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The ancient legendary island of PEUCE – myth or reality?

Gheorghe Romanescu [a,*], Octavian Bounegru [b], Cristian Constantin Stoleriu [a], Alin Mihu-Pintilie [a], Cristi Ionut Nicu [a], Andrei Enea [a], Cristina Oana Stan [c,d]

[a] Alexandru Ioan Cuza University of Iasi, Faculty of Geography and Geology, Department of Geography, Bd.Carol I 20A, 700505, Iasi, Romania
[b] Alexandru Ioan Cuza University of Iasi, Faculty of History, Bd.Carol I 11, 700506, Iasi, Romania
[c] Alexandru Ioan Cuza University of Iasi, Faculty of Geography and Geology, Department of Geology, Bd.Carol I 20A, 700505, Iasi, Romania
[d] Romanian Academy, Department of Iasi, Geography Group, 8 Carol I Blvd., 700505, Iasi, Romania

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ABSTRACT

The testimonies left by the ancient Greeks indicate the existence of the legendary Peuce Island at the mouth of the Danube. Several locations for the island have been proposed throughout history: the pre-continental inland of Chilia, the fluvio-maritime levee of Letea, the initial alluvial fan of the Danube, the Dobroudjan inland between the Danube, the Black Sea and the valley of the Telita River and the Dunavat Peninsula, and others. All of these hypotheses have been proven wrong, except for that regarding the Dunavat Peninsula; but for the Dunavat Peninsula to have represented an island, there must have been a fluvial or maritime corridor separating it from the rest of the Dobroudjan inland. The Beibugeac corridor represented the last link in deciphering this enigma. Interdisciplinary research has been conducted to confirm or refute the theory of the existence of an arm. The overall morphology is favourable to the existence of a fluvial arm. Nonetheless, analysis of the geologic boreholes demonstrates that the nature of the sediments is purely continental and that they originate in the superficial erosion of the calcareous slopes belonging to the Dunavat Hills and Bestepe Hills. The position of Peuce Island in the south of the most important Danubian arm makes possible its location between the Halmyris Gulf, the Danube Delta and the continental inland of Dobroudja. The ancient Greeks were interested only in the exploitation of the sea and the coastal area. For this reason, they built cities only within reach of the sea (Orgame [Argamum], Histria, Tomis and Callatis). When viewed from the sea or the surrounding swamp areas, the Dunavat Peninsula – given that it is elongated and narrow – seemed like an island covered by pine forests. Because it was mistaken for an island, its misleading name was ascribed and transmitted throughout history.

1. Introduction

The first Greek settlements on the western coast of the Black Sea were founded in the 8th–7th centuries BC (e.g., Istria, Tomis, Callatis, Orgame [Argamum]). The new territories were interesting from a commercial perspective, which is why people sought easy access routes to the continental inlands, mostly at the mouths of large rivers. Thus, the Ister (Danube) was mentioned early in the history of the descriptions made by foreign travellers.

The first geographic information on the Circumpontic regions emerged in the ancient Greek literary works known as the Iliad and Odyssey. "An island, called Peuce from the name of the Sarmatian Nympha, stand where Hister [the Danube], savage stream, shoe either bank is ever terrible, flows down through his wild nurslings to the sea." (*Valerius Flaccus, Argonautica 8. 217 ff, trans. Mozley, Roman epic c. 1st century AD*).

The information regarding the Black Sea becomes increasingly prevalent starting in the 6th century BC. The descriptions of Anaximander, Hecataeus and Hellenicos were lost for the most part. The western Black Sea coast and the Danube mouths were implicitly mentioned by most Greek scholars or appeared on most cartographic materials (Herodotus, 484–420 BC; Apollonius of Rhodes, 295–230 BC; Eratosthenes, 275–295 BC; Polybius, 201–120 BC; Scymnus of Chios, 185–84 BC; Strabo, 60 BC – AD 20; Plinius the Elder, AD 23–79; Seneca, 4 BC – AD 65; Pomponius Mela, the first half of the 1st century AD; Ptolemy, AD 90–168; Arrianus, AD 95–175; Marinus, AD 150; Castorius, AD 250; The Peutinger Map, 2nd–3rd centuries AD). The information was

* Corresponding author.
E-mail address: romanescugheorghe@gmail.com (G. Romanescu).

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obtained from sailors, merchants and professional soldiers or even acquired through personal journeys (Romanescu, 1995). The ancient Greeks often described two islands situated in the northwestern sector of the Black Sea: Peuce (Peuke) and Leuce (Achillea, which today is Snake Island and where Achilles requested to be brought after his death).

The most detailed ancient description of the island of Peuce is that provided by Strabo: "Near the mouths of the Ister there is a large island called Peuce … Other much smaller islands are located either upstream or downstream, very close to the sea. The river has seven mouths: the largest is Hierostoma, meaning 'sacred mouth,' and from it one has to cross a distance of 120 stadia upstream to reach the island of Peuce. At the lower end of this island, Darius has built his bridge, although nothing stopped him from starting it at the upper end. Out of the seven mouths of the Ister, Hierostoma is also the first that one encounters on the left when, after entering Pontus Euxinus, one walks along the coast; following the direction of Tyras, the other mouths then gradually come into view." (Strabon, 1853–1857).

The description above suggests that Hierostoma is the southernmost arm in the Danube Delta, bordering the island of Peuce. Pliny the Elder locates Peuce in the vicinity of lake Halmyris and the city of Histria: "Primum ostium Peuces, mox ipsa Peuce insula a qua proximus alveus appellatus XIX M. pass. magna palude sorbetur. Eodem alveo et super Istropolim lacus gignitur LXIII M. pass. ambitu, Halmyrin vocant. Secundum ostium Naracustoma appellatur, tertium Calonstoma iuxta insulam Sarmaticam, quartum Pseudostoma et in insula Conopon diabasis postea Boreostoma et Spireostoma." (Pliny the Elder, 1892–1906). He places both the arm and the island of Peuce south of the Danube Delta.

Claudius Ptolemy strengthens the idea of the existence of a southern arm going round the island of Peuce: "The disposition of the mouths of the Ister is the following: the first separation of the arms occurs at the city of Noviodunon. The southernmost branch, which goes round the island of Peuce, discharges into Pontus Euxinus through the mouth called 'The Sacred One' or 'Peuce.'" (Ptolémée, 1883–1902). The designator "Peuce" is, thus, the name most frequently used by ancient authors.

The name Peuce is known to refer to an island, a fluvial arm and the inhabitants settled in their vicinity (Peucini). Peuce in Greek (*πευχή*) means *pine*, mostly *Pinus maritima*. Many details about Peuce Island are also included in most studies dedicated to the area of the Danube Delta or the Black Sea, especially the northwestern sector. The existence of this island must be observed within the context of the landscape dynamic of the ancient periods. From this perspective, the specialized literature is particularly rich (Allenbach et al., 2014; Angelescu and Botez, 2009; Antipa, 1910; Bleahu, 1962; Brückner et al., 2010; Caraivan et al., 2003; Carozza et al., 2012, 2014; Cordova and Lehman, 2003; Dimitrov, 2003; Dimitrov and Dimitrov, 2004; Dolukhanov and Shilik, 2007, 2009; Dolukhanov and Arslanov, 2009; Feodorov, 1971; Finné et al., 2011; Giosan et al., 2006, 2009; Görür et al., 2001; Hansson and Foley, 2008; Keenleyside et al., 2011; Lepsi, 1942; Panin, 1983; Romanescu, 1996, 2009, 2013a,b; 2014; Romanescu and Bounegru, 2009; Romanescu and Cojocaru, 2010; Romanescu and Stoleriu, 2014; Ryan and Pitman, 1999; Ryan et al., 2003; Soulet et al., 2011; Stanley and Blanpied, 1980; Stoiculescu et al., 2014; Valsan, 1936; Yanko-Hombach et al., 2007; Zenkovici, 1957).

Peuce Island was similar to Rhodes Island in surface, shape and length. In this respect, Skimnos of Chios writes the following: "Habet etiam insulas in ipso sitas multas atque magnas ambitu, ut fama est, quarum una inter mare jacens fluviique ostia non minor est Rhodo; Peuce ei nomen propter copiam quam continet picearum. Rectâ ei opposita Achillis insula in alto jacet." (Nastase, 1932).

According to the data provided by the ancient Greeks, the mouth of the Peuce arm (which today is the St. George arm) was 500 stadia from the city of Istria, 400 stadia from Leuce Island and 120 stadia from the island bearing the same name (the Dunavat hills?).

The first Romanian scientist to analyse the location of Peuce Island was Ionescu-Dobrogeanu, M.D. (1904). Peuce Island occupied the space between the Danube to the north, the Black Sea to the east and the valley of the Telita River to the south. In this case, the Danube divided into branches at the level of the current town of Isaccea (Noviodunum) and formed a secondary channel in the current valley of the Telita River, which emptied into the Halmyris Gulf (the current Razim-Sinoe lagoon complex).

The name of Peuce Island was maintained throughout the Middle Ages. The seacoast books and maps elaborated by the European travellers mention it as Peuce (Pietro Vesconte, 1318, cited by Romanescu, 1995). The Walachian territory was delimited by land and river frontiers, including Peuce Island. In turn, Walachia, the other independent state, was divided into two parts: Upper and Transalpine Walachia and Lower Walachia. This administrative division made certain foreign travellers even more confused regarding the name of the Romanian principalities and their geographic delimitation. Such is the confusion of the Italian historian Paolo Giovio (in *Historiarum sui temporis ab anno 1494 ad annum 1548*, third volume, book XLV, Basileae, 1560), who mentions that Lower Walachia abuts to the north a river that emptied before Peuce Island: "And to the East [wrote the Bishop of Nocera in 1528] [Walachia] has a lake full of fish (*piscosus*) formed by the Hyerasus River, named Prut by the people who live in the area. To the north it abuts the small river of *Hoyna* and it crosses the shore lands to the Istrum, thus eluding the top of the country, and then it empties, through numerous arms, in the Istrum, before the Peuce Island …" (Postolache, 2008).

Throughout time, Romanian researchers (e.g., geographers, historians, geologists) have tried to precisely locate this island. Unfortunately, the data bestowed by Greek scholars are not very accurate. Several locations have been given for Peuce Island, and all of them fall within the space of the Danube Delta. Peuce Island has been pinpointed in the following current places: the Dunavat Hills (Kiessling, 1913; Murgoci, 1914; Parvan, 1914; Stefanescu, 1981); the continental inland of Chilia (Murgoci, 1912; Nastase, 1932); the first alluvial fan of the Danube Delta (Antipa, 1914; Valsan, 1936); the Letea levee (Romanescu, 1990); and the northern space of Dobroudja, situated between the Danube, the Black Sea and the Telita valley (Bratescu, 1921; Ionescu-Dobrogeanu, 1904; Parvan, 1914) (Fig. 1).

The current study aims to localize Peuce Island in the eastern extremity of the Tulcea Hills, in the area of Dunavat. This is the last hypothesis that can contend for the existence of this island in the area of the Danube Delta. The Beibugeac corridor – an alleged fluvial arm or sea channel – separates the Dunavat Peninsula from the Bestepe Hills, which are part of the Tulcea Hills. The geomorphologic and geologic data seek to maintain the presence or absence of this island in this area. The main aim of the present study lies in the genetic identification of the Beibugeac Corridor, the only means of proving the existence of an island or a peninsula in the eastern extremity of Dunavat Cape. This study may end the search for the legendary Peuce Island.

2. Study area

The Danube Delta represents the terminus of the most important river in Central and Eastern Europe. It covers 5600 km^2 and comprises Romania and a part of Ukraine. It has three main mouths (Chilia, Sulina and St. George), of which Chilia has the most

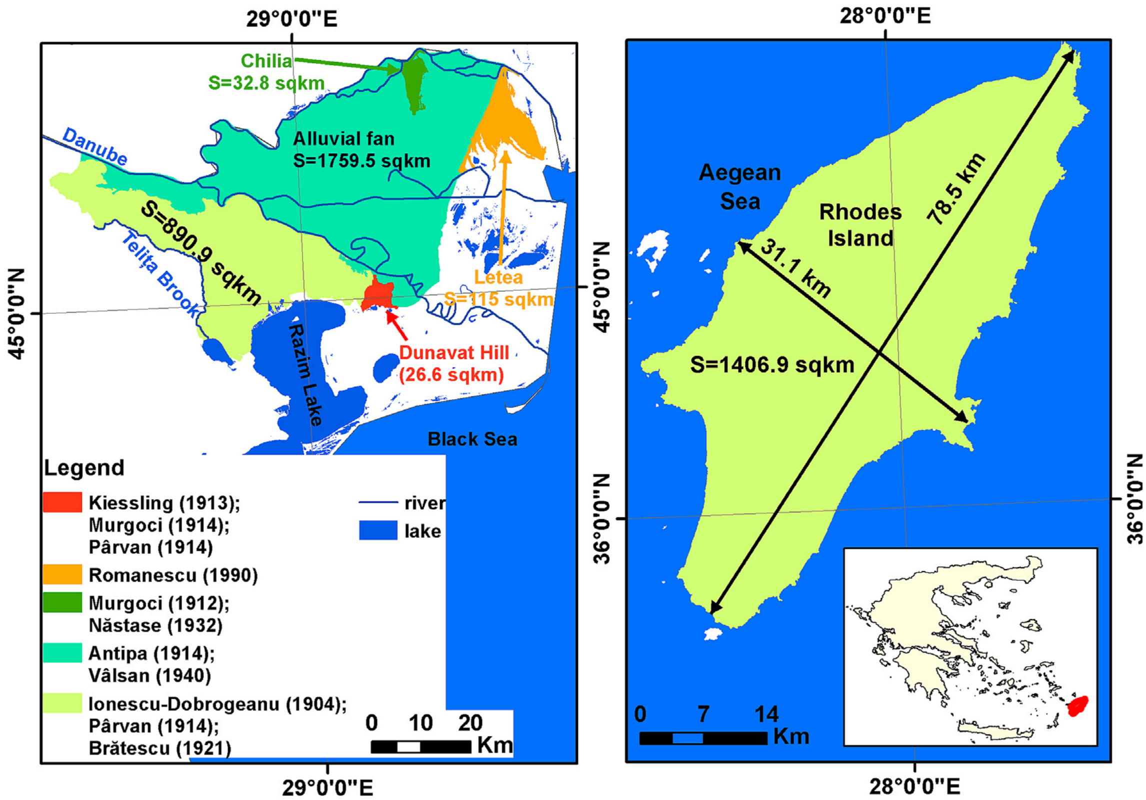

Fig. 1. Localization of Peuce Island by the most important researchers of the Danube Delta.

significant discharge. The oldest arm is St. George, situated in the south. The Sulina arm was channelled in the period 1857–1902 by the European Commission of the Danube and shortened from 83 km to 62 km, as it was used for maritime transport (Fig. 2).

In the south, it is delimited by the Hills of Tulcea and Bestepe, of Triassic and Jurassic age. Calcareous rocks modelled by external factors and transformed into a residual landform dominate the area, including inselbergs and pediments brought to the prediplanation stage. The lower, eastern edge of the Bestepe Hills is known as the Dunavat Hills.

The Beibugeac corridor, whether an alleged fluvial arm or sea channel, is positioned between the main alignment of the Bestepe Hills and the Dunavat Hills. It is situated between the localities of Murighiol, towards the St. George arm in the northeastern sector, and Sarinasuf, towards the Razim-Sinoe lagoon complex in the southeastern sector. It is 10 km long and 1–2 km wide on average. In the central sector of the corridor are lakes with low-saline waters and strictly protected landscape areas included in the Danube Delta Biosphere Reservation. The asymmetrical pediments of the Dunavat Hills continue towards the area of the Danube Delta, the Razim-Sinoe lagoon complex and the Beibugeac Corridor. The sea tides carve them into the shape of a 1–3-m-high terrace, as emphasized in the areas of Murighiol and Dunavat de Jos.

The Danubian alignment of Dobroudja represented the northern limit of the Roman Empire (lines), along which numerous cities and defence *castri* were built. The maritime side of the Danube Delta and Dobroudjan inland caught the attention of the ancient Greeks early, which is why they founded many cities there.

3. Methodology

The field measurements used the LEICA GPS 1200, comprised of a reference station and rover. The GPS was chosen over the Leica TCR1201 Total Station for greater efficiency and to determine as many points as possible. Measurements were taken during May 2012.

To begin the measurements, a field trip was organized to the ANCPI Tulcea (National Agency for Cadastre and Land Registration Tulcea) in order to obtain at least three ground control points because the study area is in the zone where the STEREO 70 projection records the maximum deformation of 42 cm/km. Three sets of coordinates were necessary to decrease errors as much as possible. Measurements were conducted in the Stereographic Projection 1970, or STEREO 70, which is the official cartographic projection of Romania, replacing the Gauss–Krüger cartographic projection following Decree No. 305 in September 1971.

The measurement started from the fourth-rank ground control point of Murighiol Hill, situated on the right side of the exit road from the Murighiol village towards the village of Dunavat de Sus (STEREO coordinates: $X = 829557.190$, $Y = 399931.392$, $Z = 63.620$ m; geographic coordinates: 70/45°01′19.8226″ N, 29°10′58.7113″ E). The other GCPs – third-rank Dunavat de Sus (located on the homonymous hill, before the entry to the village [STEREO coordinates: $X = 832{,}509.150$, $Y = 399{,}889.898$, $Z = 51.070$ m; geographic coordinates: 70/45°01′13.4819″ N, 29°13′13.1911″ E]) and fourth-rank Movila Duna (located on the right side of the road, before the entry to the Murighiol village [STEREO coordinates: $X = 825{,}675.736$, $Y = 401{,}931.418$, $Z = 45.510$ m; geographic coordinates: 70/45°02′30.9998″ N, 29°08′6.4451″ E]) – were measured again to correct the errors. Finally, 3765 points were measured. Transverse profiles were elaborated and included in the contour line file to elaborate the numerical field model. The points were also used as references to correct the altitude on the topographic maps, which use the Baltic Sea as a reference. In this case, the measurements were related to

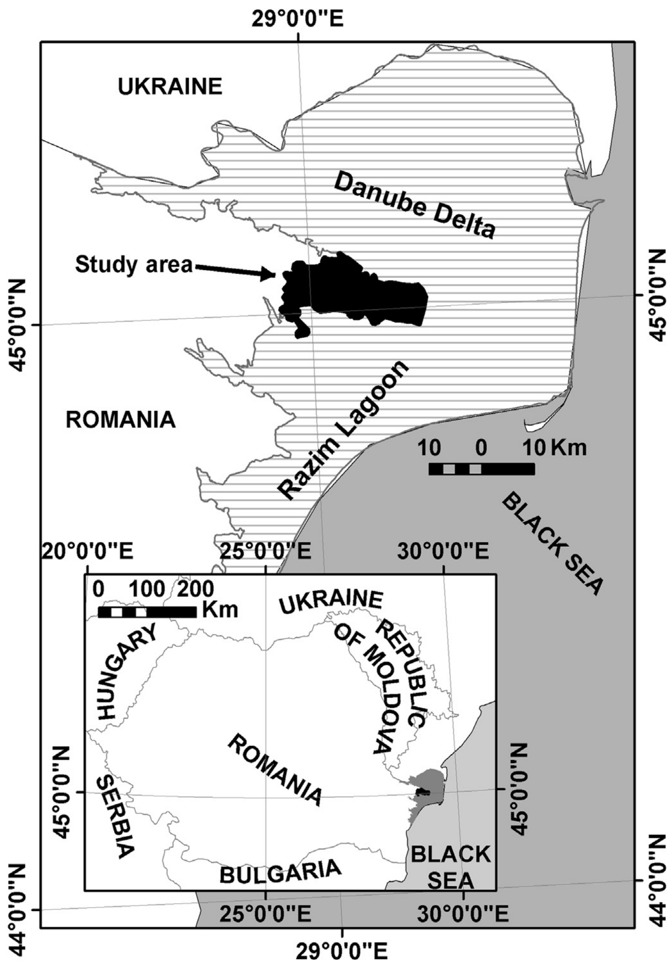

Fig. 2. Geographic position of the Danube Delta and the Beibugeac Corridor in the Romanian territory.

the reference system represented by the Black Sea. With the help of the GPS, the geologic boreholes were also located (Fig. 3).

The geographic statistical maps and data were elaborated in GIS by creating a geodatabase in the ArcGIS v.10.1 software. A first phase included georeferencing the maps scanned in the system of cartographic projection WGS_1984_UTM_Zone_35N, Datum "D_WGS_1984", Spheroid "WGS_1984". The second phase comprised the activities of vectorizing the geographic elements, including the limits of lakes, the hydrographical network, isohypses, the zones outside the built-up areas, the reed-covered surface, the vector projection of the GPS-elaborated topographic profiles and the geographic position of the geologic boreholes. In the third phase, attribute tables were elaborated for each thematic vector layer, establishing their ranking. The fourth phase included the elaboration of the numerical altitudinal field model, a slope gradient map and the slope orientation. The last phase included the creation of the final layouts to be exported as ".tif" images. The main maps with a similar format used to create the geodatabase were 1:5000-scale topographic maps and the orthophotoplans (1-m resolution). In addition to the abundant bibliographic material, the maps (seacoast books) elaborated by certain travellers who positioned Peuce Island using personal research or collected information were studied.

The geologic boreholes were placed along the entire orientation of the Beibugeac corridor. A borehole was executed at the northeastern entry (1), another one at the southwestern entry (4) and two in the central parts (2 and 3). The F1 borehole is oriented toward the St. George arm, yet it intercepts the sediments of the Beibugeac Corridor. The F4 borehole is oriented towards the Razim lagoon, intersecting the same type of sediments (Fig. 3). Three boreholes hit the foundation rock (limestone) (1, 2 and 3), whereas the 16.5-m-deep borehole within the Razim-Sinoe lagoon complex failed to reach the calcareous foundation. The cores were conserved in special tubes and then analysed in the laboratory. All boreholes are organically sterile, so C^{14} dating was not possible. The data on the deltaic and lagoonar sediments are based on the results of radiocarbon dating published in the literature. The present-day Dunavat cape is surrounded by deltaic deposits on three of its four sides (Giosan et al., 2005, 2006).

To determine the origin of the alluvia material, granulometry by dry sieving was executed. The data obtained were represented graphically. The samplings for granulometry were taken from four boreholes (F1, F2, F3 and F4), according to the disposition of the sandy deposits on the vertical. Thus, the following samplings were extracted: from F1 (12 m), 12 samplings between 0 and 11.60 m (11.60–12.00 m rock); from F2 (6 m), 8 samplings between 0 and 5.10 m (5.10–6.00 m rock); from F3 (10.5 m), 13 samplings between 0 and 9.00 m (9.00–10.5 m rock); and from F4 (16.65 m), 18 samplings between 0 and 16.65. Each granulometric analysis was performed on an average sample, initially air-dried and then disaggregated by friction in case of aggregates and cemented portions. For the samplings from deposits measuring >0.6 m, several samplings were extracted (cca. 3 samplings/1.00 m). In this case, the average sampling was determined by the method of "division into four", which involves collecting the samples within the same deposit in the shape of a cone and dividing them with a spatula into four equal parts by drawing the diagonals. Two opposite quarters of material were eliminated, and 100 g from the remaining sample was used as the final sampling.

The sample sieving took 15 min/sample. The sieves had the following sizes: S1 (1.00 mm, 0.00 Φ); S2 (0.50 mm, 1.00 Φ); S3 (0.355 mm, 1.50 Φ); S4 (0.250 mm, 2.00 Φ); S5 (0.180 mm, 2.450 Φ); S6 (0.100 mm, 3.300 Φ); S7 (0.090 mm, 3.450 Φ); and S8 (0.063 mm, 4.00 Φ). After sieving the granulometric fractions, they were weighed separately on the analytical balance. In this phase, a redistribution of the material losses due to sieving or clogged sieves was necessary. For the samplings to be valid, this error could not exceed 2% of the total amount. In this analysis, the losses due to material manipulation ranged between 1.5 and 0.2%.

Based on these values, the initial attempt was to obtain statistical and granulometric parameters through the classical calculation formulae presented by Trask (1950) and Folk (1965). These calculation methods are based on percentiles (P_5, P_{16}, P_{25}, P_{50}, P_{75}, P_{84}, P_{95}) and quartiles ($Q1 = Q_{25}$; $Q2 = Q_{50}$; $Q3 = Q_{75}$). They need a granulometric deviation in units (phi) to fall on the covariance curve in both the positive and the negative field to be projected. Because the calculation concerned only the granulometric analysis of sands in the interval 1.00–0.063 mm (0.00–4.00 phi), the values of the percentiles fall only in the positive field, so the classical method cannot be applied.

The mathematical calculation method used to obtain the numerical parameters of the granulometric distribution is called the "method of moments" and was applied by McBride (1971). The first calculation phase identifies the distribution mean (X_Φ) or granulometric mean on which the following calculation moments are based. In this case, one must calculate the mean (X_Φ), standard deviation (σ_Φ) and skewness (Sk). The proposed calculation formula proceeds until the third-order moment:

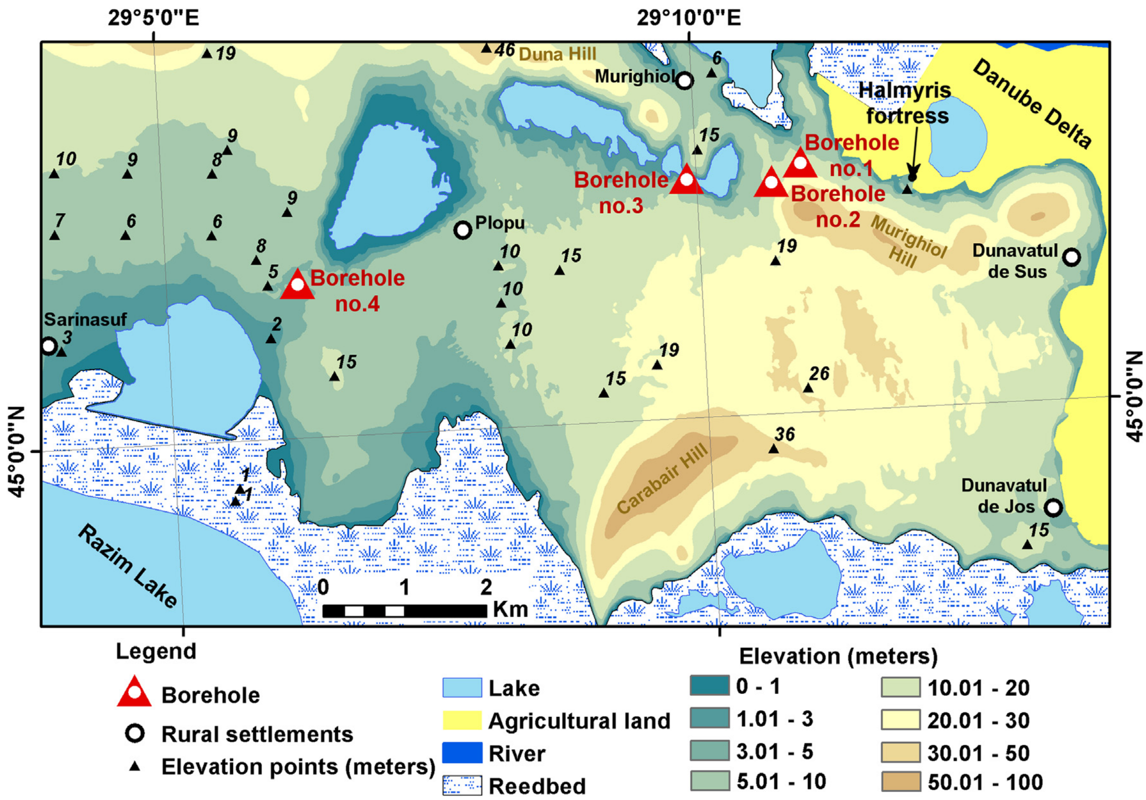

Fig. 3. Placement of the four geologic boreholes in the Beibugeac corridor.

$$X_\phi = \frac{\sum fm}{n}$$

$$\sigma_\phi = \frac{\sum f(m - X_\phi)^2}{n\sigma_\phi}$$

$$Sk = \frac{\sum f(m - X_\phi)^3}{n\sigma_\phi^3}$$

where: f is the frequency of granules within the class (%);

m is the middle of the granulometric class (phi);
n is the total frequency (%).

4. Results

All the ancient information states that Peuce Island is situated in front of Leuce Island (Snake Island). Leuce Island is the feature in the Black Sea most often mentioned by the ancient Greeks because it represented the cult of Achilles and was an extremely important strategic point for entry into the Danube's mouths. Hence, the localization of the two islands in the northwestern sector of the Black Sea is a certainty, similar to the sailing “lighthouses” for the Greek sailors. During Antiquity, Peuce Island also represented the only populated area in the Danube Delta (e.g., Triballi, Bastarnae-Peucini, Goths).

The invariably murky deltaic area was inhospitable for sustained human settlement. Conversely, the adjacent continental shelf favoured the establishment of human settlements during ancient and medieval times: Aegyssus, an ancient Roman city; Preslav, a Byzantine city; Salsovia, an ancient Roman city; Halmyris, an ancient Roman city; Dunavat, an ancient Roman fortress; Agighiol, a Thracian necropolis; Toprachioi, a Roman fortress and supply point; Babadag, a Thracian and Roman fortress; Ibida, an ancient Roman city; Enisala/Heraclea, a Genovese mediaeval city; Beidaud, a Thracian fortress; Bisericuta, a Roman fortress; Orgame/Argamum, an ancient Greek and Roman city; Histria, an ancient Greek city; and Vadu, an Ottoman fortress (Romanescu, 2013a) (Fig. 4).

The landform of the Dunavat Hills is represented by residual inselbergs, with altitudes up to 70 m. The highest points are on the Middle and Upper Triassic calcareous rocks, shaped as asymmetrical pediments continuing under the sediments and waters of the Danube Delta and Razim-Sinoe lagoon complex. The highest altitudes correspond to Carabair Hill (70 m) and Murighiol Hill (60 m) (Fig. 5). The Beibugeac Corridor, between the localities of Murighiol in the northeast and Sarinasuf in the southwest, is flanked by high hill units with altitudes over 30 m (La Hartop, 117 m; Vartop, 88 m; Movila Retezata, 85 m) on the western side in the Bestepe Hills.

The Beibugeac Corridor follows a central orientation between the units of the Dunavat Hills and the Bestepe Hills (Fig. 6). The maximum altitudes on the central valley range between 6 m in the northeast (Danube) and 1 m towards the southwest (Razim Lake). The maximum altitudes of 5–6 m are due to the sandy deposits at the foot of high slopes eroded by the lateral runoff and winds with dominance in the northeast–southwest direction.

At the northern and southern extremities, the valleys are asymmetrical, with larger slopes in the east and lower slopes in the west (Profiles 1 and 2) (Fig. 7). In the central part, the slopes are symmetrical (Profile 3). The areas with low altitudes are occupied by lacustrine cuvettes of high salinity from KCl, indicating a continental origin (Saratura Lake, Saratura Mica Lake and Beibugeac Lake). In the southwest sector, the corridor disappears into the waters of the Razim-Sinoe lagoon complex. The national road

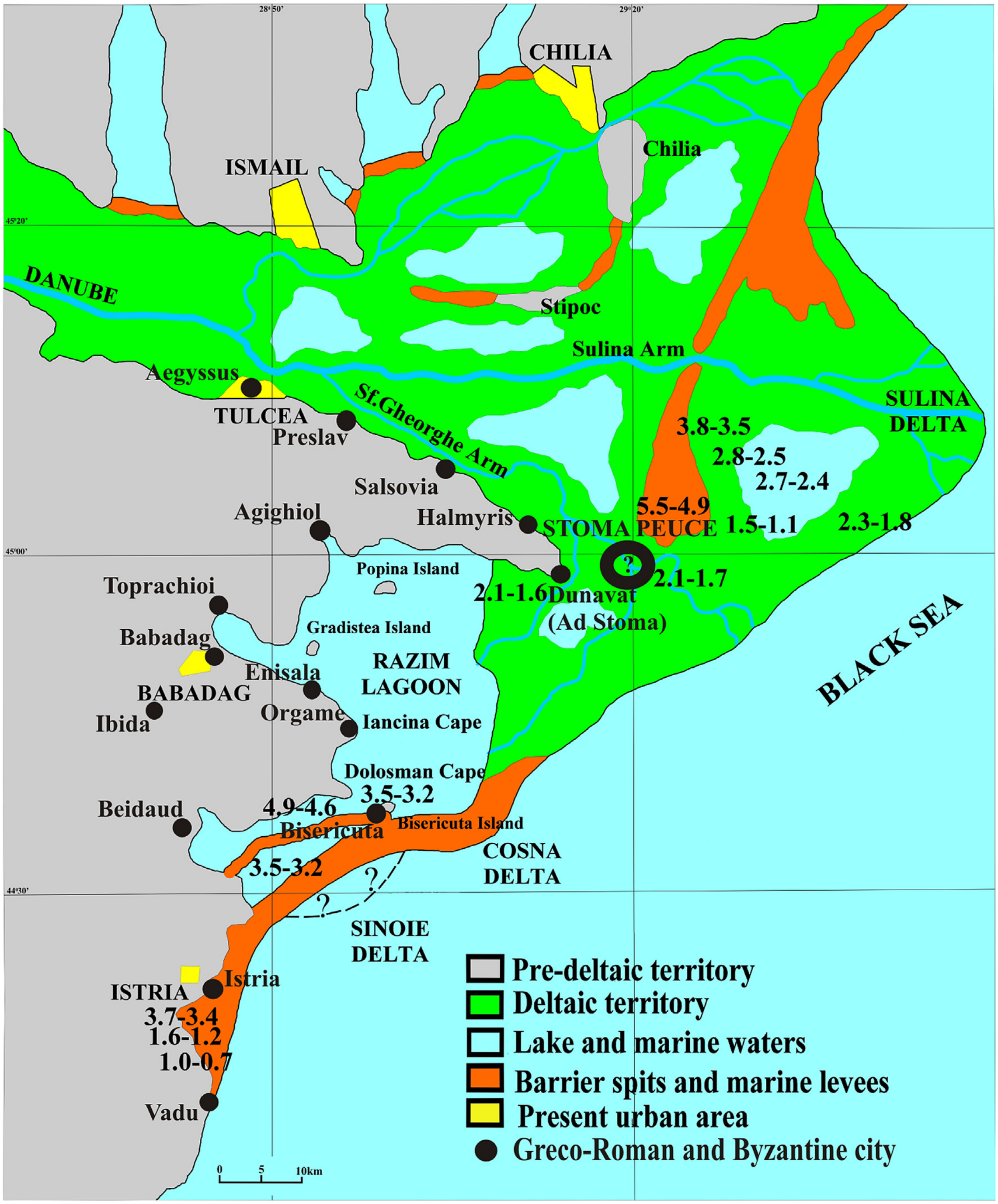

Fig. 4. Evolution of the Danube Delta and localization of the main Greco-Roman and Byzantine cities. Location of the alleged Stoma Peuce (Peuce Mouth) in the context of the Greek hegemony at the Danube mouths. Numerical ages BP (Giosan et al., 2006).

Tulcea-Dunavat de Jos interrupts the continuity of the corridor in the northeast sector, implicitly towards Murighiol Lake and the Danube (St. George arm).

The F1, F2 and F3 boreholes penetrated the calcareous foundation of the corridor. The F4 borehole, although 16.5 m deep, failed to penetrate the foundation because the sedimentary deposits are thicker in Razim Lake than in the rest of the corridor (Fig. 8).

Within the four boreholes, the sandy fraction is dominant, comprising over 60–70% of the material. Very rarely (for F1.5, F2.6 and F2.7), the clay granulometric fraction has percentages similar to the sandy fraction. The F3 borehole contains the highest degree of fine aggregates. The coarse granulometric fraction, similar to gravel, increases at the base of all boreholes. The clay and coarse parts have low percentages (Fig. 9).

5. Discussion

Most theories related to the location of the island of Peuce have been disproved. The Chilia continental shelf is cut by the northernmost arm of the Danube Delta (the Chilia arm), and the relief is not cliffy. The alluvial cone of the Danube, located in the apex of the delta, up to the level of the initial corridor, constitutes a swampy

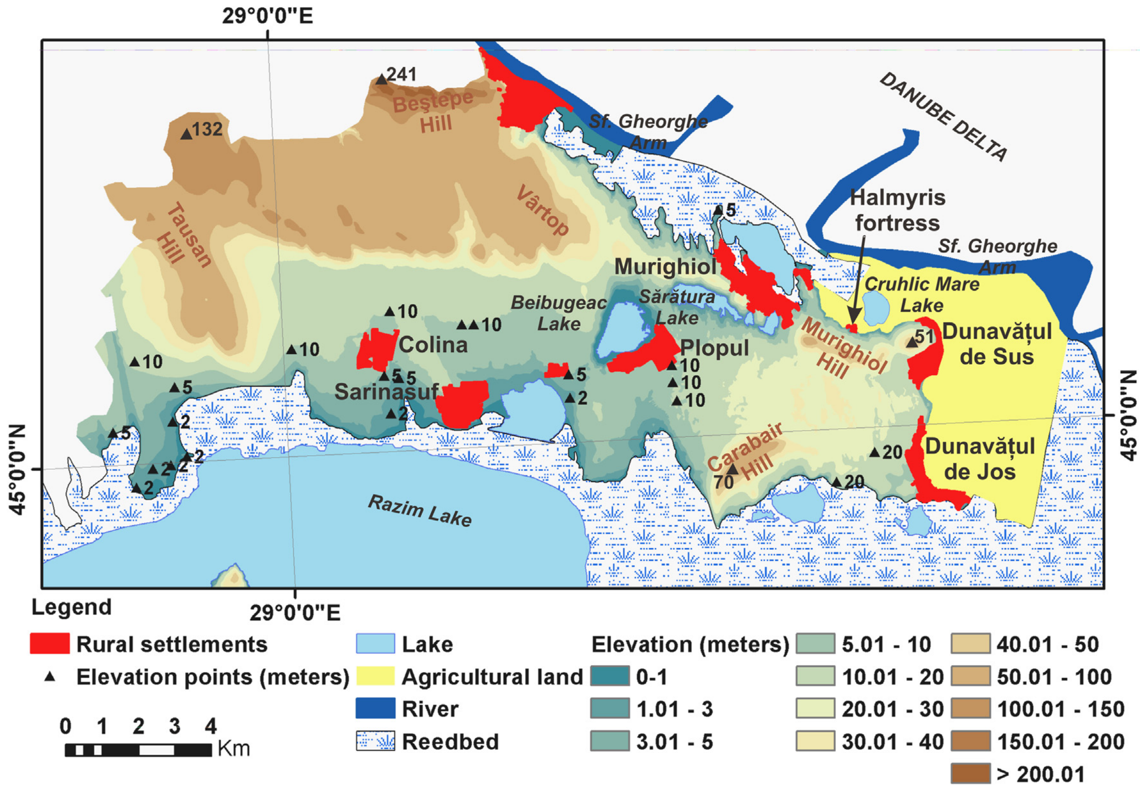

Fig. 5. Morphology of the Beibugeac corridor and surrounding hill units (Dunavat and Bestepe).

accumulation of alluvial nature, with diverging arms. The size and shape of this cone are not similar to those of Rhodos island, which Peuce island is identified with. The Letea fluvio-marine levee is sandy, and the spore-pollen of *P. maritima* may be allochthonous, having been brought by the Danube from the upper part of the basin. The north-eastern portion of the Dobrudja Plateau, located between the Danube, the Black Sea and the valley of the Telita river, does not correspond from a morphometric point of view, given the

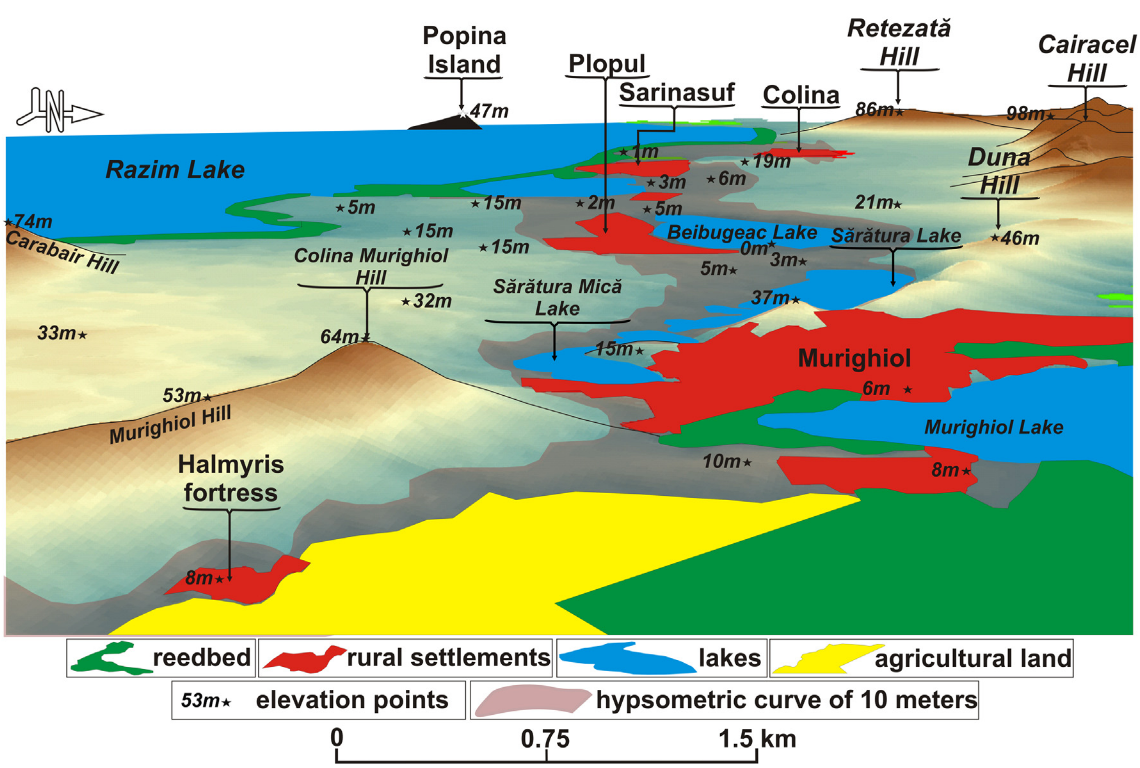

Fig. 6. 3D image of the Beibugeac Corridor, with view from the city of Halmyris.

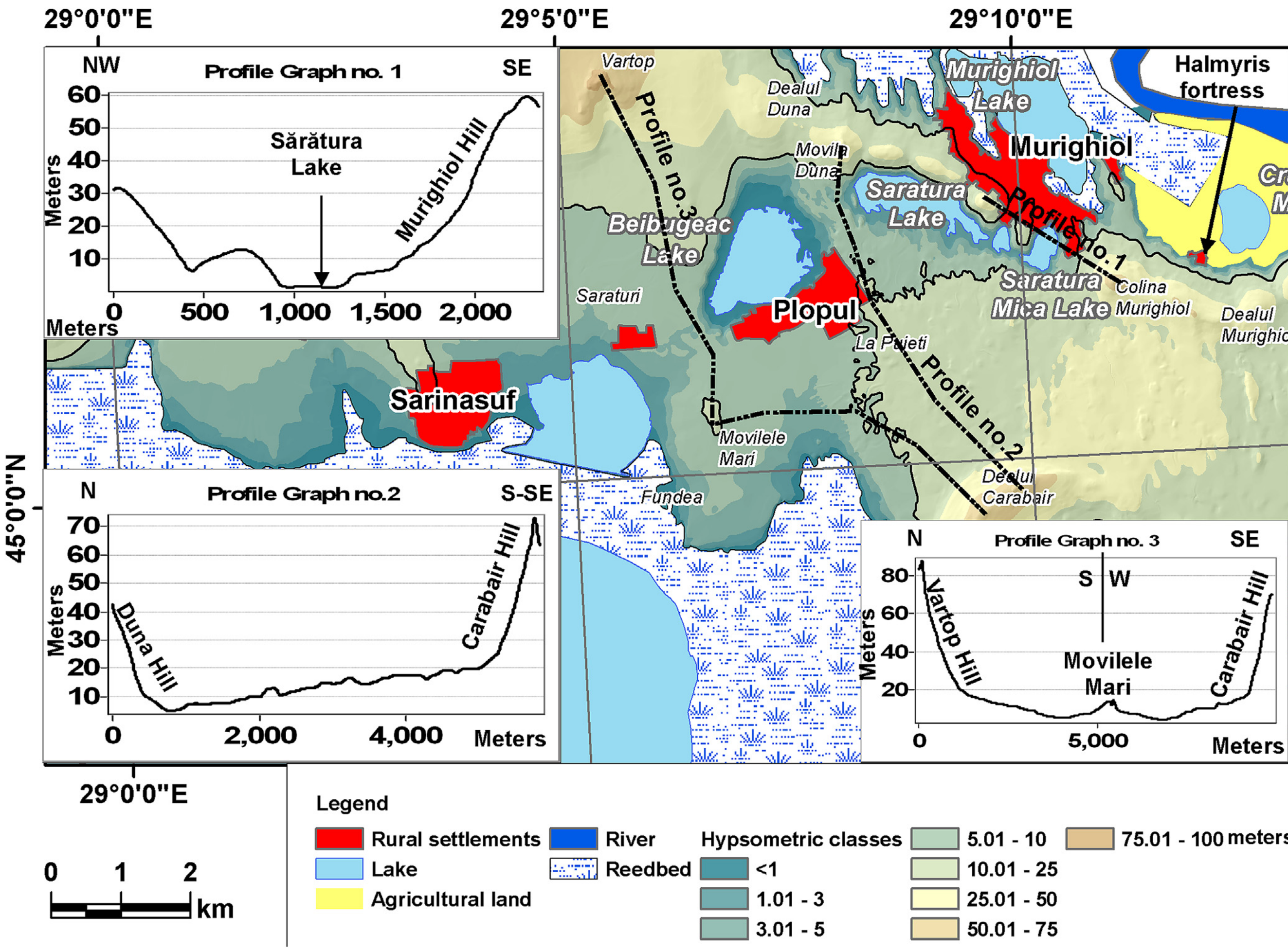

Fig. 7. Morphology of the Beibugeac corridor in horizontal and transverse plane.

high altitudes. The recent neotectonic movements do not indicate a significant several-metres-high uplift of the crust, which would have brought the corridor separating Peuce island above sea level. As of yet, the presence of the island in the eastern extremity of Dunavat cape has not been confirmed by plausible data (Kiessling, 1913; Murgoci, 1914; Parvan, 1914; Stefanescu, 1981).

The morphometric features of the corridor clearly indicate its isolation from the St. George arm or the Razim lagoon. The highest altitude in the north-eastern sector is 15 m, due to sandy accumulations in the form of æolian dunes (Fig. 10). There, the F2 borehole reached the bedrock at a depth of 6 m. As a result, the initial relief, which lacked the sedimentary accumulation, was 9 m above the current level of the Black Sea. The formation of the St George I secondary delta corresponds to a transgression, which in the Danube Delta area did not exceed 2–3 m above the current level of the Black Sea (Giosan et al., 2006). The Nymphea transgression (+2 or +3 m) coincides with the foundation of the Milesian cities of Callatis, Tomis and Histria (8th century BC) (Romanescu, 2014). Consequently, seawater could not fully isolate the Dunavat peninsula, which functioned as a small isthmus.

Peuce Island was undoubtedly situated in the area of the Danube Delta. Any other localization farther from this area can only be wrong. The morphologic dynamic of the delta and the rapid landscape transformations make the traces of this legendary island very difficult to identify. Most hypotheses regarding the location were wrongly interpreted. First, the pre-continental inland of Chilia is not located in the south of the oldest deltaic arm, and the landform is not rocky. Second, in the fluvio-maritime levee of Letea, important amounts of *Pinus maritime* pollens have been discovered, but they are also found in other deltaic levees, meaning they could have been brought from the upper Danube basin. Third, the Danubian alluvial fan formed behind the initial spit of Letea-Caraorman was situated north of the southern arm and represented a swampy area. Fourth, the hilly and rocky area between the Danube, the Black Sea and the valley of the Telita River cannot be taken into account because the landform between the locality of Isaccea and the upper river basin is much too high and has not suffered any tectonic movements in the past 2000–3000 years.

The most plausible localization remains the hill area of the Dunavat, with a relatively high and rocky landform. The rendzina and the slightly colder climate during Antiquity could have favoured the emergence of pine forests (*P. maritima*) (Stefanescu, 1981). Their disappearance could be because Dobroudja has vast steppe areas with scarce wood resources. The trees were cut down for multiple uses, including fuel and boat or house building.

The Dunavat Peninsula may have been considered an island because of erroneous information resulting from the local topography and proximity to the sea. The ancient Greeks were particularly interested in the coastal areas (Bratescu, 1921, 1922). The islands remained *terra incognito* and were rarely observed or mentioned. The only testimony for the upstream sector of the Danube is the bridge of boats built by Darius in the narrowest

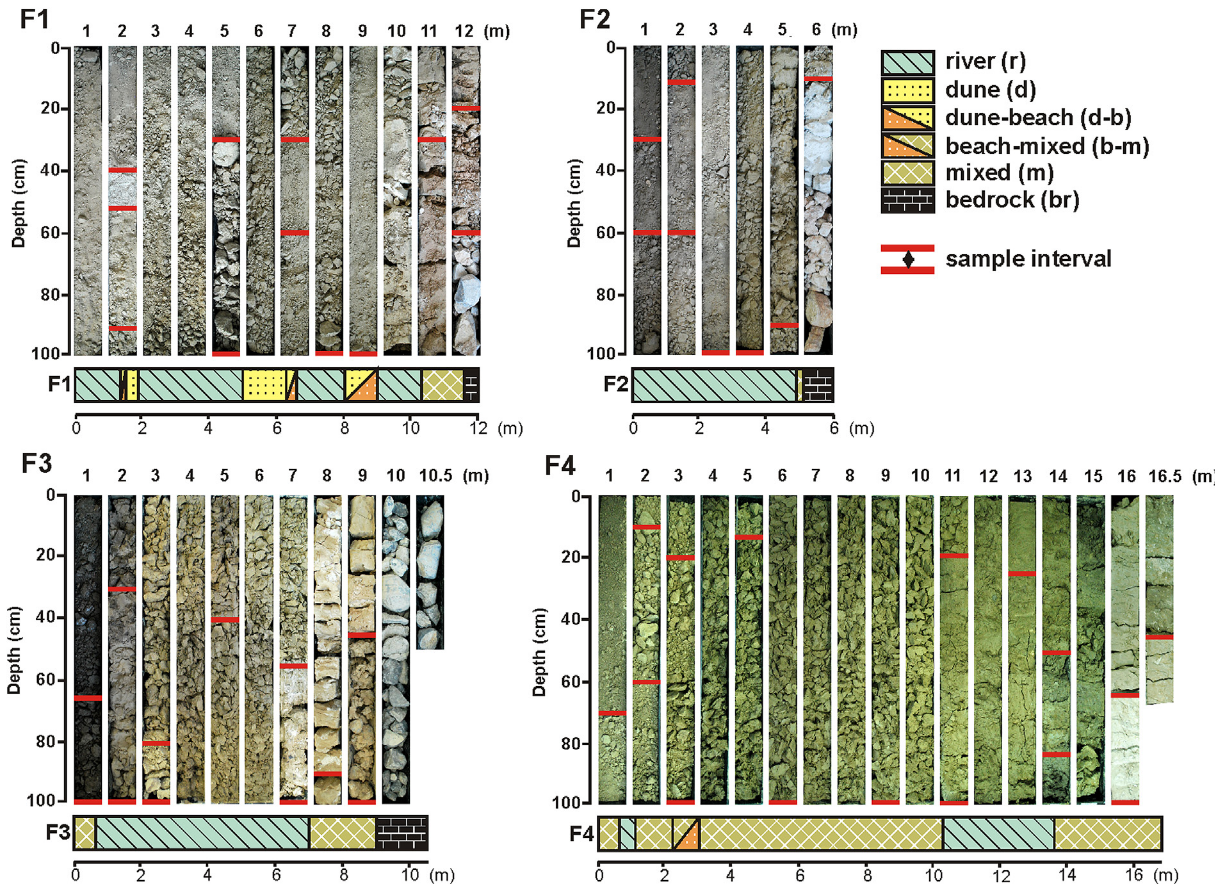

Fig. 8. Boreholes in the Beibugeac corridor (delimitations for granulometric and colour differentiations: F1.1, F1.2, … …F1.9, etc.). (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)

section at the level of the current town of Isaccea (Noviodunum) (Fig. 11).

The Peuce Mouth – also known as the Sacred Mouth (Stoma Peuke [Peuce], Sacrum Ostium or Hieronstoma), belonging to the southern arm of St. George – reached the extreme eastern point of the Dunavat Hills (Dunavat peninsula) at approximately 1000 years BC. This is confirmed by the existence of the toponym Ad Stoma (at the mouth) or Stoma Peuce (the Peuce mouth) (Strabo, Ptolemy), which designates the ancient locality of Dunavat de Jos. The Peuce mouth corresponds to the present-day St. George arm, which has been proven to be the oldest distributary in the Danube Delta (Antipa, 1910, 1912; Bratescu, 1921, 1922; Lepsi, 1942; Romanescu, 1996; Stefanescu, 1981; Valsan, 1936).

The Dunavat Island may have been separated from the continental inland (the Bestepe Hills) by a corridor. It was represented by the Beibugeac Corridor (between Murighiol and Sarinasuf), which could have been a fluvial arm linking the deltaic sector to the Halmyris Gulf (*myris* = water, *hal* = salt) (Popp, 1964; Stefanescu, 1981; Suceveanu et al., 2003). During the Climatic Optimum, this corridor could have functioned as a maritime arm (channel or strait), thus turning the extreme eastern corner of the Bestepe Hills (the Dunavat Hills) into an island (Stefanescu, 1981). The corridor clogged following the decrease in the liquid discharge of the St. George arm and in the continental alluvia transport (Fig. 7).

The specialists who stated that the Dunavat peninsula was the alleged Peuce Island had started from the idea that the morphology of the Beibugeac corridor was identical to that of a fluvial or maritime arm, subsequently clogged by alluvia (Fig. 10). The existing altitudes on the corridor, in the central part, are higher than the current level of the Black Sea and the Danube. The fluvial or maritime deposits were completed by the continental deposits due to superficial erosion. The geologic data demonstrated the absence of fossils (sterile samples); hence, the riverbed aggradation is due only to the continental contribution. The existence of 5–6-m altitudes in the northeastern sector, near the locality of Murighiol, is due to the material reworked by the wind and its deposition as dunes.

The existence of the city of Halmyris – situated on the right bank of the St. George arm, downstream from the northeastern entry of the Beibugeac corridor – demonstrates the importance of this area from a geostrategic and commercial perspective (Fig. 12). The military garrison, organized within a harbour-like system, ensured the entry and exit from the Danubian towards the Black Sea and vice versa. The city is on the extreme northern and southern lines, and it represented the last bastion at the eastern frontier. If there was no fluvial arm or maritime channel on the Beibugeac corridor, our opinion is there was intense terrestrial commerce because it represented an easy, slope-free means of transport. At the south-eastern entry, there is a military observation post at the level of Dunavat de Jos.

The determination of the absolute ages of the deposits within the Danube Delta leads to the conclusion that the area between the "initial" spit (Caraorman) and the Dunavat headland (Ad Stoma) is 2100 years old, at most (Giosan et al., 2005, 2006). In this case, it is possible to position the Peuce Mouth (Stoma Peuce) at the level of the locality of Dunavat. Hence, the St. George arm (Peuce) was also the most important, mostly for navigation. Its particular importance was also because all the Greek cities and then Roman cities

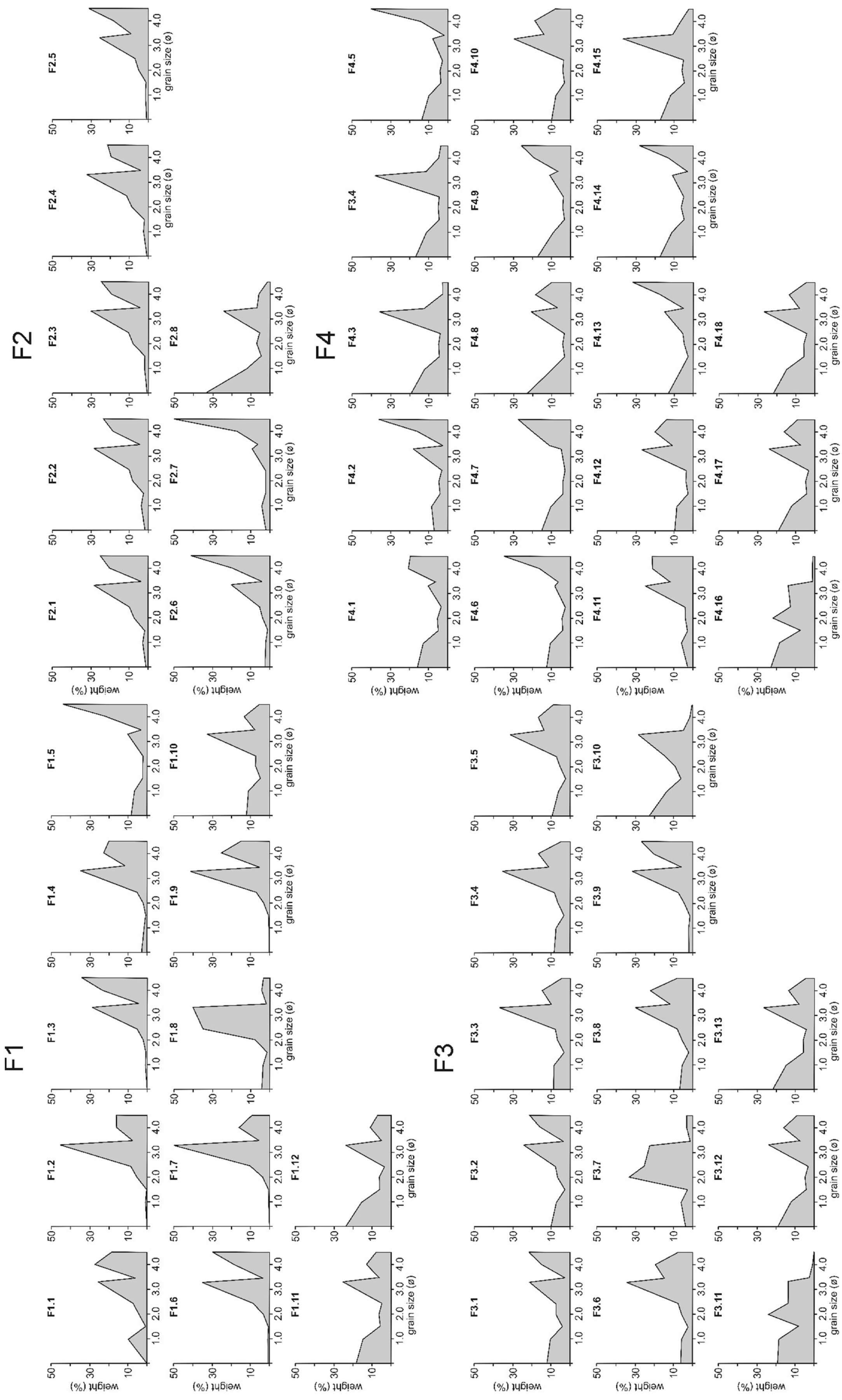

Fig. 9. Granulometric analysis in the F1, F2, F3 and F4 boreholes.

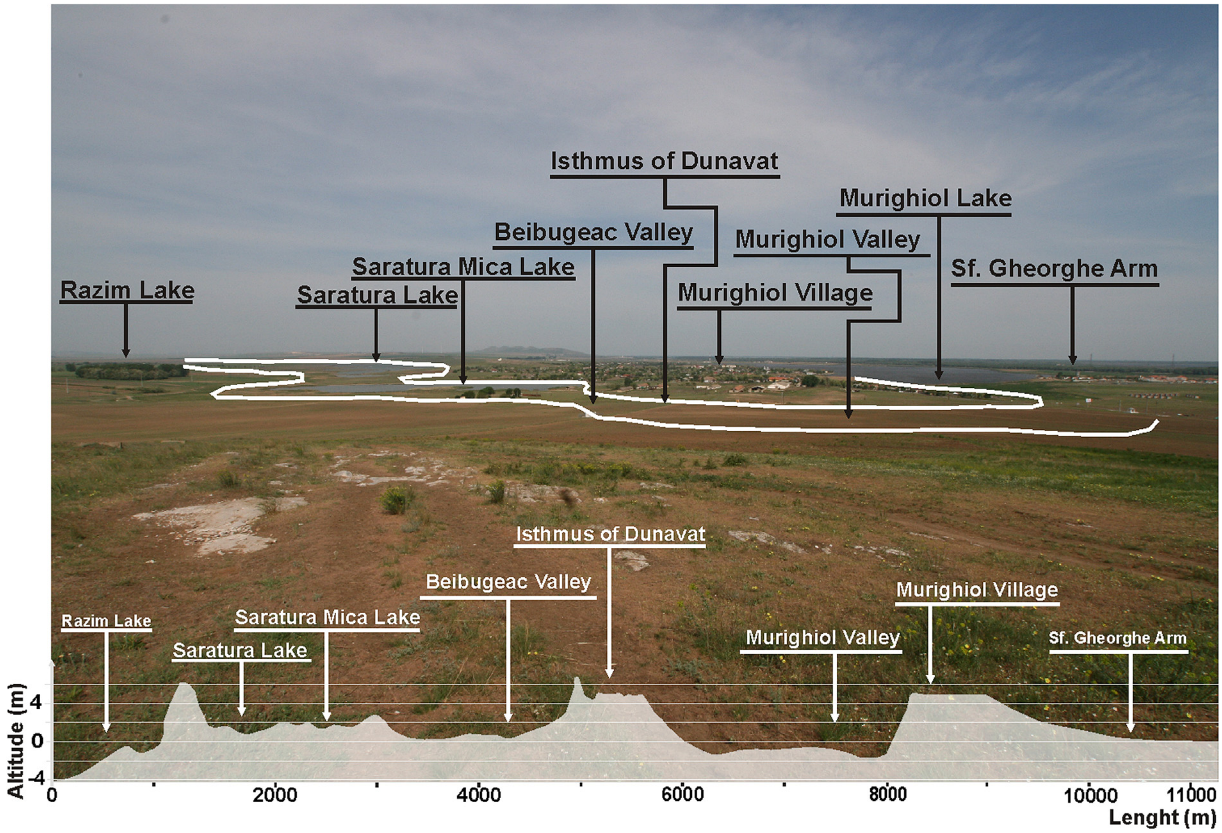

Fig. 10. Morphologic delimitation of the Beibugeac Corridor.

were built on the northern branch of the Dobroudja Plateau, adjacent to the Danube Delta and the Halmyris Gulf (Fig. 4).

During Greek Antiquity, the Danube Delta stretched up to the southern part of the initial Letea–Caraorman Corridor (Delta St. George I) (Fig. 4). Therefore, the Dunavat cape was bordered by the waters of the St. George arm (the oldest in the Danube Delta) in the north, those of the alleged Cernetu arm in the east and south-east, and those of the gulf of Halmyris in the south. The mouth of the Peuce arm was located between the southern extremity of the initial Letea–Caraorman corridor and the eastern end of Dunavat cape (Fig. 4). These data are corroborated by both ancient authors (Strabo, Ptolemy, Schimnos of Chios) and modern texts (Antipa,

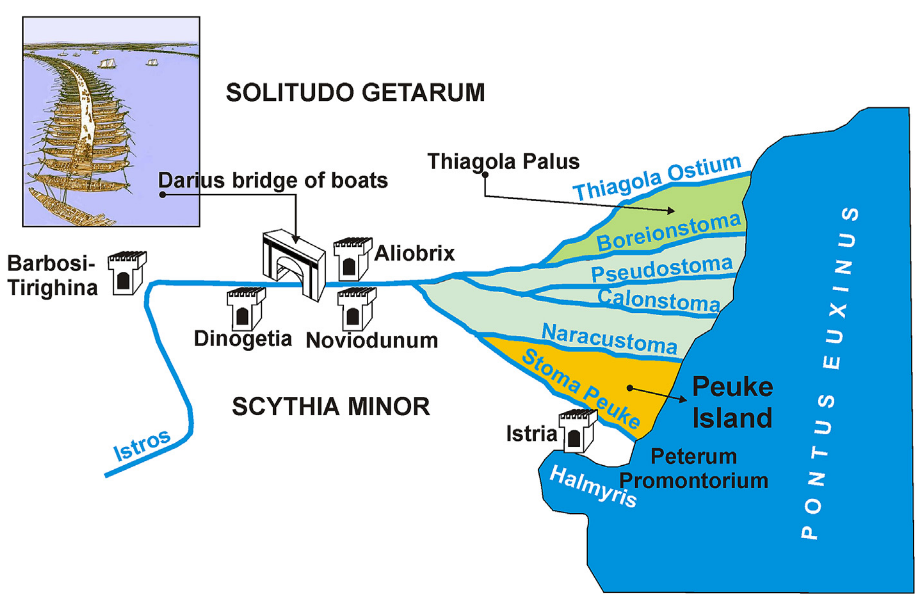

Fig. 11. Morphology of the Danube Delta and the positioning of the cities in the north of Scythia Minor during Antiquity (the mathematical coordinates belong to Ptolemy, the 2nd century BC).

Fig. 12. The harbour area of the city of Halmyris.

1910, 1912, 1915; Giosan et al., 2005, 2006; Romanescu, 1996; Stefanescu, 1981).

The lack of a fluvial or maritime corridor is also supported by the geologic analysis of the sediments existing in the Beibugeac corridor. From a granulometric perspective, the medium and coarse sands are underlain, completed by an insignificant amount of silt and clay. All four boreholes (F1, F2, F3 and F4) are obviously included in the class of sands. The high proportion of the coarse fraction indicates that the particles are carried from a short distance (Fig. 13).

The covariance diagrams indicate a fluvial origin of the sediments. The entire amount of sedimentary material comes from the erosion of continental materials from the surrounding hills. The current rock demonstrates that the loessoid deposits were completely eliminated, and the current lateral and linear erosion models significantly affected the calcareous rocks. These are not sediments belonging to the Danube River or maritime environment, which is proven by the lack of fossils. All boreholes were sterile from this point of view.

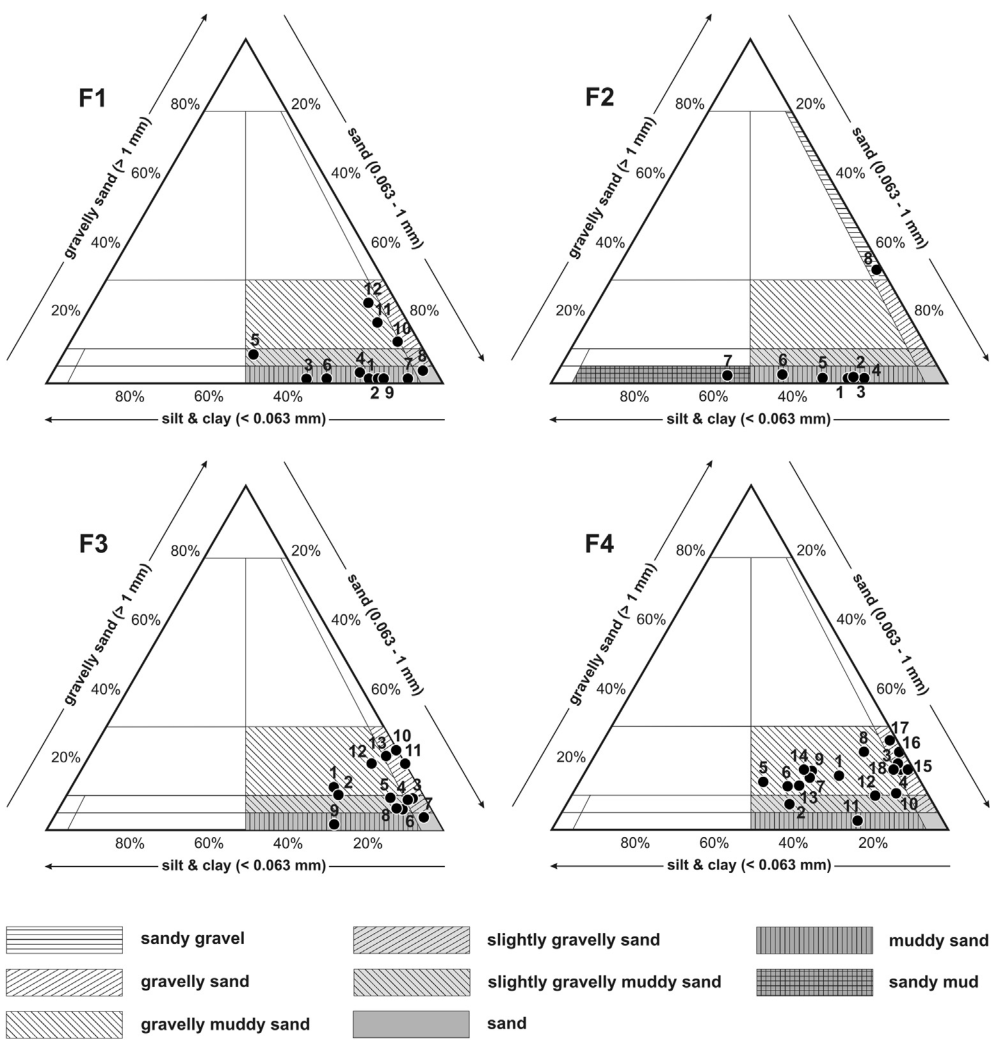

Fig. 13. Folk-style (1965) ternary diagram adjusted for the granulometric classification of the sediments by the rapport sand/silt and clay/gravelly sand.

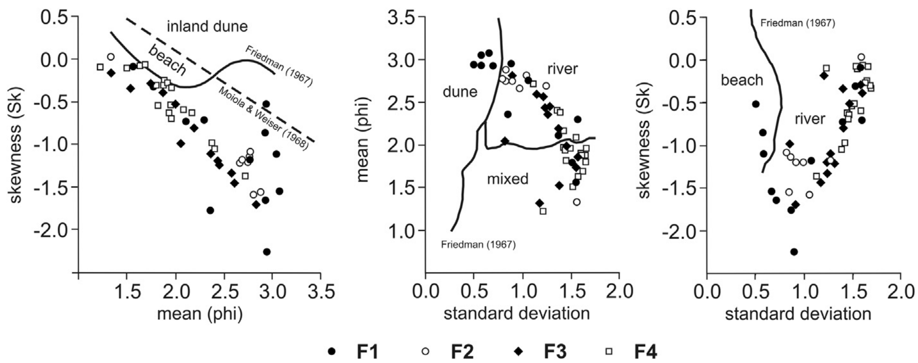

Fig. 14. Covariance diagrams of the granulometric parameters, with emphasis on the sedimentary environments (Friedman, 1961, 1967; Inman and Chamberlain, 1955; Moiola and Weiser, 1968).

Fig. 15. The Dunavat Peninsula surrounded by the waters of the Halmyris Gulf and the Danube Delta.

In certain cases, there are low frequencies of sediments specific to beaches (F1) that belong, in this case, to the wind domain (Fig. 14). The accumulations within the central sector of the Beibugeac corridor took the shape of stabilized dunes, resulting from wind erosion in the northeast–southwest direction. The winter brings the *crivat*, which is a high-speed, cold, dry wind that accentuates erosion, given the lack of vegetation and snow layer.

The existence of the continental deposits caused by lateral and torrential erosion determined the filling of the two divergent valleys, Beibugea and Murighiol, which began at the margin of the Murigiol village. One of the valleys elongated towards the Halmyris Gulf, which is occupied by Razim Lake today, and a shorter valley is oriented towards the Danube Delta, which is the St. George arm. The low altitudes and elevation of the water table determined the development of vegetation specific to wetlands. The hydrophilic vegetation was absent on the small-sized isthmus, Dunavat, situated in the eastern extremity of the Murighiol village (Figs. 6 and 10). The methodology employed, which is specific to the field of Geomorphology, is in agreement with current research requirements. The morphometric data, corroborated with the geological information (particularly that resulting from granulometric analyses), prove the continental origin of this corridor.

The Dunavat Peninsula looked like an island when viewed from both the sea and the St. George arm. This aspect may have caused ancient travellers to use the term "island" to designate what was in fact peninsula.

6. Conclusions

Geographers and historians have attempted to locate the legendary Peuce Island in the area of the Danube Delta. The main aim of the present study is to establish the origin of the Beibugeac corridor and to prove or disprove the existence of the island of Peuce. Unfortunately, the testimonies left by the ancient Greeks were not sufficiently accurate for exact positioning of this island. All the hypotheses developed thus far have been eliminated by specialized studies. The only supposition still open to discussion is the existence of a fluvial arm or maritime channel between the localities of Murighiol and Sarinasuf, which is between the St. George arm within the Danube Delta and Razim Lake within the ancient Halmyris Gulf. This corridor is known as Beibugeac, which is the ancient name of the locality of Plopu. This study presented geologic and geomorphologic arguments for the existence of a fluvial arm derived from the Danube or a maritime channel derived from the Halmyris Gulf towards the Danubian lagoon. The analysis of the four geologic boreholes executed in the Beibugeac corridor demonstrated that the alluvia deposits covering the bottom of the valley have a continental nature; they come from the superficial erosion of the slopes combined with the action of the wind. The highest altitudes are due to the accumulation of the sand, which took the shape of fixed dunes. In this case, the myth of the existence of Peuce Island in the eastern extremity of the Tulcea Hills (the Dunavat Hills) has been demolished.

It appears that the name Peuce Island was imposed by the inclusion of ancient writings in the world of navigation, commerce and science. Actually, Peuce Island was a peninsula (Dunavat). The ancient Greeks were interested only in the coastal area because the continental inland remained a *terra incognita*. The prolongation of the Dunavat Hills towards the Black Sea, in the shape of a beak, and the existence of small-sized gulfs deeply penetrating the Dobroudjan inland led certain sailors to consider this rocky dome an island (Fig. 15). The link between the Dunavat peninsula and the Dobroudjan inland per se was ensured by a small isthmus surrounded by low wetlands. In this case, the Dunavat peninsula could have been easily mistaken for an island.

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