/1, 97 – Gołostowice 2/1, 98 – Górka Sobocka 9, 99 – Górka Sobocka 9/1, 100 – Henryków 3, 101 – Henryków 8, 102 – Henryków 4, 103 – Henryków 7, 104 – Henryków 3/1, 105 – Jaźwina 18, 106 – Jaźwina 14, 107 – Jaźwina 16, 108 – Jaźwina 15, 109 – Jaźwina 25, 110 – Jaźwina 30, 111 – Jaźwina 31, 112 – Jaźwina 33, 113 – Jaźwina 44, 114 – Jaźwina 17, 115 – Jakubów 1, 116 – Jakubów 7 , 117 – Jakubów 13, 118 – Janowiczki 2, 119 – Janowiczki 5, 120 – Janowiczki 3, 121 – Janówka 16, 122 – Janówka 18, 123 – Janówka 6 , 124 – Janówka 7, 125 – Janówka 8, 126 – Jaworek 11, 127 – Jaworek 14, 128 – Karczowice 2, 129 – Karszów 20, 130 – Karszów 16, 131 – Karszów 5, 132 – Karszów 21, 133 – Karszów 17, 134 – Karszów 3, 135 – Karszów 15, 136 – Karszów 18, 137 – Karszów 2, 138 – Karszów 8, 139 – Karszów 3/1, 140 – Kazanów 8, 141 – Kazanów 12, 142 – Kazanów 7, 143 – Kazanów 5, 144 – Kietlin 6, 145 – Kondratowice 3, 146 – Kondratowice 10, 147 – Kondratowice 2, 148 – Kondratowice 9, 149 – Kondratowice 8, 150 – Kondratowice 10, 151 – Kondratowice 4, 152 – Kondratowice 10/1, 153 – Kondratowice 10/2, 154 – Kobyla Głowa 7, 155 – Kobyla Głowa 3, 156 – Komorowice 6, 157 – Komorowice 5, 158 – Koźmice 1, 159 – Kowalskie 1, 160 – Kowalskie 16, 161 – Koziniec 4, 162 – Krzelków 4, 163 – Krzelków 9, 164 – Krzelków 8, 165 – Krzelków 13, 166 – Krzelków 12, 167 – Krzelków 5, 168 – Krzelków 11, 169 – Krzelków 10, 170 – Krzelków 17, 171 – Krzelków 20, 172 – Krzelków 24, 173 – Krzelków 8/1, 174 – Krzelków 13/1, 175 – Krzepice 27, 176 – Krzepice 4, 177 – Krzepice 6, 178 – Krzepice 5, 179 – Księginice Wielkie 80, 180 – Księginice Wielkie 71, 181 – Księginice Wielkie 81, 182 – Księginice Wielkie 49, 183 – Księginice Wielkie 24, 184 – Księginice Wielkie 59, 185 – Księginice Wielkie 48, 186 – Księginice Wielkie 52, 187 – Księginice Wielkie 55, 188 – Księginice Wielkie 56, 189 – Księginice Wielkie 18, 190 – Księginice Wielkie 54, 191 – Księginice Wielkie 75, 192 – Księginice Wielkie 61, 193 – Księginice Wielkie 63, 194 – Księginice Wielkie 67, 195 – Księginice Wielkie 73, 196 – Księginice Wielkie 72, 197 – Księginice Wielkie 10 , 198 – Księginice Wielkie 83, 199 – Księginice Wielkie 82, 200 – Księginice Wielkie 17, 201 – Księginice Wielkie 32, 202 – Księginice Wielkie 39, 203 – Księginice Wielkie 34, 204 – Księginice Wielkie 29, 205 – Księginice Wielkie 44 , 206 – Księginice Wielkie 51, 207 – Księginice Wielkie 12 , 208 – Księginice Wielkie 19, 209 – Księginice Wielkie 12/1, 210 – Księginice Wielkie 71/1 , 211 – Ligota Mała 1, 212 – Ligota Mała 2, 213 – Lipa 1, 214 – Lipa 1/1, 215 – Lipowa 5, 216 – Lipowa 4, 217 – Lipowa 6, 218 – Lipowa 1, 219 – Lipowa 2, 220 – Lipowa 8, 221 – Lipowa 34, 222 – Lutomierz 1, 223 – Maleszów 3, 224 – Maleszów 1, 225 – Maleszów 5, 226 – Maleszów 11, 227 – Maleszów 8, 228 – Maleszów 9, 229 – Mikoszów 2, 230 – Mikoszów 2/1, 231 – Młynica 19, 232 – Młynica 7, 233 – Młynica 12, 234 – Muszkowice 3, 235 – Muszkowice 5, 236 – Muszkowice 7, 237 – Muszkowice 20, 238 – Muszkowice 4, 239 – Muszkowice 9, 240 – Muszkowice 28, 241 – Muszkowice 22, 242 – Muszkowice 26, 243 – Muszkowice 28/1, 244 – Niedźwiednik 18, 245 – Niedźwiednik 7, 246 – Niedźwiednik 9, 247 – Niemcza 75, 248 – Niemcza 62, 249 – Niemcza 70, 250 – Niemcza 1, 251 – Niemcza 3, 252 – Niemcza 29, 253 – Niemcza 35, 254 – Niemcza 36, 255 – Nieszkowice 9, 256 – Nieszkowice 5, 257 – Nieszkowice 5/1, 258 – Nieszków 10, 259 – Nieszków 11, 260 – Nieszków 1, 261 – Nieszków 7, 262 – Nowa Wieś Niemczańska 1, 263 – Nowa Wieś Niemczańska 3, 264 – Nowa Wieś Niemczańska 4, 265 – Nowa Wieś Niemczańska 5, 266 – Nowy Dwór 2, 267 – Ośno 3, 268 – Ośno 4, 269 – Ośno 4/1, 270 – Olbrachcice Wielkie 14, 271 – Oleszna 28, 272 – Oleszna 23, 273 – Oleszna 20, 274 – Oleszna 87, 275 – Oleszna 32, 276 – Oleszna 9, 277 – Oleszna 74, 278 – Oleszna 28, 279 – Oleszna 15 , 280 – Oleszna 85, 281 – Oleszna 26, 282 – Oleszna 12, 283 – Oleszna 49, 284 – Oleszna 54, 285 – Oleszna 57, 286 – Oleszna 52, 287 – Oleszna 11, 288 – Oleszna 92, 289 – Oleszna 31, 290 – Oleszna 48, 291 – Oleszna 63, 292 – Oleszna 43, 293 – Oleszna 25, 294 – Oleszna 45, 295 – Oleszna 44, 296 – Oleszna 86, 297 – Oleszna 81, 298 – Oleszna 33, 299 – Oleszna 77, 300 – Oleszna 88, 301 – Oleszna 84, 302 – Oleszna 91, 303 – Oleszna 90, 304 – Oleszna 78, 305 – Oleszna 65, 306 – Oleszna 40, 307 – Oleszna 5, 308 – Oleszna 67, 309 – Oleszna 97, 310 – Oleszna 18, 311 – Oleszna 23/1, 312 – Oleszna 20/1, 313 – Oleszna 87/1, 314 – Oleszna 18/1, 315 – Osina Mała 2, 316 – Osina Mała 1, 317 – Osina Wielka 2, 318 – Osina Wielka 5, 319 – Osina Wielka 1, 320 – Piotrowice 6, 321 – Piława Górna 3, 322 – Piława Górna 1, 323 – Podlesie 4, 324 – Podlesie 12, 325 – Prusy 1, 326 – Prusy 19, 327 – Prusy 16, 328 – Prusy 26, 329 – Prusy 20, 330 – Prusy 27, 331 – Prusy 28, 332 – Prusy 30, 333 – Prusy 31, 334 – Przedborowa 1, 335 – Przerzeczyn Zdrój 2, 336 – Przerzeczyn Zdrój 3, 337 – Przerzeczyn Zdrój 13, 338 – Przerzeczyn Zdrój 4, 339 – Przeworno 11, 340 –

Przeworno 20, 341 – Przeworno 3, 342 – Przeworno 7, 343 – Przeworno 10, 344 – Przeworno 25, 345 – Przeworno 18, 346 – Przeworno 6, 347 – Przeworno 5, 348 – Radzików 63, 349 – Radzików 83, 350 – Radzików 62, 351 – Radzików 61, 352 – Radzików 64, 353 – Radzików 20, 354 – Radzików 60, 355 – Radzików 31, 356 – Radzików 9, 357 – Radzików 13, 358 – Radzików 17, 359 – Radzików 42, 360 – Radzików 12, 361 – Radzików 15, 362 – Radzików 57, 363 – Radzików 56, 364 – Radzików 14, 365 – Radzików 67, 366 – Radzików 65, 367 – Radzików 26, 368 – Radzików 19, 369 – Radzików 27, 370 – Radzików 53, 371 – Radzików 48, 372 – Radzików 49, 373 – Radzików 46, 374 – Radzików 47, 375 – Radzików 44, 376 – Radzików 55 , 377 – Radzików 19/1, 378 – Radzików 44/1, 379 – Radzików 55/1, 380 – Ratajno 3, 381 – Rososznica 13, 382 – Rososznica 9, 383 – Rososznica 79, 384 – Rososznica 14, 385 – Rososznica 24, 386 – Rososznica 30, 387 – Rososznica 33, 388 – Rososznica 32, 389 – Rososznica 31, 390 – Rososznica 41, 391 – Rososznica 42, 392 – Samborowiczki 2, 393 – Sienice 38, 394 – Sienice 3, 395 – Sienice 11, 396 – Sienice 20, 397 – Sienice 7, 398 – Sienice 36, 399 – Sienice 31, 400 – Sienice 13, 401 – Sienice 5, 402 – Sienice 4, 403 – Sienice 8, 404 – Sienice 6, 405 – Sienice 35, 406 – Sienice 10, 407 – Sienice 14, 408 – Sienice 11/1, 409 – Sieroszów 3, 410 – Sieroszów 4, 411 – Sokolniki 33, 412 – Sokolniki 31, 413 – Sokolniki 34, 414 – Sokolniki 24, 415 – Sokolniki 30, 416 – Sokolniki 28, 417 – Sokolniki 12, 418 – Sokolniki 16, 419 – Sokolniki 2, 420 – Sokolniki 9, 421 – Sokolniki 8, 422 – Sokolniki 27, 423 – Starczówek 5, 424 – Starczówek 6, 425 – Starczówek 11, 426 – Starczówek 7, 427 – Starczówek 9, 428 – Starczówek 10, 429 – Stary Henryków 13, 430 – Stary Henryków 17, 431 – Stary Henryków 5, 432 – Stary Henryków 12, 433 – Stary Henryków 14, 434 – Stary Henryków 11, 435 – Stary Henryków 19, 436 – Stary Henryków 15, 437 – Stary Henryków 7, 438 – Stolec 4, 439 – Stolec 14, 440 – Stolec 20, 441 – Stolec 21, 442 – Stolec 25, 443 – Stolec 27, 444 – Stolec 44, 445 – Stolec 47, 446 – Stoszowice 7, 447 – Stoszowice 18, 448 – Stoszowice 11, 449 – Strachów 4, 450 – Strachów 7, 451 – Strachów 16, 452 – Strzegów 3, 453 – Strzegów 4, 454 – Strzelin 18, 455 – Strzelin 15, 456 – Strzelin 15/1, 457 – Strzelin 18/1, 458 – Służejów 3, 459 – Służejów 5, 460 – Służejów 6, 461 – Służejów 8, 462 – Służejów 9, 463 – Słupice 1, 464 – Słupice 30 , 465 – Słupice 10, 466 – Słupice 27, 467 – Słupice 31, 468 – Słupice 12, 469 – Słupice 17, 470 – Słupice 29, 471 – Słupice 8, 472 – Słupice 1/1, 473 – Sulisławice 8, 474 – Sulisławice 20, 475 – Sulisławice 3, 476 – Szklary 2, 477 – Łagiewniki 4, 478 – Łagiewniki 122, 479 – Łagiewniki 177, 480 – Łagiewniki 91, 481 – Łagiewniki 67, 482 – Łagiewniki 113, 483 – Łagiewniki 114, 484 – Łagiewniki 76, 485 – Łagiewniki 71, 486 – Łagiewniki 97, 487 – Łagiewniki 119, 488 – Łagiewniki 112, 489 – Łagiewniki 89, 490 – Łagiewniki 115, 491 – Łagiewniki 90, 492 – Łagiewniki 106, 493 – Łagiewniki 73, 494 – Łagiewniki 78, 495 – Łagiewniki 72, 496 – Łagiewniki 109, 497 – Łagiewniki 84, 498 – Łagiewniki 70, 499 – Łagiewniki 74, 500 – Łagiewniki 77, 501 – Łagiewniki 75, 502 – Łagiewniki 118, 503 – Łagiewniki 104, 504 – Łagiewniki 87, 505 – Łagiewniki 121, 506 – Łagiewniki 83, 507 – Łagiewniki 107, 508 – Łagiewniki 88, 509 – Łagiewniki 79, 510 – Łagiewniki 69, 511 – Łagiewniki 66, 512 – Łagiewniki 85, 513 – Łagiewniki 81, 514 – Łagiewniki 68, 515 – Łagiewniki 1, 516 – Łagiewniki 34, 517 – Łagiewniki 39, 518 – Łagiewniki 42, 519 – Łagiewniki 27, 520 – Łagiewniki 29, 521 – Łagiewniki 33, 522 – Łagiewniki 32, 523 – Łagiewniki 41, 524 – Łagiewniki 6, 525 – Łagiewniki 4, 526 – Łagiewniki 28, 527 – Łagiewniki 17, 528 – Łagiewniki 16, 529 – Łagiewniki 15, 530 – Łagiewniki 11, 531 – Łagiewniki 23, 532 – Łagiewniki 111, 533 – Łagiewniki 177/1, 534 – Łagiewniki 29/1, 535 – Targowica 3, 536 – Targowica 21, 537 – Targowica 22, 538 – Targowica 12, 539 – Targowica 17, 540 – Targowica 10, 541 – Targowica 9, 542 – Targowica 27, 543 – Targowica 8, 544 – Targowica 18, 545 – Targowica 28, 546 – Targowica 23, 547 – Targowica 23/1, 548 – Tarnów 10, 549 – Tarnów 17, 550 – Tarnów 18, 551 – Tomice 3, 552 – Tomice 2, 553 – Tomice 1, 554 – Trzebnik 3, 555 – Trzebnik 26, 556 – Trzebnik 28, 557 – Trzebnik 2, 558 – Trzebnik 24, 559 – Trzebnik 25, 560 – Trzebnik 12, 561 – Trzebnik 19, 562 – Trzebnik 27, 563 – Trzebnik 6, 564 – Trzebnik 5, 565 – Trzebnik 1, 566 – Trzebnik 23, 567 – Trzebnik 7, 568 – Trzebnik 13, 569 – Trzebnik 22, 570 – Trzebnik 20, 571 – Trzebnik 21, 572 – Trzebnik 4, 573 – Trzebnik 10, 574 – Trzebnik 8, 575 – Trzebnik 3/1, 576 – Trzebnik 26/1, 577 – Wadochowice 6, 578 – Wadochowice 10, 579 – Wadochowice 8, 580 – Wilamowice 7, 581 – Wilamowice 3, 582 – Wilamowice 14, 583 – Wilamowice 12, 584 – Wilamowice 5, 585 – Wilamowice 10, 586 – Wilków Wielki 15, 587 – Wilków Wielki 16, 588 – Wilków Wielki 6, 589 – Wilków Wielki 7, 590 – Wilków Wielki 13, 591 – Wilków Wielki 17, 592 – Witostowice 7, 593 – Ząbkowice Śląskie 1, 594 – Ząbkowice Śląskie 3, 595 – Ząbkowice Śląskie 45, 596 – Ząbkowice Śląskie 50, 597 – Ząbkowice Śląskie 66, 598 – Ząbkowice Śląskie 67, 599 – Ząbkowice Śląskie 68, 600 – Ząbkowice Śląskie 70, 601 – Ząbkowice Śląskie 23, 602 – Ząbkowice Śląskie 27, 603 – Ząbkowice Śląskie 44, 604 – Ząbkowice Śląskie 48, 605 – Ząbkowice Śląskie 54, 606 – Ząbkowice Śląskie 69, 607 – Zarzyca 8, 608 – Zarzyca 18, 609 – Żelowice 28, 610 – Żelowice 5, 611 – Żelowice 7, 612 – Żelowice 6, 613 – Ziębice 3, 614 – Ziębice 1, 615 – Ziębice 6, 616 – Ziębice 9, 617 – Ziębice 12, 618 – Ziębice 25, 619 – Zwrócona 1, 620 – Zwrócona 2, 621 – Zwrócona 4, 622 – Rososznica 21*

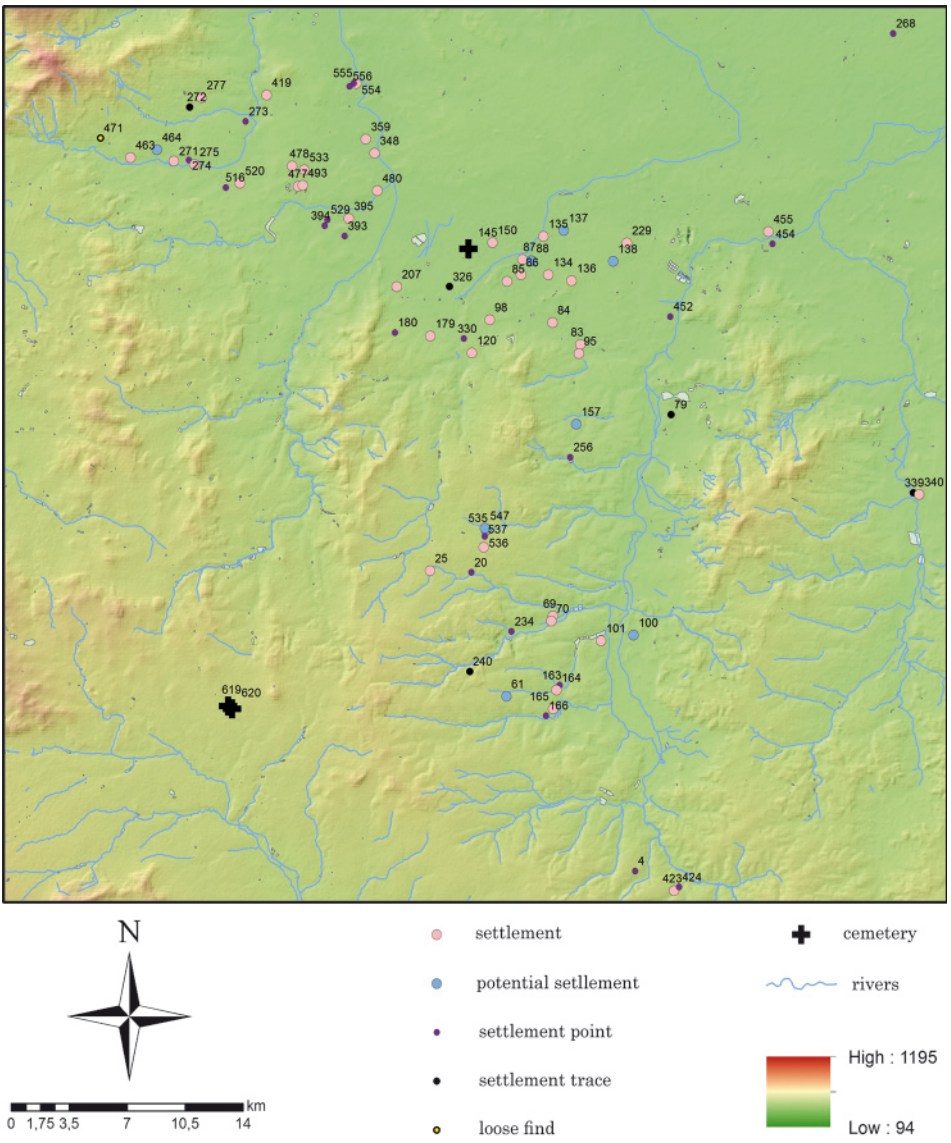


Fig. 3. Przeworsk culture sites within the Niemcza-Strzelin Hills area in the Pre-Roman Period

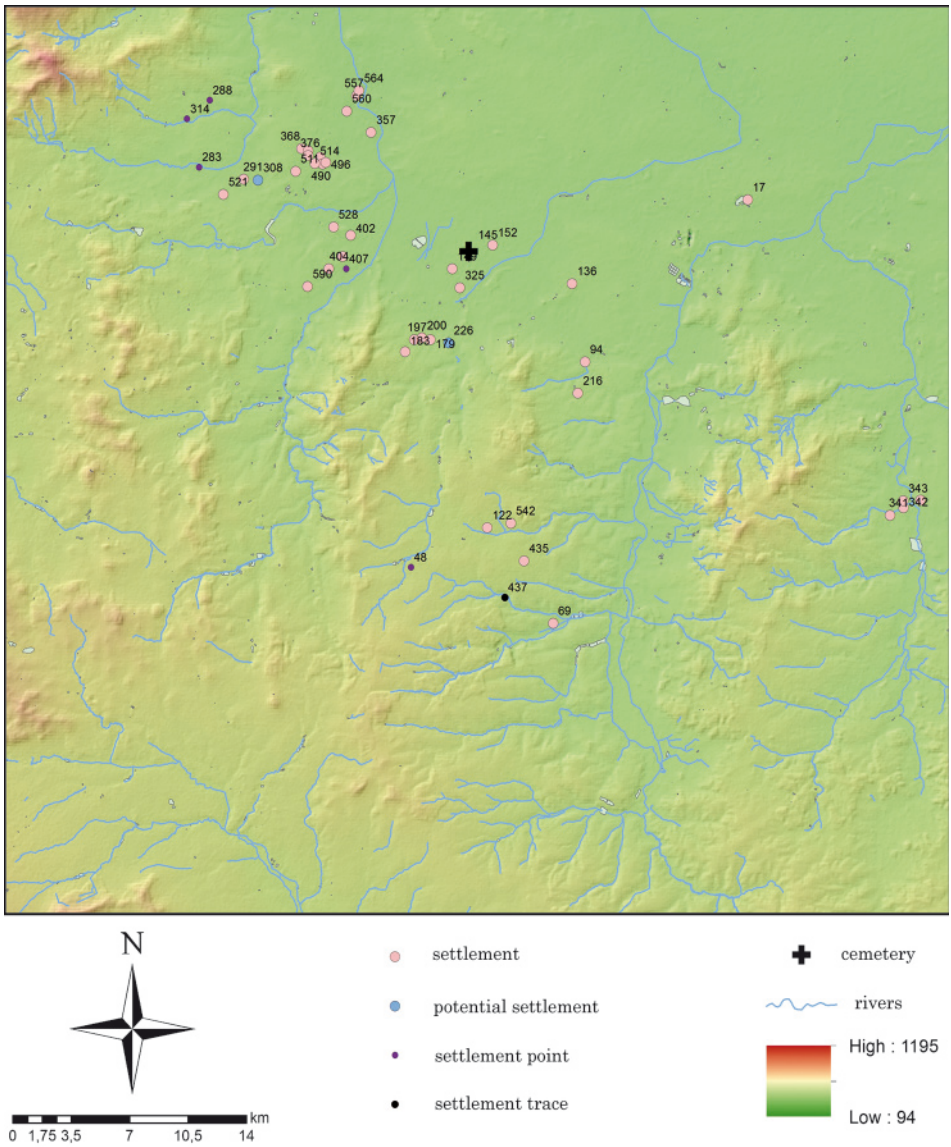


Fig. 4. Przeworsk culture sites within the Niemcza-Strzelin Hills area in the Early Roman Period

expansion is visible both in the northern and southern parts of the region. The great density of settlement in the Ślęza and Mała Ślęza River basins is striking (Fig. 5). New settlement appears across the Oława river, and there is a further development of previous settlement along the Oława tributaries and those far south. New material appears in the Budzówka River basin and by the neighboring Zatoka Creek. This grouping is also the most southern part of this settlement region.

The fourth map is comprised of all sites dating to the Migration Period, including those with precise dating and those with only general dating (Fig. 6). Here, the first significant degradation of settlement is conspicuous. Over half of the sites disappear from the region. Nevertheless, there is no collapse of settlement structures. The northern groups remain, even though these were the ones affected by the greatest attrition. Considerable development is observed in the Oława River basin. An accumulation of compact settlement is also visible in the area of the Krynka River basin and the upper Oława River basin right before the Krynka estuary. Development is also present in Budzówka River basin.

For the above sets of settlements, the Average Nearest Neighbour analysis was carried out. Its aim was to evaluate in an objective way the structure of site distribution. For all phases, the algorithm confirmed clustered settlement, whilst ensuring that there is less than a 1% likelihood that this clustered pattern could be the result of random chance (Fig. 7).

In the next stage of analysis, the density of the settlement network was examined. The results show the migration of settlement density from north to south over time (Fig. 8). During almost the entire duration of the Przeworsk culture, the tendency toward accumulation of sites in the areas of the Ślęza and Mała Ślęza River basins is visible. The second of these rivers, especially in its upper run, increases significantly in importance in the Late Roman Period. Density analysis shows that in the Migration Period, settlement concentrates in the Oława River basin, while a drastic decline of settlement is seen around the Mała Ślęza. The area around the left tributaries of the Oława River, between the river itself and the Szklarski Massif, shows a particularly high density of settlement at this time.

The above analyses were supplemented by the designation of central points for each of the discussed phases (Fig. 9). The results show how the central point of settlement shifts in the landscape across the timeline, visibly migrating from north to south. This analysis additionally underscores the previously-mentioned domination of the Oława River basin in the Migration Period, in comparison to the Mała Ślęza, which was so well settled and developed in the Late Roman Period.

To gain a better understanding of the settlement network, another step was added to the analysis, in which so-called settlement stabilizers were identified. According to the adopted criteria, a stabilizer is a settlement in continuous existence through a minimum of 4 phases. The resulting map shows 10 locations, 9 of which probably were inhabited continuously for 4 phases; the tenth may have been inhabited throughout 6 phases — the entire duration of the Przeworsk culture (Fig. 10). Two concentrations of settlements can be

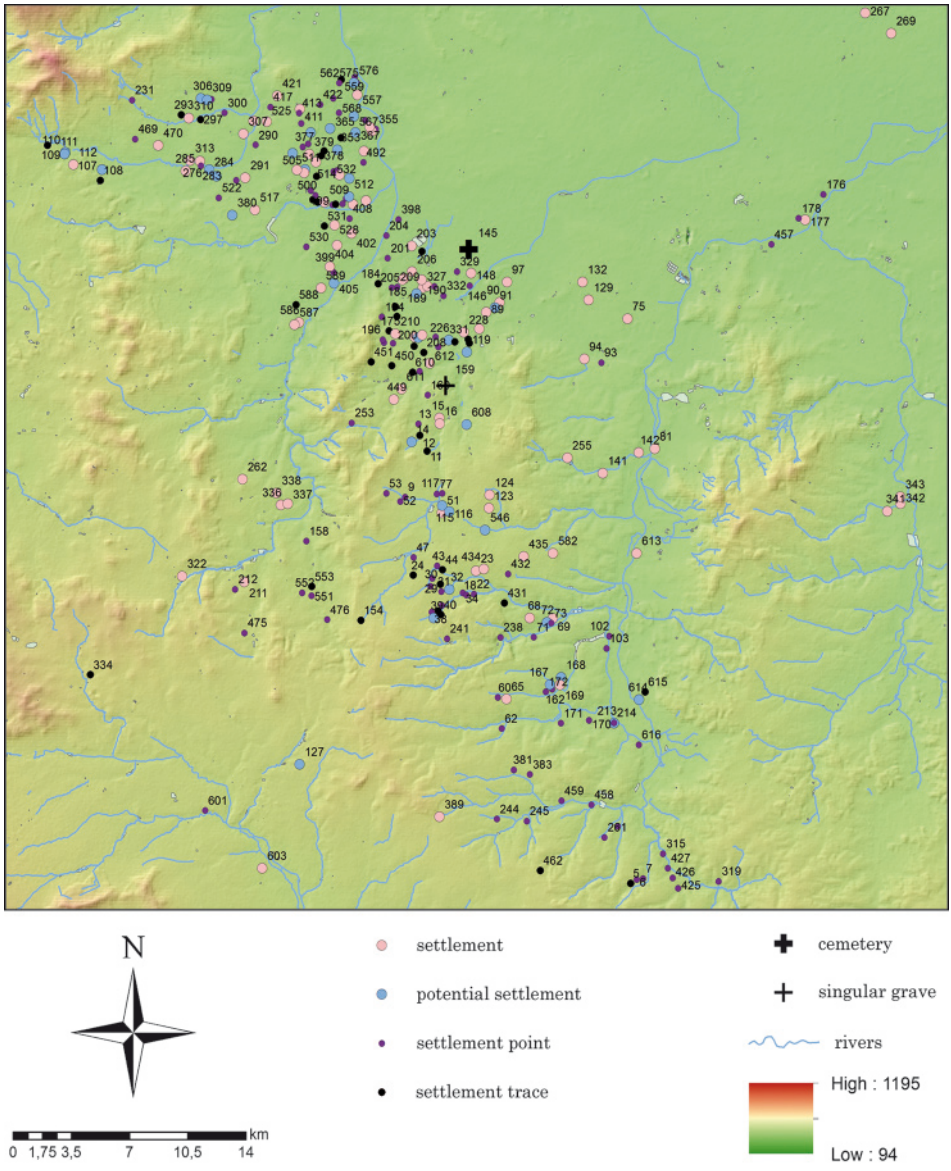


Fig. 5. Przeworsk culture sites within the Niemcza-Strzelin Hills area in the Late Roman Period

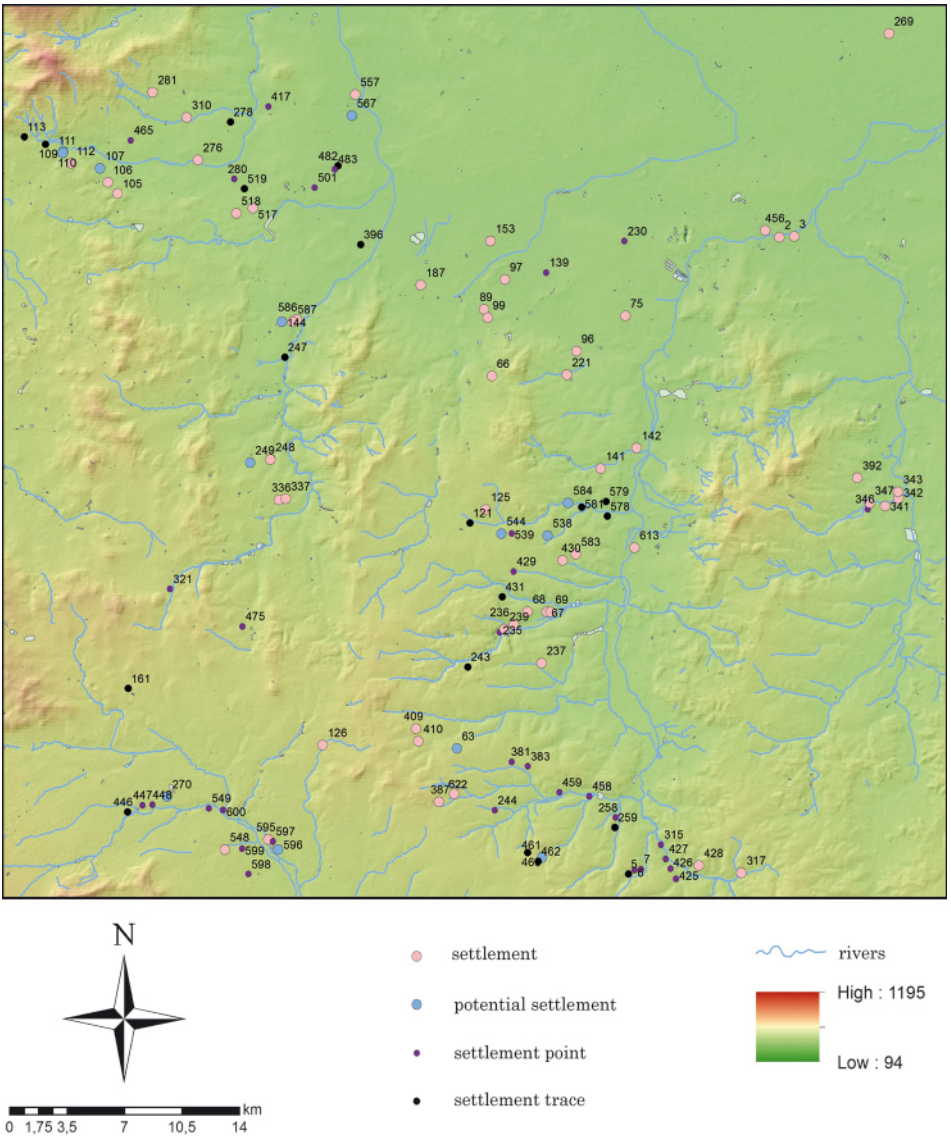
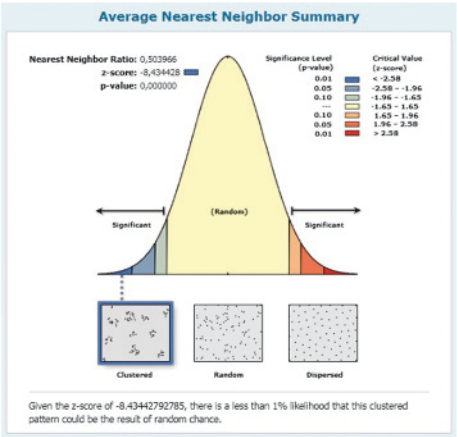


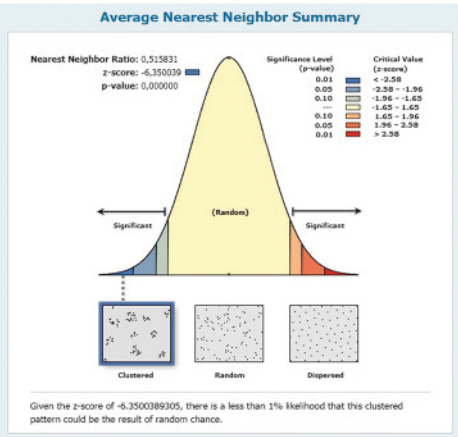
Fig. 6. Przeworsk culture sites within the Niemcza-Strzelin Hills area in the Migration Period

A



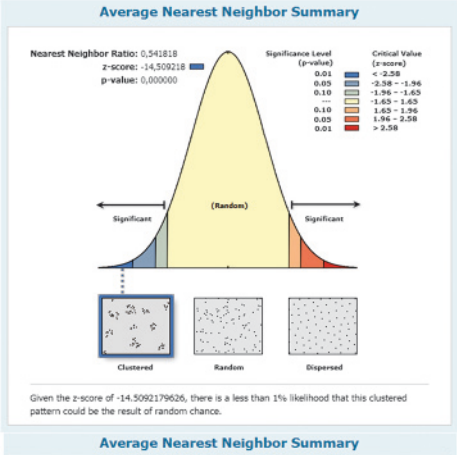
Average Nearest Neighbor Summary	
Observed Mean Distance:	1363,3310 Meters
Expected Mean Distance:	2705,2029 Meters
Nearest Neighbor Ratio:	0,503966
z-score:	-8,434428
p-value:	0,000000

B



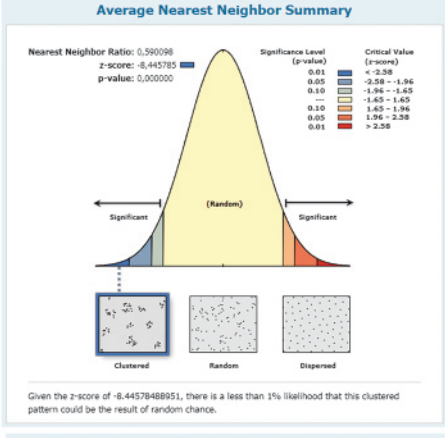
Average Nearest Neighbor Summary	
Observed Mean Distance:	1475,4909 Meters
Expected Mean Distance:	2860,4128 Meters
Nearest Neighbor Ratio:	0,515831
z-score:	-6,350039
p-value:	0,000000

C



Average Nearest Neighbor Summary	
Observed Mean Distance:	865,1115 Meters
Expected Mean Distance:	1596,6824 Meters
Nearest Neighbor Ratio:	0,541818
z-score:	-14,509218
p-value:	0,000000

D



Average Nearest Neighbor Summary	
Observed Mean Distance:	1502,8424 Meters
Expected Mean Distance:	2546,7678 Meters
Nearest Neighbor Ratio:	0,590098
z-score:	-8,445785
p-value:	0,000000

Fig. 7. Average Nearest Neighbour reports for each individual chronological period;
A – Pre-Roman Period, B – Early Roman Period, C – Late Roman Period, D – Migration Period

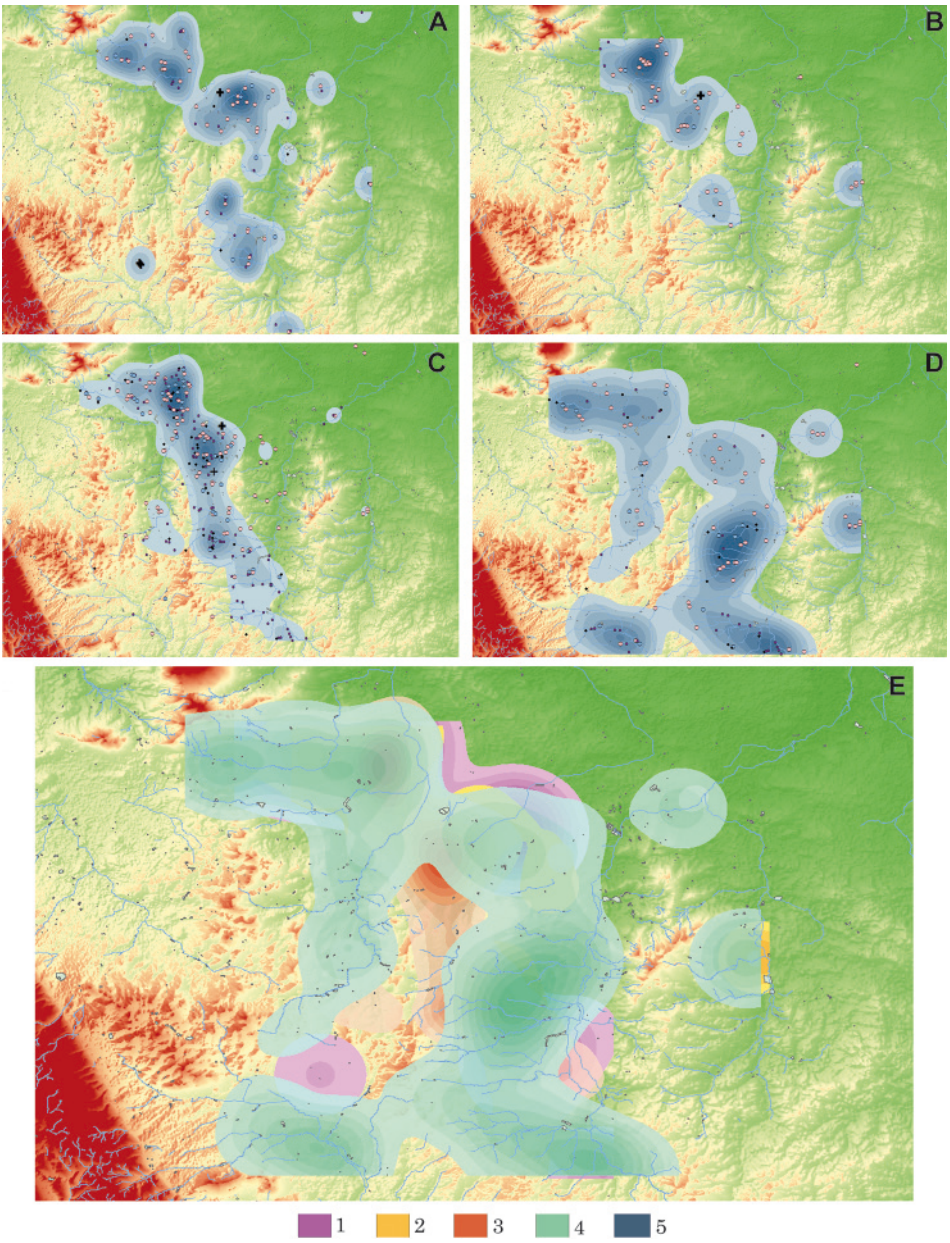


Fig. 8. Kernel Density analysis results for each individual chronological period, and aggregate map; A – Pre-Roman Period, B – Early Roman Period, C – Late Roman Period, D – Migration Period, E – mosaic of settlement density for all periods; For picture E: 1 – settlement density in Pre-Roman Period, 2 – settlement density in Early Roman Period, 3 – settlement density in Late Roman Period, 4 – settlement density in Migration Period; For pictures A, B, C, D: 5 – settlement density for individual periods

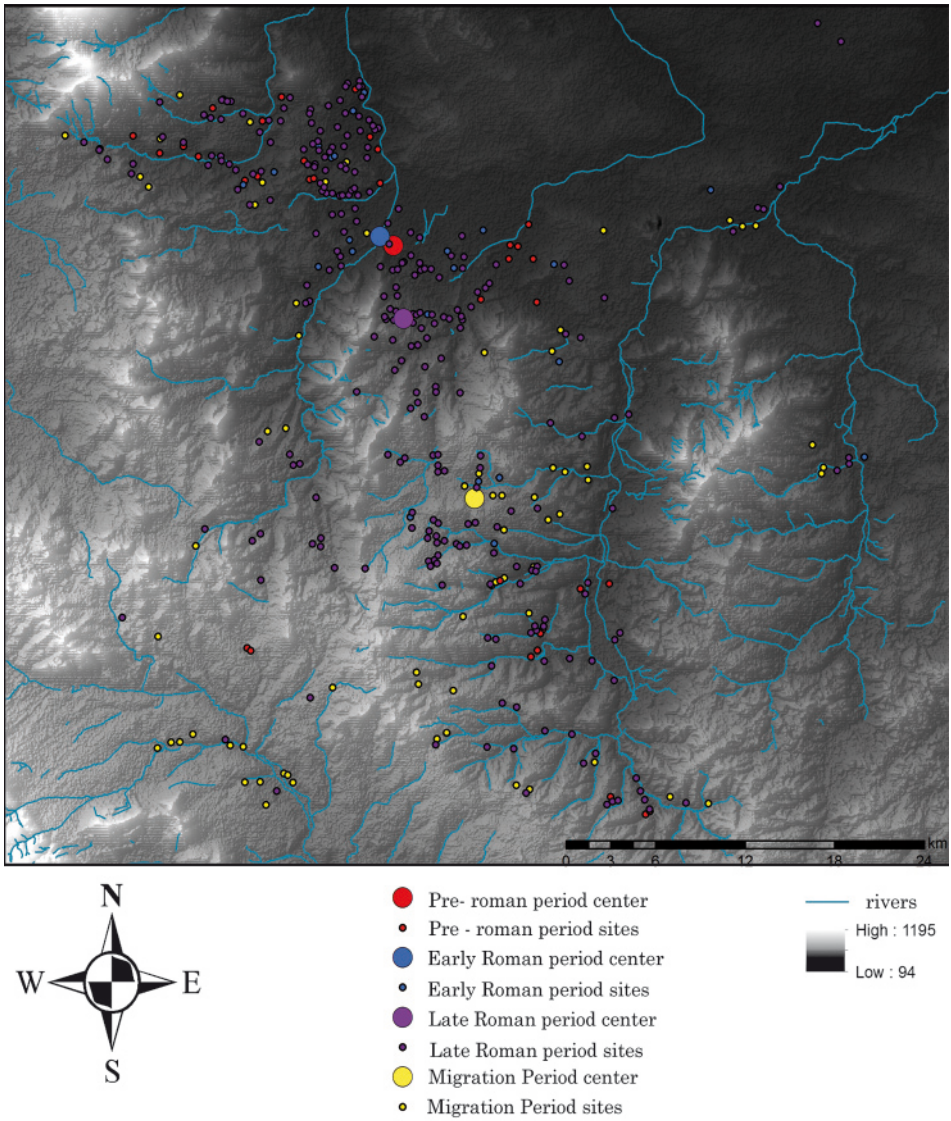


Fig. 9. Median Center analysis results for each individual chronological period of the Przeworsk culture

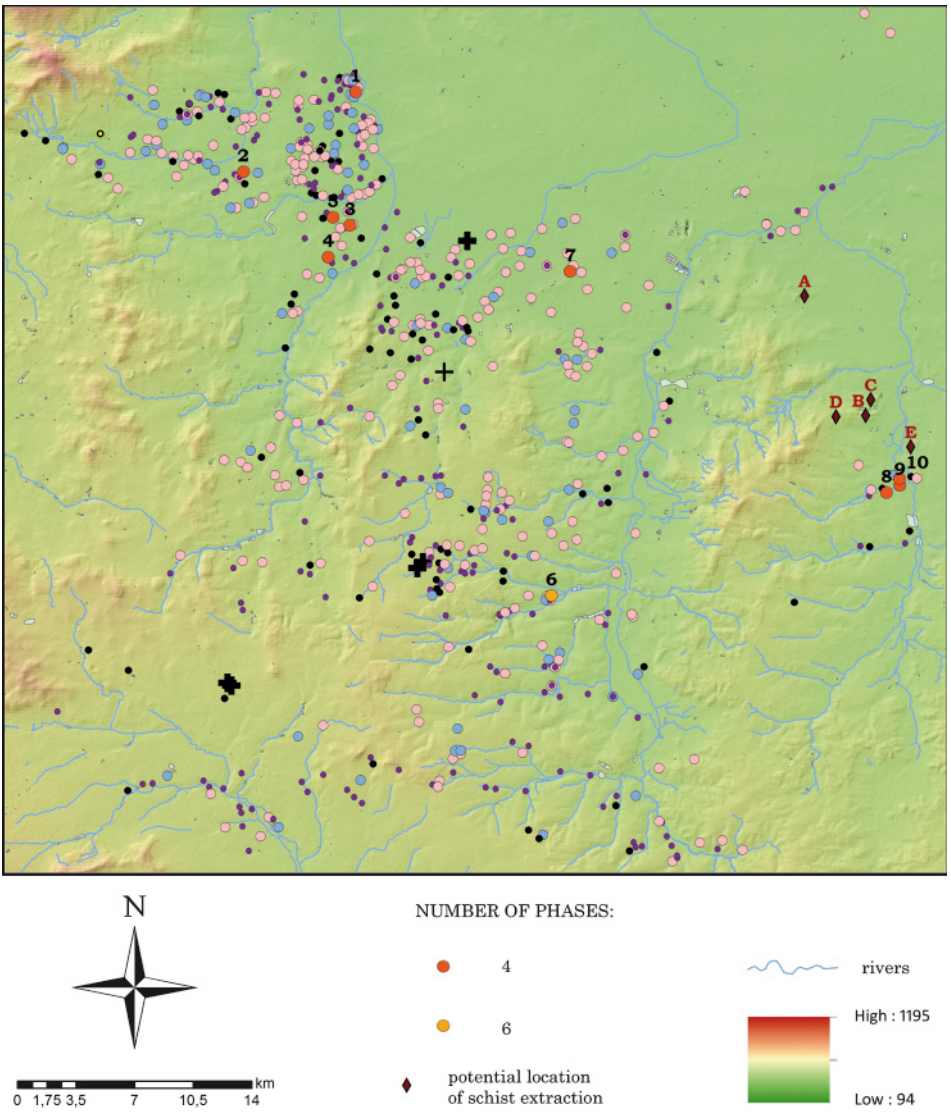


Fig. 10. Distribution of settlement stabilizers against the background of Przeworsk Culture settlement in the Niemcza-Strzelin Hills area and potential locations of schist extraction; 1 – Trzebnik, stan. 86-27/148/2, 2 – Oleszna, stan. 86-26/130/63, 3 – Sienice, stan. 87-27/15/4, 4 – Sienice, stan. 87-27/17/6, 5 – Łagiewniki stan. 87-27/4/16, 6 – Czesławice stan. 89-28/75/8, 7 – Karszów stan. 87-28/67/18, 8 – Przeworno, stan. 89-30/3/3, 9 – Przeworno, stan. 89-30/5/7, 10 – Przeworno, stan. 89-30/8/10; A – quartzite quarry in Kuropatnik, B – quartzite schist quarry next to Goethe's crag and tail, C – quartzite schist quarry in Jegłowa, D – quartzite quarry in Krowiniec, E – quartzite quarry on Kryształowa Mountain

seen: one is connected with the north-western part of the region, essentially coinciding with the Ślęza River basin; the second corresponds to the potential location of a schist extraction area in the Krynka River basin. Stabilizer 6: Czesławice 8 is located in the south, at the confluence of the Złotnik and Cienkówka Rivers.

Additional analyses were carried out with regard to which environmental conditions were preferred. The relationships between sites and environmental features such as slope aspect, hillside slope, absolute altitude, water source, and type of soils were investigated. Some preferences in the selection of settlement locations are visible. For the Pre-Roman Period, locations with southeasterly and easterly aspects predominate. In the Early Roman Period, settlements located on an easterly aspect are the most numerous, and following closely behind are those with north and northeasterly aspects. A similar situation is visible in the Late Roman Period, where settlement focuses on sites with easterly aspect slopes, while a secondary role is taken by northeasterly and southeasterly aspects. The biggest change is visible in settlement patterns during the Migration Period, where the majority of sites are found in locations with north and northeasterly aspects, followed by those with easterly aspects. With regard to hillside slope, the value is standardized throughout the existence of the Przeworsk culture, never exceeding 2° (Table 1). Turning to the relation between settlement and absolute altitude, for the Pre-Roman, Early and Late Roman Periods, the majority of settlements were built in the range of 154-193 meters above the sea level. Here also, the pattern is disrupted during the Migration Period, where the majority of settlements are located in the range of 220-237 meters above the sea level. The distance of sites from water sources is variable. The greatest distance, 700 meters, was measured for the Pre-Roman Period. In the next phases, this value fluctuates around 600 meters. It should be pointed out that this analysis was performed based on contemporary river networks. Prehistoric water resources might have been more diverse (currently non-existing lakes, for example the Strzelin Lake Region, creeks, rivers spurs; Fig. 11-14).

Based on soil data analysis, it could be said that the population of this region made full use of the potential of regional soils, settling first of all on good and very good classes of soils. According to the analysis, the leading role belongs to black earths and cambisols. In the Pre-Roman period, settlement was focused in areas of black earths; cambisols were used as well, but less frequently. During the Early Roman Period, cambisoils and black earths are still the preeminent soils used, but they are used equally at this time. The Late Roman Period is characterized by a substantial increase in the use of cambisols in relation to black earths. In the Migration Period, the vast majority of settlement sites are located on cambisols, and in second place are black earths. Only singular sites are located on types of soil other than those mentioned above.

This analysis was also conducted for all settlements marked as stabilizers. A large majority of them are located on black-earth areas. Singular sites are located in areas with cambisols and their sub-types. Single-phase sites were investigated as well, which showed a similar tendency as the multi-phase settlements of the Late Roman and Migration Periods.

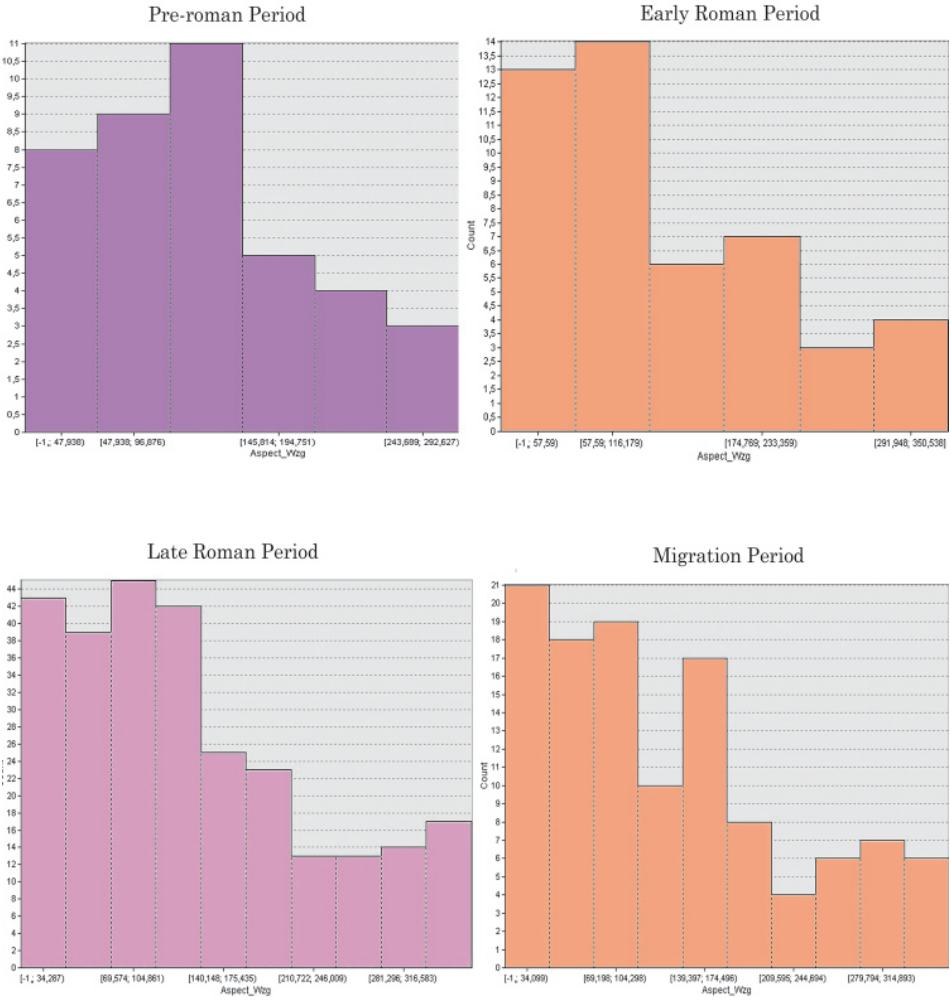


Fig. 11. Distribution of sites according to slope aspect

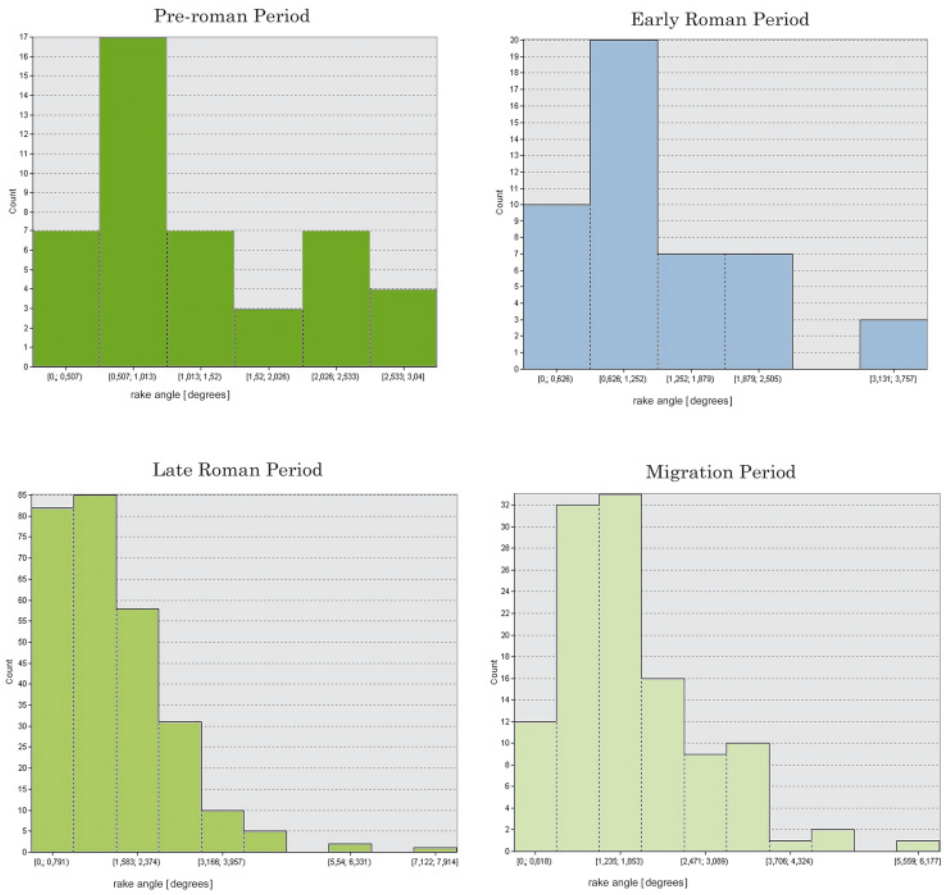


Fig. 12. Distribution of sites according to hillside slope. Description in the table (Table 1)

Table 1. Hillside slope description. Based on Lemkowska (2012a)

Rake angle [°]	Description	Construction fitness	Danger of erosion
<2°	Flat terrain	Beneficial	Infinitesimal
2-3°	Very mild slopes	Beneficial	Low
3-6°	Mild slopes	Medium beneficial	Medium
6°-10°	Medium slopes	Unfavorable	High
10-15°	Medium steep slopes	Unfavorable	Very high
15-20°	Very steep slopes	Unfavorable	Very high
20-30°	Sheer slopes	Unfavorable	Very high

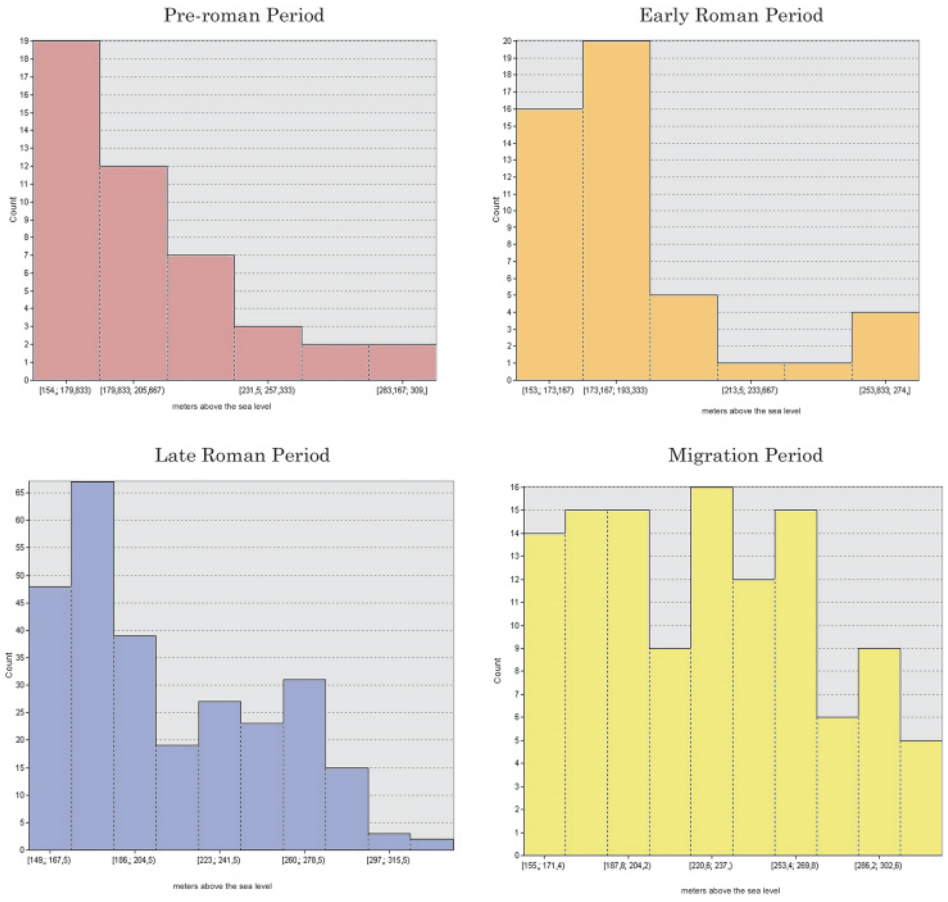


Fig. 13. Distribution of sites according to absolute altitude

Cambisols are the predominant soil types found in settlement areas, with black earths following in second place (Fig. 15).

Based on this part of the analysis, it can be concluded that in the first phase of settlement, when it was not so extensive, soils of the best quality – the black earths – were used. In the Early Roman Period, settlement was slightly reduced, but new locations continued to appear on new terrain, which is probably the reason for the parity in ranking between black earths and cambisols during this phase. The major increase in the use of cambisols in the Late Roman Period is most likely connected with the population peak at this time. Settlement development on a big scale and the settling of new areas – still with good quality soils – is characteristic for this period. A similar situation is observed during the Migration

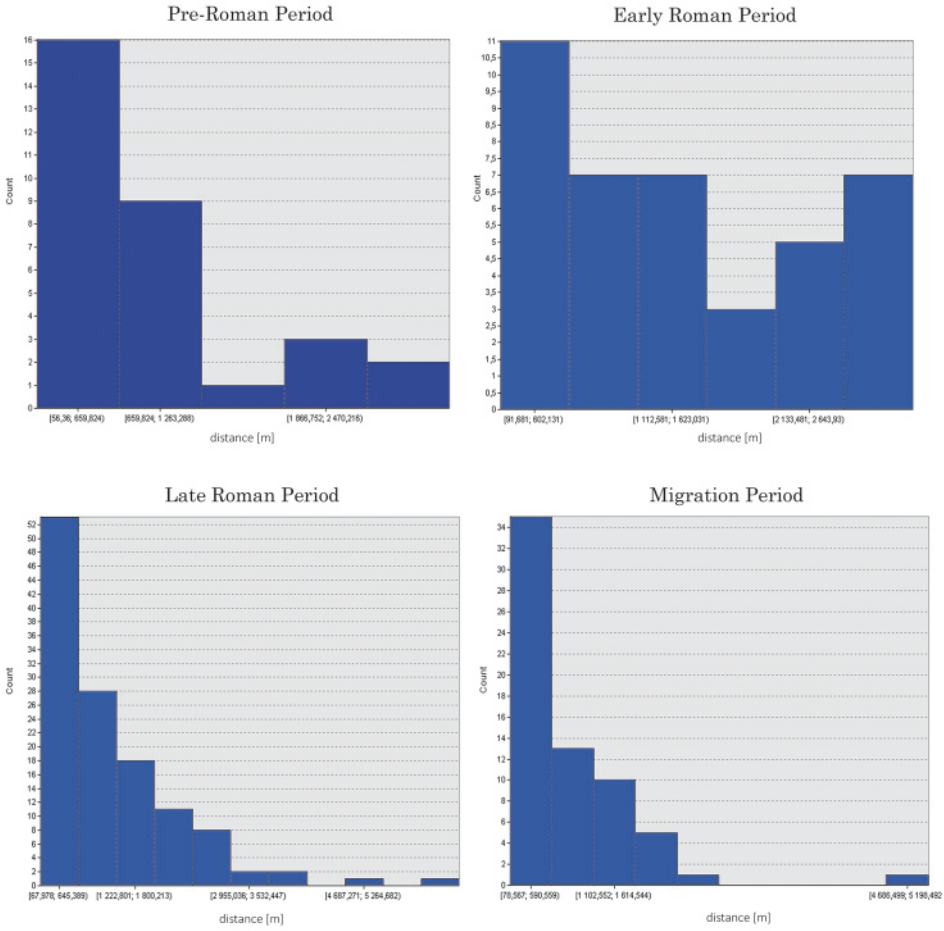


Fig. 14. Distribution of sites according to water source

Period. It can be said that in relation to the previous phases, the smallest number of sites were located on soils other than cambisols and black earths during this period.

It is important to note that this pattern of settlement structure in relation to soil type is conditioned by the prevalence of cambisols relative to black earths in the region; the more settlement, the greater the contribution of cambisols, as those are the soils more available, common, numerous in the region.

It should be said that in the early phases of Przeworsk culture development (Pre-Roman and Early Roman Periods), high-class and good-class wheat soil complexes were the majority of those used. A similar situation applies to stabilizers, where the high-class wheat soil complex predominates, because all such sites were founded in the early phases. In the

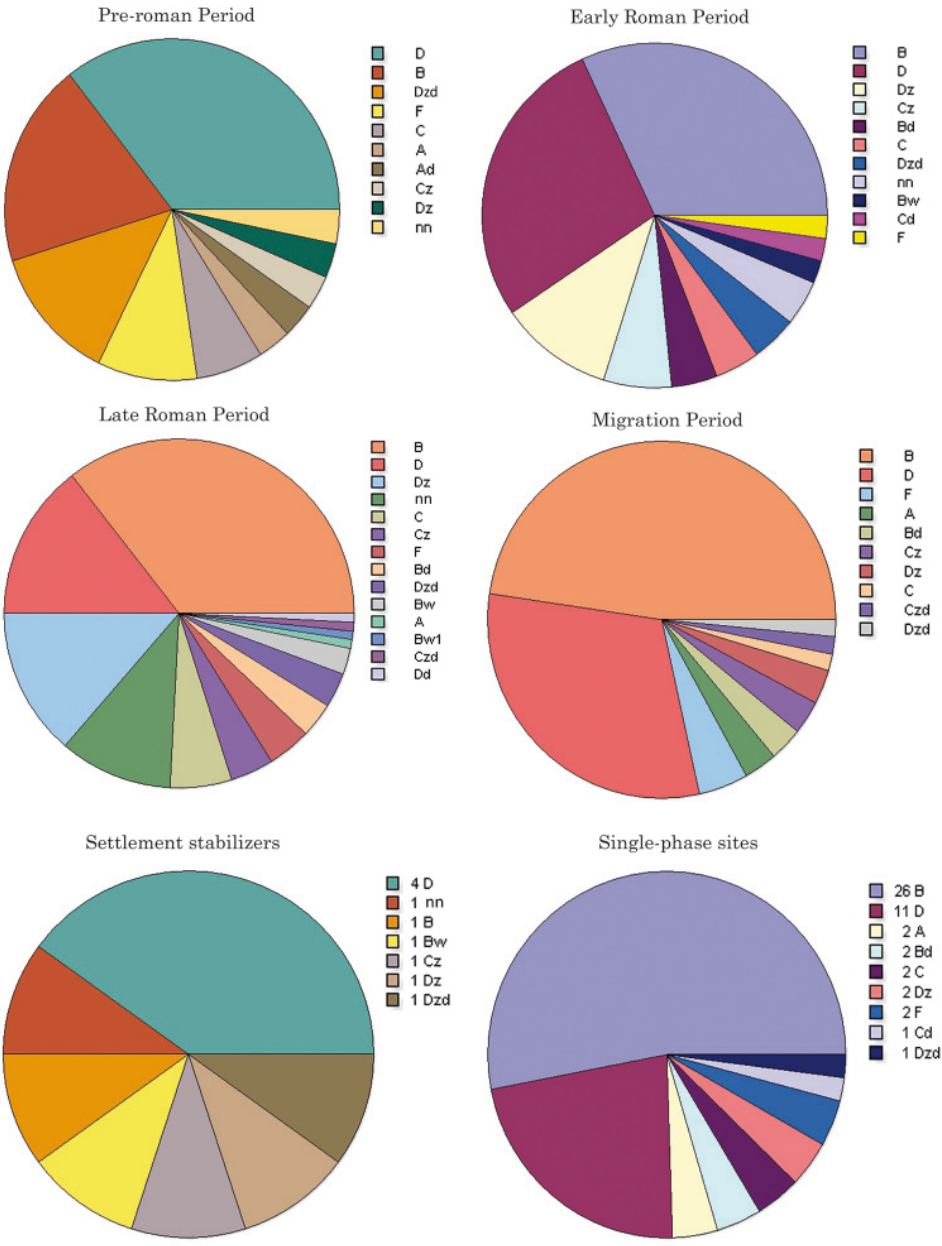


Fig. 15. Distribution of sites according to type of soils. List of the soil symbols with description (based on Lemkowska 2012): A – podzolic and clay-illuvial soils, Ad – deluvial podzolic and clay-illuvial soils, B – typical cambisols, Bd – deluvial cambisols, Bw – acid cambisols, C – typical chernozems, Cd – deluvial chernozems, Cz – degraded chernozems, Czd – deluvial degraded chernozems, D – typical black earths, Dd – deluvial black earths, Dz – degraded black earths, Dzd – degraded deluvial black earths, F – alluvial soils, nn – no data

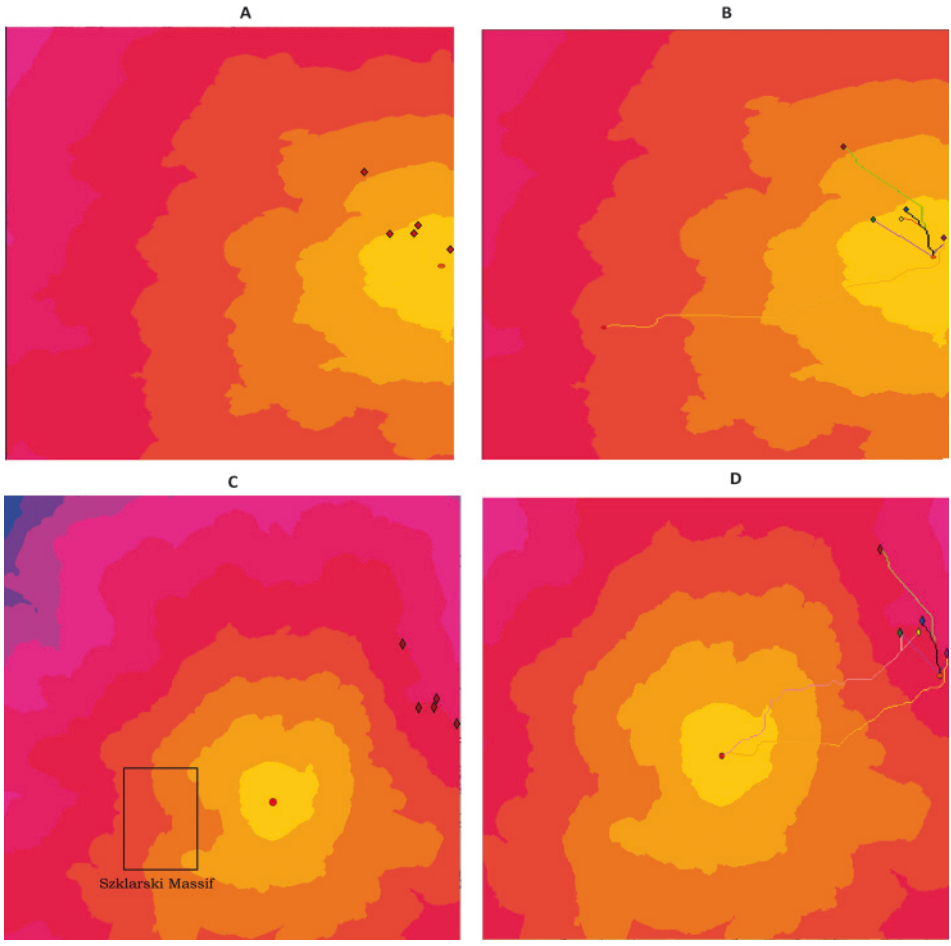


Fig. 16. Cost Distance analysis results for chosen settlement stabilizers;
A – B – stabilizer 10; C – D – stabilizer 6

Late Roman Period, sites located on flawed-class wheat soil, good-class rye soil and poor-quality rye soil complexes appear; no earlier Przeworsk settlements have been recorded on these soil types in the region. This tendency persists in the Migration Period, where the majority of sites occur on good-quality wheat soil complexes, and occasionally on good-quality rye soils as well. The fact that these are modern classifications notwithstanding, these patterns quite likely reflect real changes that took place in the Central European Lowlands in the Late Roman Period. Rye began to be cultivated eagerly. Changes in agriculture were preceded by population growth, dated to the B2 – C1a phases, which contri-

buted to the use of poorer-quality soils (Godłowski 1985; Żygadło 2011, 182). The increasing popularity of rye cultivation can be linked to improvements made in the construction of plowing equipment, since it required deeper ploughing than other types of cereals (Żygadło 2011, 182). An example of an iron coulter is known from the archival site of Rososznica 21, located in the southern part of the region in question, dated to the Migration Period (Bohr 2014; Żygadło 2011; Nowothnig 1939).

In the next stage of research, Cost Distance analysis was carried out for two chosen settlement stabilizers (6 and 10), which demonstrate the strongest probability of relations with other economic domains, apart from agriculture. The aim of this analysis is to estimate the effort (or "cost") required to reach other locations from the points in question (Fig. 16). Results A and B are related to stabilizer 10. It is clearly shown that 4 potential locations of schist extraction are situated in places where the effort required to reach them is the lowest. The most isolated and furthest to the north of these 4 locations is associated with a higher, but still reasonable cost. The same analysis carried out for stabilizer 6 (results C and D) shows that the actual cost to reach these potential locations of schist extraction from this point is very high, and therefore economically unwise. The Szklarski Massif is much better situated relative to stabilizer 6, as the effort required to reach it is only moderately difficult.

As a next step, Least Cost Path analysis was carried out. The main question raised at this point was: could the exploration of raw lithic materials be connected with nearby settlements? Additionally, which of the potential locations of schist extraction would be the most likely to be exploited? According to the results, it can be concluded that schist extraction would only have been pursued by the group of settlements located in close proximity to its occurrence (Fig. 17). It is worth pointing out that this small unit includes 3 stabilizers, located very near to one another. This group is very isolated from the main settlement body extending to the west from Gromnik Ridge, which is the highest rock formation of the Niemcza-Strzelin Hills. The most likely location of schist extraction based on this analysis could be (in order of least to greatest effort): quarries E, B, C and possibly D. Concerning the exploration of schist material from quarry E, the river crossing should be taken into account. Indeed, all settlement stabilizers are located on the western bank of the Krynka River. There is a strong probability of schist extraction from three further quarries. Access to them is not limited by any geographical barriers.

The last set of results concerns Viewshed analysis. Two analyses were carried out with two different tools. The first of them was applied only to two selected stabilizers (6, 10), whereas the second one investigated all ten. The aim of the first analysis was to estimate what was within sight of the stabilizers. Initially, an unlimited view was used as a parameter, and then in next step, the field of view was limited to 5 kilometers, which represents the average range of human vision. The results show that the potential locations of schist extraction were very well visible for settlers in the Krynka River basin (Fig. 18). For stabilizer 10, the highly visible quarries were B and D when the analysis was conducted using

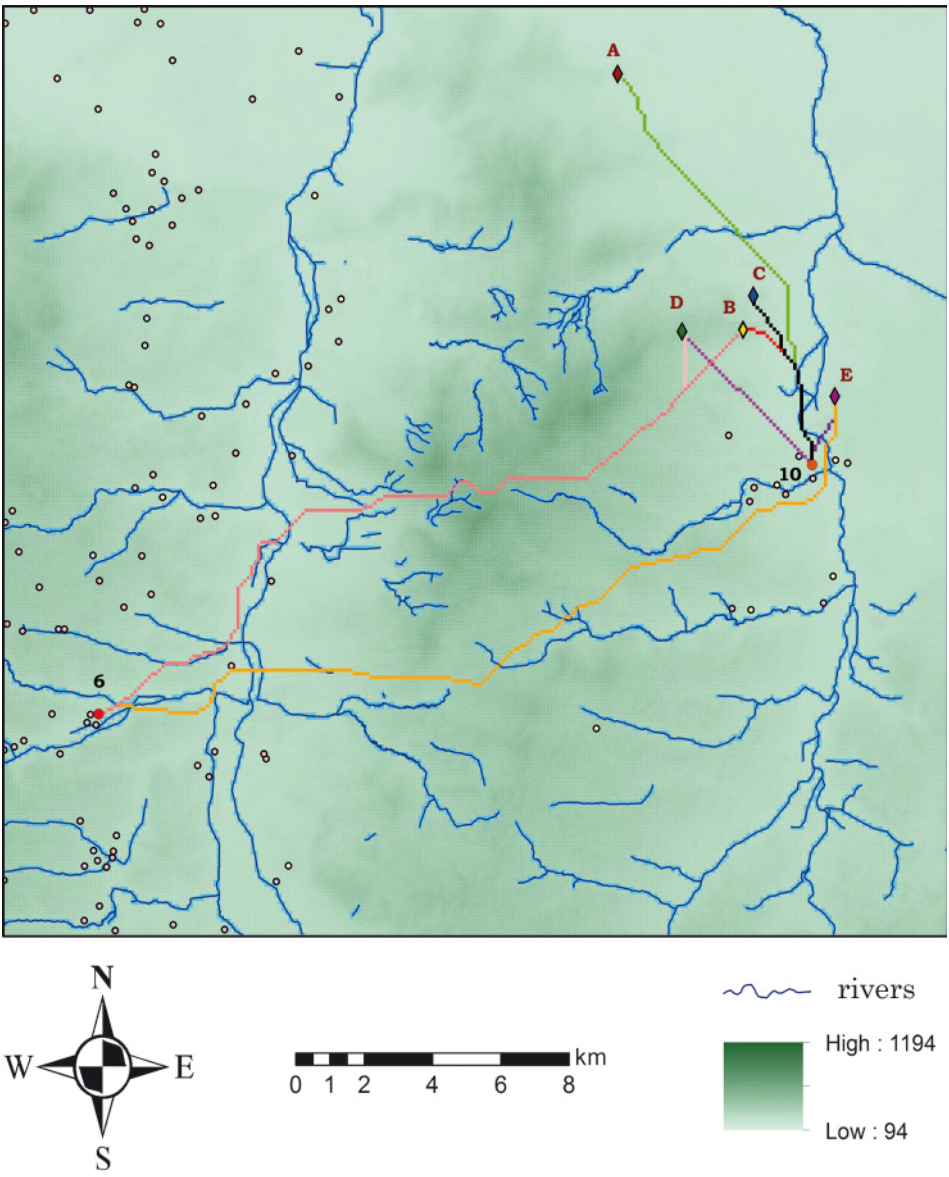


Fig. 17. Least Cost Path analysis results for chosen settlement stabilizers 6 and 10 according to potential locations of extraction of schist A, B, C, D, E

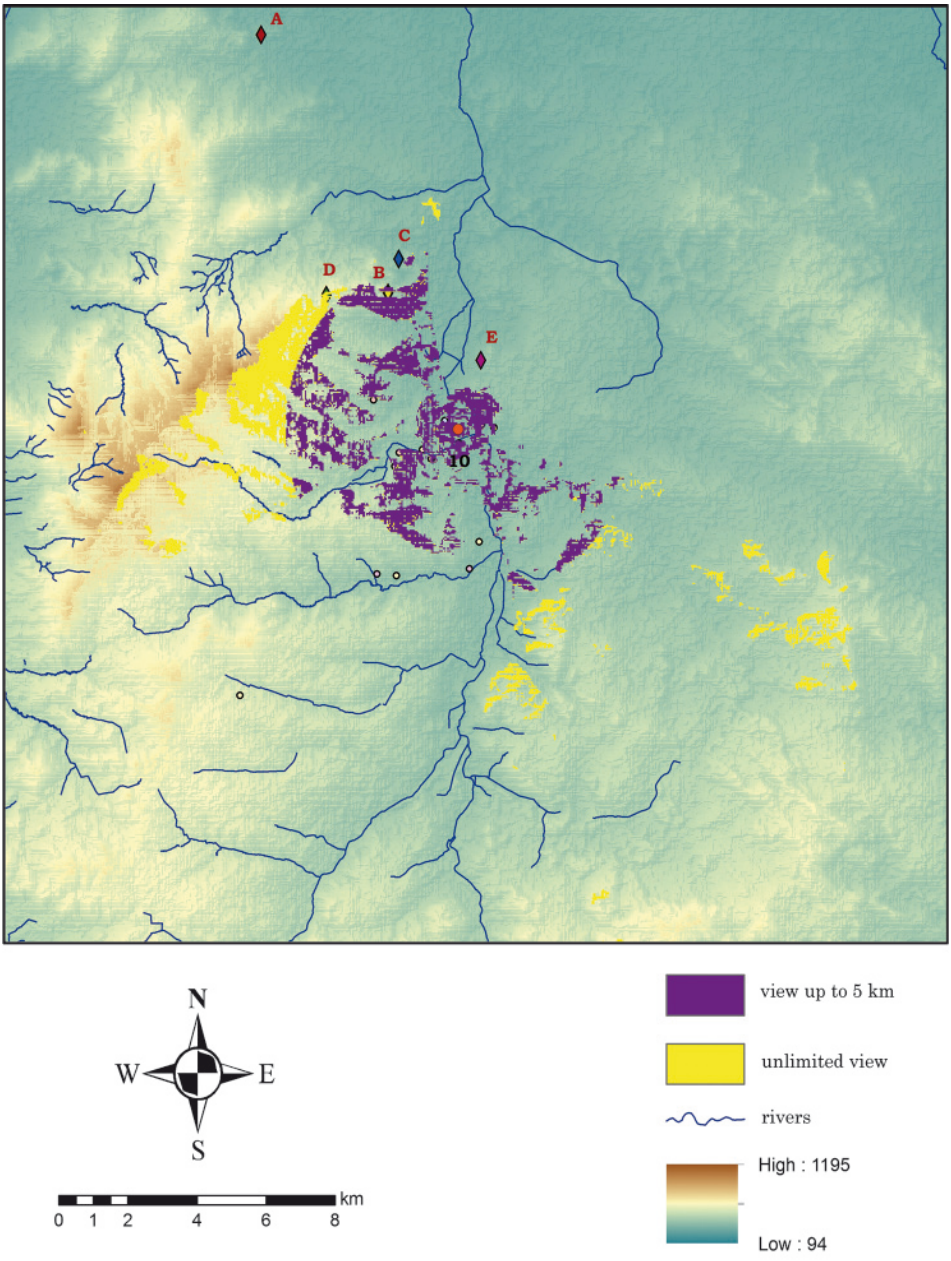


Fig. 18. Viewshed analysis results for settlement stabilizer 10

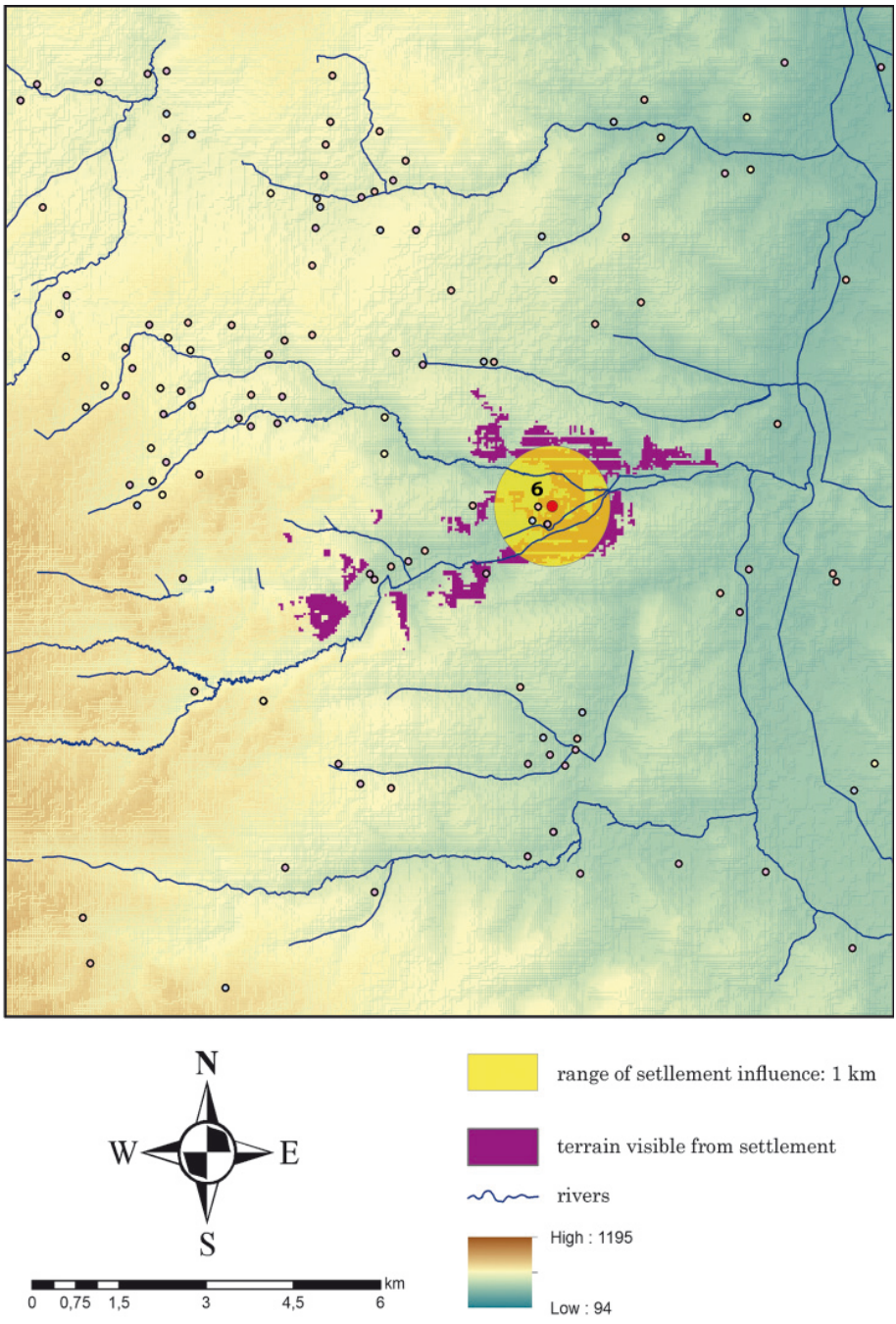


Fig. 19. Viewshed analysis results for settlement stabilizer 6

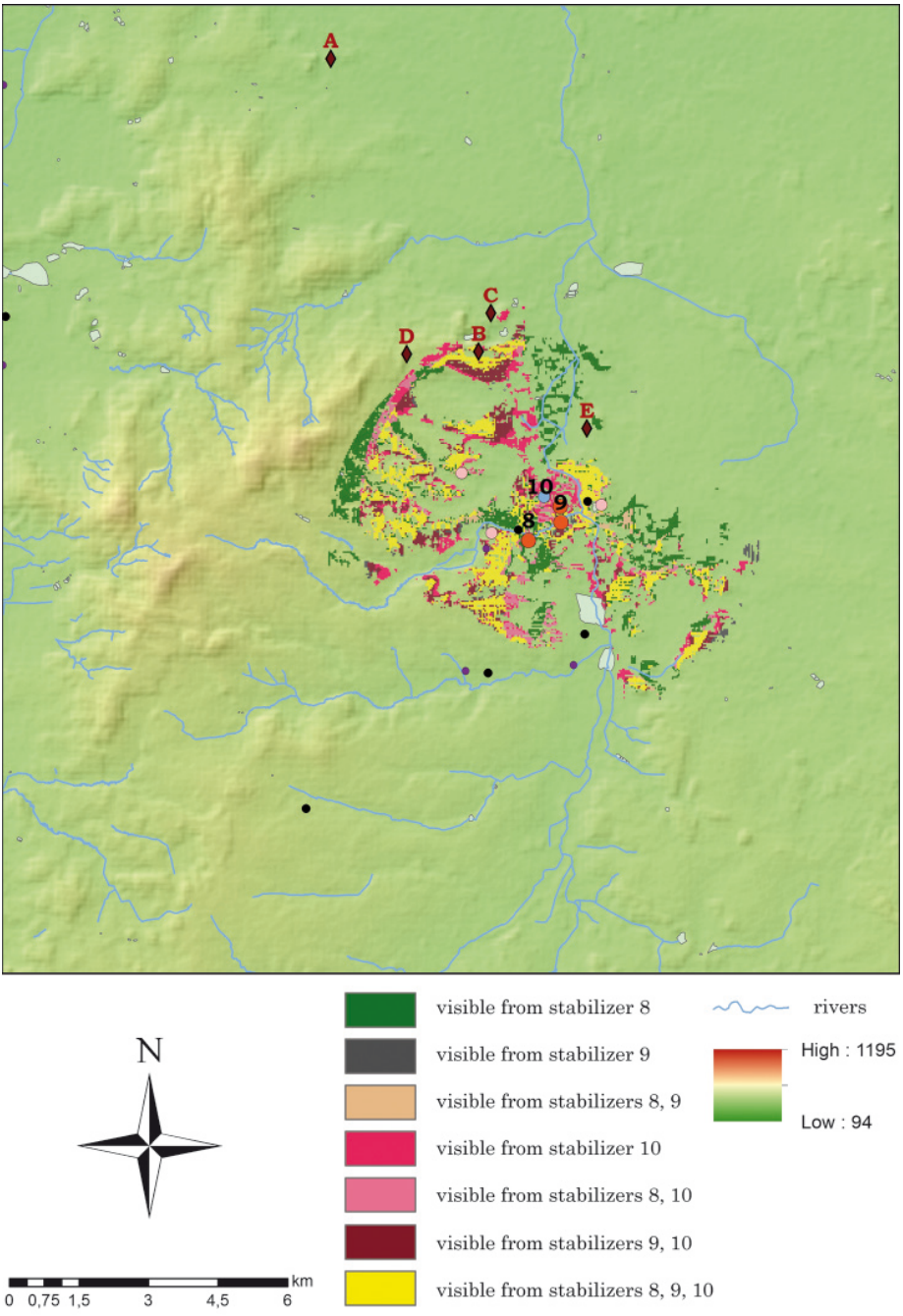


Fig. 20. Viewshed analysis results for settlement stabilizers located near potential locations of schist extraction

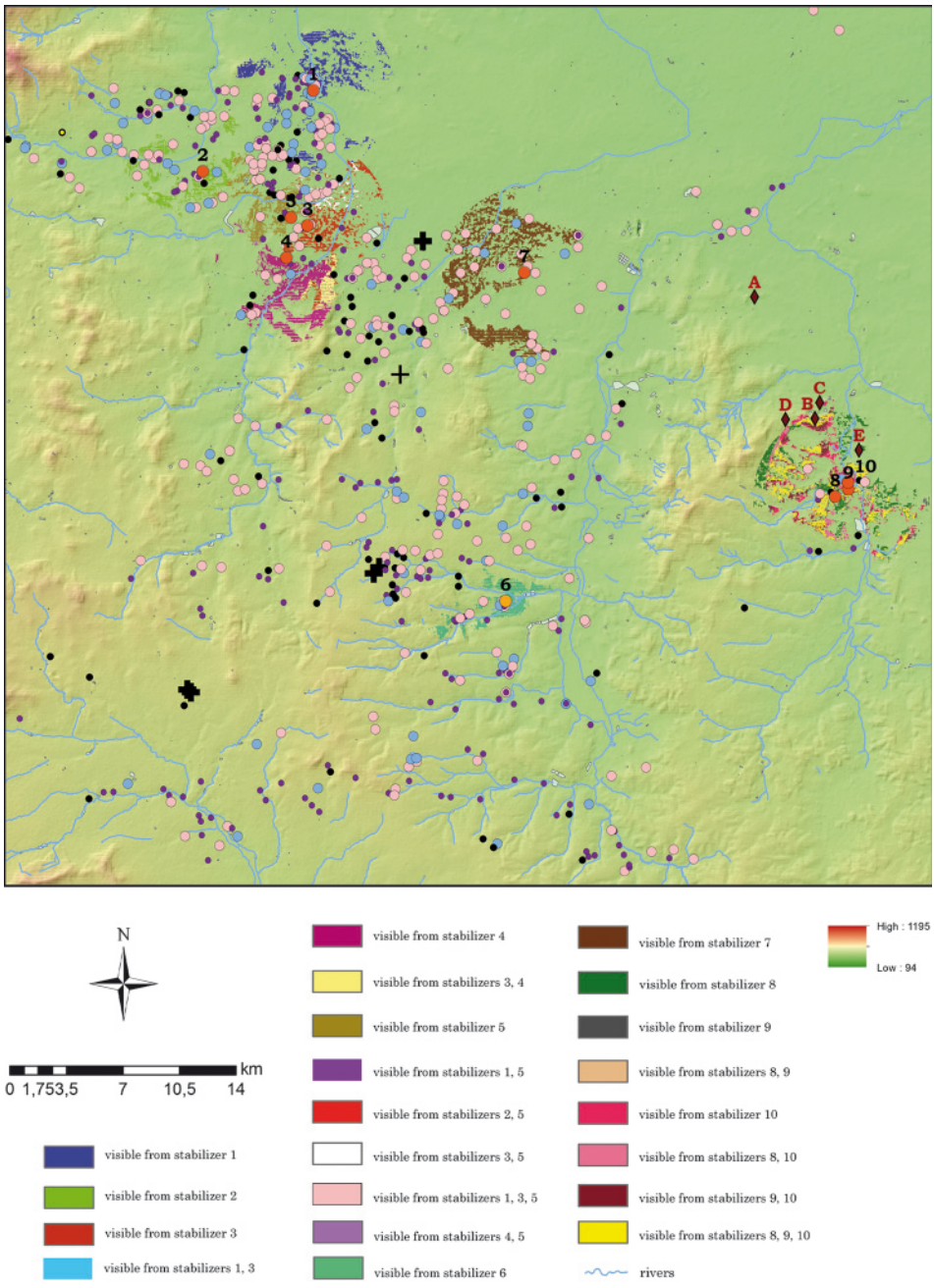


Fig. 21. Viewshed analysis results for every settlement stabilizer occurring in the Niemcza-Strzelin Hills area

the "unlimited view" parameter, and only B after applying the five-kilometer cap. Quarry C occurs on the edge of the range of visibility. The results concerning stabilizer 6 are particularly noteworthy (Fig. 19). It must be said that the most well visible area from this point is the Złotnik River basin. This is a very unique outcome, different from any other. Using an additional buffer of a 1 km radius around the settlement additionally shows the connection of the settlement with the area of two rivers' confluence.

The second method, which allows one to determine the viewshed for any of multiple, user-defined observer points ("who can see what") – as well as their overlap – was conducted for all ten stabilizers. An excerpt of this map was generated especially for the area of the quarries, showing the viewshed from all three stabilizers that existed in this area (Fig. 20). Results show that the most well visible quarry for all settlements in the Krynka River basin is quarry B. Analyzing the results for stabilizers located in the northwestern area, it may be said that many of them could see one another (Fig. 21). Sections of some rivers also remain within their range of sight. The viewshed from these locations is not focused on specific elements in space, apart from the very dense settlement of the surrounding area.

DISCUSSION

The above analysis shows some results worthy of discussion. One of the most important is the puzzling location of stabilizer 6 (Czesławice, 8). It is apparent that this site was located favorably to the Oława river basin, having the confluence of two of its tributaries within range of sight. In the early phases, the explicit separation of this area is visible. It is worth mentioning that the Szklarski Massif is situated nearby to the site (10 kilometers in a straight line). The Złotnik River runs through the immediate vicinity of the settlement, connecting it with the Szklarski Massif. The serpentine-rich massif of Szklary is located in the Niemcza area, about 6 kilometers to the north of Ząbkowice Śląskie. The majority of serpentinic waste from this massif contains nickel (Sachanbiński 2014, 90). In lateritic nickel ores, platinum group metals were found, as well as gold in above-average quantities (Sachanbiński and Łazarienkow 1994; Oberc-Dziedzic and Madej 2014). Native gold occurs in Szklary in the form of clods ranging from a few μm to 0,2 mm (Michalik 2002; Sachanbiński 2014). Gemstones, such as chrysoprase, opal, and jasper are also found in the Szklarski Massif (Oberc-Dziedzic and Madej 2014, 71-81). Native silver has been found in lateritic cambisols as well (Sachanbiński, 2014). Perhaps it is not without reason that the name of the river is called the "Złotnik" ("Goldsmith," in English). Inhabitants of this area did not need to be familiar with all advantages of the Szklarski Massif, but it should be considered probable that some economic activity may have taken place there. It is possible that the Złotnik River was a trade link, and the settlement itself had commercial importance. In any case, the above analysis confirms that the confluence of the Złotnik and Cienkówka Rivers is in the direct neighborhood and viewshed of the settlement, meaning

that these waterways could be easily controlled by its inhabitants. The Złotnik River basin is particularly visible from the settlement, thus distinguishing this site from other stabilizers. In the Late Roman period, the empty spaces between the northern areas and the southern settlements are filled by new settlement groups, concentrating mostly in the Mała Ślęza River basin, which also runs to the area of the Szklarski Massif. The Mała Ślęza, Złotnik and Cienkówka Rivers all originate from the same area.

Another interesting observation that pertains to the whole area in question is the almost complete lack of iron smelting sites. Among all investigated locations, bloomery slag was found in only three of them. It may be that this is a confirmation of committed economic relationships with settlements in the Wrocław Plain, where iron metallurgy is well developed. Both areas are parts of the same settlement grouping. It is worth pointing out that the numerous whetstones found at settlements in the Plain – made from schist obtained in the Przeworno-Krzywina area – are indisputable indicators of trade (Pazda and Sachanbiński 1991). It is conceivable that in addition to schist from the Krynka River area, materials from the Szklarski Massif were also on the market.

The isolated settlement complex, in close proximity to quartz and schist quarries, is also of interest. As previously mentioned, evidence of trade connections with the furthest reaches of the Bytrzyca-Oława region, as well as whole of Silesia, is well known and represented by whetstones (Pazda and Sachanbiński 1991; Lisowska, 2017). It is curious, however, that there is a lack of any archaeological data about the use of valuable local resources by the Przeworsk culture in this region, aside from quartz or schist (Pazda and Sachanbiński 1991; Lisowska 2017). The analysis shows that stabilizer 10 (Przeworno 10) is in the direct neighborhood of Kryształowa Mountain, which, as its name indicates, is a source of mountain crystal – in addition to quartz. Furthermore, stabilizer 10 is located even closer to the well-recognized marble quarries at Przeworno, situated on the other side of the river (Lisowska 2017). To date, there is no evidence for the exploitation of either marble or mountain crystal by the Przeworsk culture, despite the fact that it is known that these materials were highly desired in the Roman Empire. Perhaps the current picture is a result of the state of research. This question could be clarified by systematic excavations, which have never been carried out in the Przeworno area. Another reason for this situation may lie in the oversight of some information during previous archaeological research. Based on the current data, it cannot be stated conclusively whether the use of the aforementioned materials took place, but it can be said that long-term, settled populations of this area had those resources in their own back yard.

In conjunction with the above, there is the question of the significance of the rivers. In terms of prehistoric economy, rivers cannot be treated as boundaries or impediments on the road to reach economically important places. Situations in which rivers have served as "prehistoric highways" have been well documented by archeological data. In regard to the Przeworno 10 site, the river was probably helpful in reaching the schist quarries further north, as well as the closest quarry on the other side of the river, which probably was con-

nected with river crossing. Taking into account these circumstances, rivers in the above analyses were treated as neutral factors. It is impossible to say unequivocally whether they were boundaries, or on the contrary allowed quicker access to certain points. However, considering the particularities of the Przeworsk culture, it might be said that in most cases, rivers had roles in facilitating transport, communication, and trade.

CONCLUSIONS

In summary, settlement of the Niemcza-Strzelin Hills area increased gradually and changed in character with time. Throughout the duration of the Przeworsk culture, especially in its heyday, settlement of this region was strongly connected to the river network. Settlement tended toward linear patterns along the rivers. A significant proportion of settlement stabilizers are located close to either river estuaries or their confluences. Good examples of this situation are settlements Czesławice 8 and Przeworno 10, most likely connected with trade. Settlement in the Niemcza-Strzelin Hills area shows movement from north to south. Of significant importance were the Ślęza and Mała Ślęza Rivers, particularly in early phases of development, with the notable preeminence of the latter in the Late Roman Period. In the Migration Period, settlement is collapsed in this area, and emphasis shifts to the Oława River instead, which takes on the main role.

Some settlement patterns were observed, which were based on conscious choices about optimal locations in the environment. This phenomenon also applies to single-phase settlements, which means that their placement was not a case of coincidence; their collapse was likely not connected with agricultural factors, but social ones, and the quicker tempo of their collapse was likewise most probably connected with reasons other than agricultural ones (most of them appear in the Late Roman Period, and are connected with demographic development). The majority of settlements featured an easterly aspect, a slope of not more than 2°, and were situated either on black earths or cambisols, never more than 1 kilometer from a water source.

Due to its wealth of geologic formations as well as high quality soils, this region would have appeared to be economically desirable. In reference to the general conclusion about economy and land-use, it can be stated beyond any doubt that schist extraction took place only in the vicinity of settlement groupings located nearby its outcrops. Schist could be transported upriver to the north, where the largest quantities of whetstones were found on settlement sites. It could account for some part of the trade with communities of the Wrocław Plain, for example in exchange for iron. It is not out of the question that the use of other regional minerals and rocks, mainly from the Szklarski Masiff, took place. The economic engine for the whole region was agriculture and animal husbandry, which is supported by the fact that the majority of settlements were located in areas that were environmentally optimal for these purposes. The population of this region seems to use the whole palette of available high- and good-quality soils.

Przeworsk culture settlement as developed in the Niemcza-Strzelin region gives the appearance of a well-functioning organism, for which rivers seem to be the *sine qua non* of economic activity. The above analyses demonstrate and confirm at the same time, that the region in question is part of a bigger settlement structure, which is economically connected.

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