Society for the Exploration of Eurasia, Switzerland

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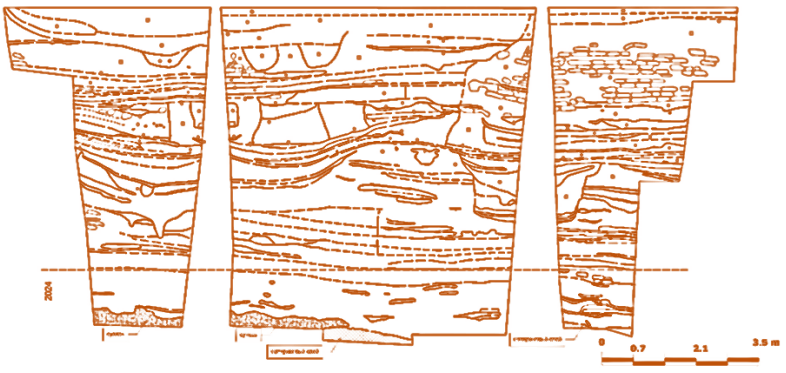
LLC RUTRUM

FIELD REPORT
ON THE
ARCHAEOLOGICAL EXCAVATIONS
AT KESKE KUYUK KALA,
KAZAKHSTAN IN 2024



stratigraphy of the Kesken-Kuyuk Kala site

Almaty 2025

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Introduction

In 2024, investigations were conducted at the Kesken-Kuyuk Kala site to study the settlement's stratigraphy by continuing work in Excavation No. 1 (stratigraphic test pit). As a result of the work undertaken, the stratigraphic trench was excavated down to the natural soil, which in this case is represented by a sandy alluvial layer and a dense silty layer containing inclusions of gypsum minerals. This layer constitutes the base of one of the former channels of the Syr Darya, which was situated in this area prior to the existence of the Kesken-Kuyuk Kala (small) settlement. (see Appendix – Drawing documentation, fig. 1, appendix - Photographic Appendix, fig. 1-8)

In total, the depth of the test pit reached 8 meters (with the lowest point at 66.732 meters), and in 2024 the excavation was deepened by 1.7 meters. As a result of the work conducted, 45 stratigraphic layers were identified and documented.

During the course of the excavation, ceramic and osteological material was discovered. The ceramic assemblage is represented by fragments of hand-made and wheel-thrown vessels, including rims, handles, ornamented and unornamented walls of red clay and grey clay ceramic vessels. Bone materials are represented by an antler point and a bone preform. The stone artifact assemblage is represented by fragments of stone querns. (see Appendix – Results of Archaeozoological Analysis of Animal Bone Remains, appendix - Description and Illustration of Ceramics and Finds, appendix - Catalogue of Finds)

To determine the age of the lower strata, organic samples were collected for radiocarbon dating. A total of six samples were collected in 2024, and samples from 2023 are also currently being processed. (see Appendix – Results of Radiocarbon Dating)

The osteological assemblage is represented by fragments of cattle and small ruminant bones, as well as fish bones.

Within the framework of the 'Rivers of the Silk Roads Project: How Water Shaped Societies and Empires in Central Asia,' research was conducted on irrigation at the Kesken-Kuyuk Kala site and its broader environs, including the Kesken-Kuyuk Kala (Big) site, Zhankent, and Myntobe. Specialists from the University of Lincoln participated in this work, including Professor Mark Macklin (PI), Dr Willem Toonen (CI), and James Thomas (RA). (see Appendix – Irrigation Studies)

The objective of the work is to investigate the chronology of historical and prehistoric river channels and their associated irrigation canal systems, particularly those connected with prominent archaeological sites. The dating of riverbeds and irrigation infrastructure will provide new data on

the development and abandonment of archaeological sites, as well as information on changes in settlement structure and economy associated with these irrigation systems.

At each selected area, a trench was excavated in the former riverbeds and of the canal, identified through remote sensing, and all stratigraphic sections were meticulously documented. The location of each sampling site was recorded directly in ArcGIS using a tablet computer and incorporated into the project database. If organic material (such as plant remains, charcoal, or bones) was encountered, it was collected for ^{14}C dating. Samples for OSL dating were also taken from appropriate sandy sediment layers. In total, more than 15 samples were collected. At present, the material is being processed.

Main Section

1. Objectives and Aims

Objective No. 1

Continuation of the study of the site's stratigraphy by deepening the stratigraphic test pit.

Tasks:

- Deepening and expanding the existing stratigraphic excavation; preparation of detailed documentation, including the creation of three-dimensional profile models, photographic recording, descriptions, and drawings.

- Collection of samples for radiocarbon dating.

Objective No. 2

Study of ceramic materials and preparation of a scientific report.

Tasks:

- Collection of ceramic materials at the settlement;

- Washing, coding, drawing, and compilation of statistical tables;

- Preparation of a scientific report on the results of the work.

Objective No. 3

Study of the irrigation system surrounding the Kesken-Kuyuk Kala settlement.

Tasks:

- Analysis of cartographic data;

- Field inspection of key elements of the irrigation system;

- Collection of samples for C14 and OSL analysis.

2. Description of Scientific Research

Prior to the commencement of scientific research on the construction horizons and the contents of the cultural Layer in the stratigraphic test pit, preparatory measures were undertaken to document the area. This included a description of its appearance, aerial photography, and photographic documentation of the territory designated for investigation.

Scientific research on the earlier Layers, construction elements, and accumulations in the test pit began with the cleaning of previously excavated surfaces and the removal of overlying soil within the test pit.

Excavation was conducted simultaneously across the entire area of the test pit, employing a methodical, layer-by-layer cleaning of each identified stratum, with the gradual removal of soil fill.

Photographic documentation and recording of the identified elements—including the ditch, walls, hearth, refuse pits, ash lenses, and so forth—were carried out across the entire area of the designated test pit.

In total, the depth of the test pit reached 8 meters (with the lowest point at 66.732 meters), and in 2024 the excavation was deepened by 1.7 meters. As a result of the work undertaken, 46 stratigraphic layers were identified and documented.

During the course of the work, the wall structure identified in 2023 and subdivided into three phases was dismantled. The exposure of previously missing sections of the northern and southern stratigraphic profiles yielded new data on the formation of the earliest layers of the settlement. From the lowest Layer El. No. 12, two samples were taken from different profiles for radiocarbon dating analysis. As a result, a date ranging from 429 to 600 AD was obtained.

The principal layers identified in 2024 are represented by mudbrick masonry (possibly a floor or the foundation of a destroyed wall) in the northern stratigraphic profile at a depth of 70.9 meters. Below this layer lies a substantial organic layer with a thickness of 1.34 meters. At the center of the test pit, at the very bottom, a pit filled with ash was identified. Apparently, the first settlers used ash and the entire layer of organic material to create a waterproofing layer, thereby separating the old Syr Darya riverbed from the new constructions (the foundation of the city). Also noteworthy is the layer overlying the mudbrick masonry, which consists of a substantial accumulation of reed, laid in successive courses to a total thickness of 35–40 cm. This layer also represents one of the stages in the formation of the foundation for subsequent construction. A more detailed description of the stratigraphic context will be provided below.

2.1 Stratigraphic Trench No. 1

The excavation is situated in the southern part of the Kesken-Kuyuk Kala settlement. This excavation represents a continuation of a previously established stratigraphic trench.

The objective of this excavation is to identify the stratigraphic context of the settlement and to determine the chronological range of its occupation.

During the course of the work, 46 layers were identified, associated both with architectural features (floors, walls) and with evidence of settlement activity (refuse pits, alluvial layers).

2.1.1 List of Elements

1. Layer of very dense grey loam.
2. Layer of highly compact grey-brown loam.
3. Layer of very dense grey loam.
4. Layer of very dense grey-yellow loam.
5. Layer of very dense grey-yellow loam with a brownish hue.
6. Layer of very dense bright brown loam.
7. Layer of very dense dark brown loam.
8. Layer of very dense light greyish-brown loam with traces of bright orange iron oxide.
9. Layer of medium-density sandy loam, yellow-brown in color.
10. Uniform organic layer (reed), loose and bright brownish-brown in color, occurring in layers interspersed with burnt strata.
11. Thick layer of dense gray loam with a significant amount of bright orange iron oxide, occurring in horizontal interlayers.
12. Thick layer of disturbed deposit (organic matter, burnt strata, loam of various colors), dark brown in color.
13. Bright yellow dense loam (brick).
14. Pit (see 2023 report).
15. Ash-colored sandy loam (ash).
16. Layer of laminated sandy loam with charcoal and ash, overlying layers No. 04 and 08.
17. Bright brown dense loam.
18. Bright gray loose sandy loam.
19. Whitish, cloddy, loose sandy loam.

20. Bright brown dense loam.

21. Gray loose loam, with a layer of brown organic matter at the bottom.

22. Layer of organic matter.

23. Layer of dense loam, bright gray in color.

24. Loose sandy loam, bright orange in color (fired).

25. Layer of medium-density loam-sandy loam, bright yellow in color.

26. Dense loam, gray-brown in color.

27. Dense loam, light yellow-brown in color.

28. Layer of very dense sandy loam, gray-brown in color.

29. Dense gray loam.

30. Bright yellow, very dense sandy layer.

31. Light gray silty loam.

32. Layer of black-gray loam containing a high concentration of carbonates.

33. Interlayer of loose, greenish-brown, sand-rich sandy loam.

34. Bright yellow sandy loam, very dense, resembling brick.

35. Light gray, silty, sand-rich loam.

36. Very dense, yellow-brown sandy loam layer.

37. Bright yellow sand with significant orange inclusions (iron oxide).

38. Very dense, greenish-gray loam (silt) with iron oxide inclusions.

39. Dense grayish-brown loam.

40. Loose, light grayish-yellow sandy loam.

41. Cloddy, loose, grayish-brown sandy loam.

42. Two rows of bricks (36 × 36 × 10 cm) made from dense grayish-brown loam with numerous orange inclusions (iron oxide).

43. Bright grayish-brown loam with inclusions of vivid orange iron oxide.

44. Dense, bright brown loam with numerous inclusions of charcoal and carbonaceous layers.

45. The orange sandy loam is very loose and exhibits a high sand content.

46. Masonry of raw blocks made of grey-brown dense loam with inclusions of iron oxide.

2.1.2 Description of Stratigraphic Elements

Northern stratigraphic profile.

General parameters.

Profile dimensions: length at the top—6.56 m; length at the bottom—6.19 m; height—2.94 m (upper elevation 69.672 m, lower 66.732 m). The profile comprises eight Layers (Nos. 09, 10, 11, 12, 30, 38, 44, 45). Samples for radiocarbon dating were collected from Layer No. 12. The sequence of layer description proceeds from the top downward. (see Appendix – Drawing Documentation, fig. 4, 8-14)

Layer Number

№09

Layer Characteristics

Layer of medium-density sandy loam, yellow-brown in color.

Layer Location

The top layer of the northern stratigraphic profile, situated at an elevation of 69.672 m, overlies Layer No. 10. In the eastern part, remains of a structure (El.) were identified in 2023. No. 84 (interpreted as a wall). In the lower part, beneath the 'wall', a row of four mud bricks with a total length of 1.4 meters was identified. The length of the bricks ranges from 30 to 50 cm, with a height of 7–8 cm.

Layer dimensions

The average layer thickness is approximately 45 cm, with a length of 430 cm.

Elevation mark

Top: 0.000 m

Bottom: -0.450 m

Layer Number

№10

Layer Characteristics

Uniform organic layer (reed), loose and bright brownish-brown in color, occurring in layers interspersed with burnt strata.

Layer Location

The layer is situated beneath Layer No. 9, overlies Layer No. 44, and extends along the entire length of the profile. In the eastern part, under el. In the area of No. 84 (interpreted as a wall), this layer narrows.

Layer dimensions

The average layer thickness in the western part is approximately 20 cm, in the eastern part approximately 10 cm, with a length of 644 cm.

Elevation mark

Top: -0.450 m

Bottom: -0.780 m

Layer Number

№44

Layer Characteristics

Dense, bright brown loam with numerous inclusions of charcoal and carbonaceous interlayers.

Layer Location

This layer is situated beneath Layer No. 10, overlies Layer No. 11, and extends along the entire length of the profile.

Layer dimensions

The average layer thickness is approximately 17 cm, with a length of 640 cm.

Elevation mark

Top: -0.780 m

Bottom: -0.940 m

Layer Number

№11

Layer Characteristics

A substantial layer of dense gray loam containing abundant bright orange iron oxide, occurring in horizontal interlayers. In the central part of the layer, there is a masonry of unfired bricks arranged in two rows: the upper row contains six bricks, the lower row ten bricks. Dimensions: length from 55 to 22 cm, height 9–10 cm. In 2023, masonry (el.) was identified in the excavation. No. 109, possibly forming part of a substantial platform or wall, and representing the earliest construction phase at the site in this specific location. The length of the masonry in the profile is 3 meters. (see Appendix – Photographic Appendix, fig. 13-14)

Layer Location

The layer is situated beneath Layer No. 44, overlies Layer No. 12, and extends the entire length of the profile.

Layer dimensions

The average layer thickness is approximately 28 cm, with a length of 637 cm.

Elevation mark

Top: -0.940 m

Bottom: -1.230 m

Layer Number

№12

Layer Characteristics

A substantial disturbed deposit (organic matter, burnt strata, loam of various colors) of dark brown color. This layer does not contain any structural remains; it represents a disturbed deposit composed of ash, clay, and a large quantity of broken ceramics and animal bones. The layer was formed gradually, as evidenced by numerous interlayers. In the lower part of the layer, a rounded depression was identified, containing a substantial amount of ash and charcoal. (see Appendix – Photographic Appendix, fig. 17-19)

Layer Location

The layer is situated beneath Layer No. 11, overlies Layer No. 38 (natural soil) and No. 30, and extends along the entire length of the profile.

Layer dimensions

The average thickness of the layer is approximately 125 cm, with a length of 630 cm.

Elevation mark

Top: -1.230 m

Bottom: -2.640 m

Layer Number

№46

Layer Characteristics

The masonry from raw blocks with dimensions 36×36×10 cm, made of grey-brown dense loam with inclusions of iron oxide

Layer Location

Located inside layer No. 11, lies on layer No. 12

Layer dimensions

In the central part of the layer there is a masonry of raw bricks (el. 46) in 2 rows - upper row of 6 bricks, lower row of 10 bricks, dimensions: length from 55 to 22 cm, height 9-10 cm.

Elevation mark

Top: -1,020 m

Bottom: -1,220 m

Layer Number

№12

Layer Characteristics

A substantial disturbed deposit (organic matter, burnt strata, loam of various colors) of dark brown color. This layer does not contain any structural remains; it represents a disturbed deposit composed of ash, clay, and a large quantity of broken ceramics and animal bones. The layer was formed gradually, as evidenced by numerous interlayers. In the lower part of the layer, a rounded depression was identified, containing a substantial amount of ash and charcoal.

Layer Location

The layer is situated beneath Layer No. 11, overlies Layer No. 38 (natural soil) and No. 30, and extends along the entire length of the profile.

Layer dimensions

The average thickness of the layer is approximately 125 cm, with a length of 630 cm.

Elevation mark

Top: -1.230 m

Bottom: -2.640 m

Layer Number

№45

Layer Characteristics

The orange sandy loam is very loose and exhibits a high sand content. It is represented by two rounded elements measuring between 8 and 14 cm.

Layer Location

The Layer is situated in the western part of the profile, within Layer No. 12.

Layer dimensions

It is represented by two rounded elements measuring between 8 and 14 cm.

Elevation mark

Top: -2.390 m

Bottom: -2.480 m

Layer Number

№30

Layer Characteristics

Bright yellow, very dense sandy layer.

Layer Location

The Layer is situated in the eastern part of the profile and is intersected by Layer No. 12. It is most likely a sedimentary sand layer formed during the existence of the riverbed or the canal. It does not contain any cultural materials or evidence of human activity. (see Appendix – Photographic Appendix, fig. 15-16)

Layer dimensions

The average layer thickness is approximately 23 cm, with a length of 211 cm.

Elevation mark

Top: -1.970 m

Bottom: -2.200 m

Layer Number

№38

Layer Characteristics

Very dense greenish-grey loam (silt) with inclusions of iron oxide and gypsum mineral. This layer represents the lower part of the riverbed or canal and does not contain traces of habitation or cultural materials (natural soil layer). This is the original surface upon which urban construction was initiated. Accordingly, Layer No. 12, situated above Layer No. 38, from which samples for carbon-14 analysis were taken, is the oldest. (see Appendix – Photographic Appendix, fig. 22)

Layer Location

The lowest layer of the northern stratigraphic profile is overlain by Layer No. 12.

Layer dimensions

The average layer thickness is approximately 30 cm, with a length of 200 cm.

Elevation mark

Top: -2.640 m

Bottom: -2.940 m

Southern stratigraphic profile.

General parameters.

Profile dimensions: length at the top is 7.14 m, length at the bottom is 6.27 m, height is 7.62 m (upper elevation 74.813 m, lower elevation 66.213 m). The profile contains 27 layers, and samples for radiocarbon dating were taken from Layer No. 12. The sequence of layer description proceeds from the top downward. (see Appendix – Drawing Documentation, fig. 5-7, 24-40)

Layer Number

№14

Layer Characteristics

Pit (see 2023 report). During the clearing of the pit fill, in addition to the dark brown sandy loam, osteological material was identified, including sheep bones, bird bones, and individual fragments attributable to cattle.

The ceramic assemblage within this fill is represented by a variety of handmade vessel fragments, primarily belonging to water-carrying jugs, pots, braziers, and cauldrons. Many of these fragments exhibit traces of exposure to fire.

Among the osteological material, a vertebra of a large river fish was identified, apparently belonging to a large catfish. In the same layer, ribs of large river fish specimens were found.

At the 32.362 mark, an ash fill layer was observed, beneath which, at the 32.167 mark, a rounded pit bottom was revealed.

Layer Location

The refuse pit is situated in the southwestern corner of the stratigraphic test pit. The refuse pit is bounded to the east and north by a dense, greenish-hued loam layer (90). Represents a multi-layered accumulation of diverse layers. At the 33.146 level, an infill of dark brown sandy loam is observed.

Layer dimensions

The average layer thickness is approximately 70 cm, with a length of 95 cm.

Elevation mark

Top: -3.820 m

Bottom: -4.820 m

Layer Number

№15

Layer Characteristics

Layer of laminated sandy loam containing charcoal and ash. Represents a lens with a subsided central portion. The transition between the edges and the center is approximately 70 cm.

Layer Location

The layer overlies Layer No. 02 and is situated in the eastern part of the profile.

Layer dimensions

The average layer thickness is approximately 7 cm, with a length of 290 cm.

Elevation mark

Top: -3.200 m

Bottom: -3.880 m

Layer Number

№16

Layer Characteristics

Layer of laminated sandy loam with charcoal and ash.

Layer Location

This layer overlies layers No. 04 and 02. It is observed along the entire length of the profile.

Layer dimensions

The average layer thickness is approximately 5 cm, with a length of 641 cm.

Elevation mark

Top: -4.510 m

Bottom: -4.560 m

Layer Number

№04

Layer Characteristics

Layer of gray-yellow, very dense loam. In the 2023 report, this section was interpreted as the first phase of the wall's existence. In 2024, this structure was removed, and several layers of dense loam, each with an average thickness of 20 cm, were identified in the profile. It is presumed that this was a structure constructed by the method of clay pouring in layers. The edges of this structure are only faintly discernible in the eastern part. This is most likely associated with the later construction of a large refuse pit, which subsided into the interior space of the room that was bounded on the west by this structure.

Layer Location

Situated in the central part of the profile. The layer overlies Layer No. 32.

Layer dimensions

The average thickness of the layer is approximately 19 cm, with a length of 132 cm.

Elevation mark

Top: -4.530 m

Bottom: -4.730 m

Layer Number

№05

Layer Characteristics

Layer of gray-yellow, very dense loam with a brownish tint. Comparable to Layer No. 04. In the 2023 report, this section was interpreted as the second phase of wall existence. In 2024, this structure was removed, and several layers of dense loam, each with an average thickness of 20 cm, were identified in the profile. It is presumed that this was a structure constructed by the method of clay pouring in layers. The edges of this structure are only faintly discernible in the eastern part. This is most likely associated with the later construction of a large refuse pit, which subsided into the interior space of the room that was bounded on the west by this structure.

Layer Location

Situated in the central part of the profile. The layer is situated beneath Layer No. 04 and overlies Layer No. 32.

Layer dimensions

The average thickness of the layer is approximately 19 cm, with a length of 132 cm.

Elevation mark

Top: -4.730 m

Bottom: -4.950 m

Layer Number

№32

Layer Characteristics

Layer of black-gray loam containing a high concentration of carbonates.

Layer Location

Situated in the central part of the profile. This layer is situated beneath Layer No. 05 and overlies Layer No. 06.

Layer dimensions

The average thickness of the layer is approximately 3 cm, with a length of 98 cm.

Elevation mark

Top: -4.820 m

Bottom: -4.930 m

Layer Number

№06

Layer Characteristics

A layer of very dense, bright brown loam, similar to Layers No. 04 and 05. In the 2023 report, this section was interpreted as the second phase of wall existence. In 2024, this structure was removed, and several layers of dense loam, each with an average thickness of 20 cm, were identified in the profile. It is presumed that this was a structure constructed by the method of clay pouring in layers. The edges of this structure are only faintly discernible in the eastern part. This is most likely associated with the later construction of a large refuse pit, which subsided into the interior space of the room that was bounded on the west by this structure.

Layer Location

Situated in the central part of the profile. This layer is located beneath Layer No. 32 and rests upon Layer No. 03.

Layer dimensions

The average thickness of the layer is approximately 20 cm, with a length of 132 cm.

Elevation mark

Top: -4.820 m

Bottom: -4.150 m

Layer Number

№02

Layer Characteristics

Layer of highly compact grey-brown loam.

Layer Location

Located in the eastern and western parts of the profile, separated by the group of Layers No. 04–06. The Layer is situated beneath Layer No. 16 and rests upon Layer No. 01.

Layer dimensions

The average layer thickness is approximately 39 cm, with a length of 639 cm.

Elevation mark

Top: -4.550 m

Bottom: -4.990 m

Layer Number

№02

Layer Characteristics

Layer of highly compact grey-brown loam.

Layer Location

Located in the eastern and western parts of the profile, separated by the group of Layers No. 04–06. The Layer is situated beneath Layer No. 16 and rests upon Layer No. 01.

Layer dimensions

The average layer thickness is approximately 39 cm, with a length of 639 cm.

Elevation mark

Top: -4.550 m

Bottom: -4.990 m

Layer Number

№01

Layer Characteristics

Layer of very dense grey loam.

Layer Location

Located in the eastern part of the profile. The Layer is situated beneath Layer No. 02, overlies Layer No. 09, and adjoins Layer No. 3 to the west.

Layer dimensions

The average layer thickness is approximately 4 cm, with a length of 44 cm.

Elevation mark

Top: -4.750 m

Bottom: -4.850 m

Layer Number

№03

Layer Characteristics

Layer of very dense grey loam, compressed in the central part. This is a thin interlayer separating two periods of use of this area. Possibly an exposed surface.

Layer Location

The layer is situated beneath layers No. 02 and 06, overlies layers No. 07 and 09, and extends along the entire profile.

Layer dimensions

The average layer thickness is approximately 5 cm, with a length of 637 cm.

Elevation mark

Top: -4.740 m

Bottom: -5.200 m

Layer Number

№07

Layer Characteristics

A layer of very dense dark brown loam. Similar to layers No. 04, 05, and 06. In the 2023 report, this section was interpreted as the second phase of wall existence. In 2024, this structure was removed, and several layers of dense loam, each with an average thickness of 20 cm, were identified in the profile. It is presumed that this was a structure constructed by the method of clay pouring in layers. The edges of this structure are only faintly discernible in the eastern part. This is most likely associated with the later construction of a large refuse pit, which subsided into the interior space of the room that was bounded on the west by this structure.

Layer Location

The layer is located in the central part of the profile, beneath layer No. 03, and overlies layer No. 08.

Layer dimensions

The average layer thickness is approximately 17 cm, with a length of 130 cm.

Elevation mark

Top: -5.240 m

Bottom: -5.570 m

Layer Number

№08

Layer Characteristics

A layer of very dense dark brown loam. Similar to Layers No. 04, 05, 06, and 07. In the 2023 report, this section was interpreted as the second phase of wall existence. In 2024, this structure was removed, and several layers of dense loam, each with an average thickness of 20 cm, were identified in the profile. It is presumed that this was a structure constructed by the method

of clay pouring in layers. The edges of this structure are only faintly discernible in the eastern part. This is most likely associated with the later construction of a large refuse pit, which subsided into the interior space of the room, bounded on the west by this structure. This layer is situated above the substantial organic Layer No. 10 and represents the lowest stratum in this multi-layered structure.

Layer Location

The layer is located in the central part of the profile, beneath Layer No. 07, and rests upon Layer No. 10.

Layer dimensions

The average layer thickness is approximately 17 cm, with a length of 167 cm.

Elevation mark

Top: -5.220 m

Bottom: -5.550 m

Layer Number

№09

Layer Characteristics

Layer of medium-density sandy loam, yellow-brown in color.

Layer Location

Located in the eastern and western parts of the profile, separated by the group of Layers No. 07–08. The Layer is situated beneath Layer No. 1–3 and rests upon Layer No. 10.

Layer dimensions

The average layer thickness is approximately 38 cm, with a length of 633 cm.

Elevation mark

Top: -4.840 m

Bottom: -5.330 m

Layer Number

№33

Layer Characteristics

Interlayer of greenish-brown, loose, sandy loam, semi-spherical in form.

Layer Location

Located in the eastern part of the profile. The Layer is situated beneath Layer No. 9 and rests upon Layer No. 10.

Layer dimensions

The average layer thickness is approximately 19 cm, with a length of 58 cm.

Elevation mark

Top: -4.840 m

Bottom: -5.330 m

Layer Number

№10

Layer Characteristics

A uniform organic layer (reed), loose and of a bright brown color, occurring in layers interspersed with burnt interlayers.

Layer Location

Extends along the entire length of the profile. The layer is situated beneath layers No. 8 and 9, and overlies layer No. 11.

Layer dimensions

The average layer thickness is approximately 33 cm, with a length of 630 cm.

Elevation mark

Top: -5.570 m

Bottom: -5.890 m

Layer Number

№11

Layer Characteristics

A substantial layer of dense gray loam containing a significant amount of bright orange iron oxide, occurring in horizontal interlayers.

Layer Location

Extends along the entire length of the profile. The layer is situated beneath Layer No. 11 and overlies Layer No. 12.

Layer dimensions

The average layer thickness is approximately 35 cm, with a length of 630 cm.

Elevation mark

Top: -5.890 m

Bottom: -6.270 m

Layer Number

№34

Layer Characteristics

Bright yellow sandy loam, very dense, resembling brick.

Layer Location

Located within Layer No. 11 in the eastern section.

Layer dimensions

38 × 10 cm

Elevation mark

Top: -5.740 m

Bottom: -5.840 m

Layer Number

№12

Layer Characteristics

A substantial disturbed deposit (organic matter, burnt strata, loam of various colors) of dark brown color. Fragments of mudbrick blocks (El. No. 13) are present within the layer. This layer does not contain any structural remains; it represents a disturbed deposit composed of ash, clay, and a large quantity of broken ceramics and animal bones. The layer was formed gradually, as evidenced by numerous interlayers. In the lower part of the layer, a rounded depression was identified, containing a substantial amount of ash and charcoal.

Layer Location

Situated beneath Layer No. 11 and overlying Layers No. 30 and 38.

Layer dimensions

The average layer thickness is approximately 110 cm, with a length of 628 cm.

Elevation mark

Top: -6.270 m

Bottom: -7.360 m

Layer Number

№13

Layer Characteristics

Bright yellow dense loam (brick).

Layer Location

Located in Layer No. 12, eastern section.

Layer dimensions

Blocks of amorphous form

Elevation mark

Top: -6.170 m

Bottom: -6.770 m

Layer Number

№36

Layer Characteristics

Very dense, yellow-brown sandy loam layer.

Layer Location

Located in Layer No. 12, western section, resting on Layer No. 35.

Layer dimensions

Average layer thickness approximately 8 cm; length 41 cm.

Elevation mark

Top: -6.790 m

Bottom: -6.870 m

Layer Number

№35

Layer Characteristics

Light gray, silty, sand-rich loam.

Layer Location

Located in Layer No. 12, western section, beneath Layer No. 36, resting on Layer No. 37.

Layer dimensions

Average layer thickness approximately 10 cm; length 100 cm.

Elevation mark

Top: -6.870 m

Bottom: -7.000 m

Layer Number

№37

Layer Characteristics

Bright yellow sand with significant orange inclusions (iron oxide).

Layer Location

Located within Layer No. 12, in the western section, beneath Layer No. 35.

Layer dimensions

Average layer thickness is approximately 7 cm; length is 52 cm.

Elevation mark

Top: -6.930 m

Bottom: -7.000 m

Layer Number

№30

Layer Characteristics

The bright yellow sandy layer is notably dense. It is most likely a sedimentary sand layer formed during the existence of the riverbed or the canal. It does not contain any cultural materials or evidence of human activity.

Layer Location

Located within Layer No. 12, in the eastern part of the profile, beneath Layer No. 12.

Layer dimensions

Average layer thickness is approximately 27 cm; length is 267 cm.

Elevation mark

Top: -7.000 m

Bottom: -7.200 m

Layer Number

№38

Layer Characteristics

Very dense greenish-grey loam (silt) with inclusions of iron oxide and gypsum mineral. This layer represents the lower part of the riverbed or canal and does not contain traces of habitation or cultural materials (natural soil layer). This is the original surface upon which urban construction was initiated. Accordingly, Layer No. 12, situated above Layer No. 38, from which samples for carbon-14 analysis were taken, is the oldest.

Layer Location

The lowermost layer of the southern stratigraphic profile, overlain by Layers No. 12 and 30.

Layer dimensions

The average layer thickness is approximately 36 cm, with a length of 624 cm.

Elevation mark

Top: -7.200 m

Bottom: -7.610 m

Eastern stratigraphic profile.

General parameters.

Profile dimensions: upper length 4.66 m, lower length 1.98 m, height 7.62 m (upper elevation 74.813 m, lower elevation 67.213 m). The profile comprises 25 layers; samples for radiocarbon dating were collected from Layer No. 12. The sequence of layer description proceeds from the top downward. (see Appendix – Drawing Documentation, fig. 2, 6-7, 15-23)

Layer Number

№17

Layer Characteristics

Dense loam of a vivid brown color. The layer descends towards the center of the profile.

Layer Location

Located in the left part of the profile. Overlies Layer No. 18.

Layer dimensions

The average layer thickness is approximately 4 cm, with a length of 74 cm.

Elevation mark

Top: -3.340 m

Bottom: -3.720 m

Layer Number

№16

Layer Characteristics

Layer of laminated sandy loam containing charcoal and ash.

Layer Location

Extends along the entire profile, exhibits a lens-shaped form, and descends towards the center of the profile. Overlies Layers No. 19 and 18.

Layer dimensions

The average layer thickness is approximately 4 cm, with a length of 262 cm.

Elevation mark

Top: -3.490 m

Bottom at -4.020 m

Layer Number

№18

Layer Characteristics

Loose, bright gray sandy loam. Represents a pit filled with ashy material, overlain by burnt layer No. 17.

Layer Location

Located in the left part of the profile. Overlain by layer No. 17.

Layer dimensions

Average layer thickness is approximately 40 cm; length is 89 cm.

Elevation mark

Top at -3.360 m

Bottom at -4.000 m

Layer Number

№19

Layer Characteristics

Light, cloddy, loose sandy loam.

Layer Location

Extends along the entire profile; in the center, it is penetrated by a burrow. Overlain by layer No. 16 and, from below, it overlies layer No. 15.

Layer dimensions

The average layer thickness is approximately 43 cm, with a length of 265 cm.

Elevation mark

Top: -4.030 m

Bottom: -4.310 m

Layer Number

№15

Layer Characteristics

Ash-colored sandy loam (ash). Lens-shaped layer, consisting of two parts, penetrated at the center by a burrow; the layers slope downward toward the center of the profile.

Layer Location

Extends along the entire profile; in the center, it is penetrated by a burrow. Overlain by Layer No. 19 above, and overlies Layer No. 20 below.

Layer dimensions

The average layer thickness is approximately 5 cm, with a length of 265 cm.

Elevation mark

Top: -3.910 m

Bottom: -4.400 m

Layer Number

№20

Layer Characteristics

Bright brown dense loam.

Layer Location

Extends along the entire profile; in the center, it is penetrated by a burrow. Overlain by Layer No. 15 above, and overlies Layers No. 21 and 23 below.

Layer dimensions

The average layer thickness is approximately 26 cm, with a length of 256 cm.

Elevation mark

Top: -4.400 m

Bottom: -4.670 m

Layer Number

№21

Layer Characteristics

Gray, loose loam; at the base, a layer of brown organic material (burrow) is present.

Layer Location

Situated at the center of the profile. Overlain by Layer No. 20 above and overlying Layer No. 23 below.

Layer dimensions

The average layer thickness is approximately 22 cm, with a length of 44 cm.

Elevation mark

Top: -4.710 m

Bottom: -4.930 m

Layer Number

№22

Layer Characteristics

Layer of organic matter.

Layer Location

Situated at the center of the profile. Overlain by Layer No. 21 above and overlying Layer No. 23 below.

Layer dimensions

The average layer thickness is approximately 2 cm, with a length of 44 cm.

Elevation mark

Top: -4.930 m

Bottom: -4.940 m

Layer Number

№23

Layer Characteristics

Layer of dense loam, bright gray in color.

Layer Location

Extends along the entire profile. Overlain by Layer No. 20 above, and overlies Layers No. 10 and 29 below.

Layer dimensions

Average layer thickness is approximately 37 cm; length, 252 cm.

Elevation mark

Top: -4.620 m

Bottom: -5.050 m

Layer Number

№24

Layer Characteristics

Loose sandy loam, bright orange in color (fired).

Layer Location

Located in the left part of the profile. Overlain by Layer No. 23 above.

Layer dimensions

Average layer thickness is approximately 4 cm; length, 40 cm.

Elevation mark

Top: -4.670 m

Bottom: -4.800 m

Layer Number

№26

Layer Characteristics

Dense loam of gray-brown coloration. Clay blocks measuring 38 × 7 cm. Arranged one above the other in four rows.

Layer Location

Located in the left part of the profile. Overlain by Layer No. 23 at the top and resting on Layer No. 27 at the bottom.

Layer dimensions

The average layer thickness is approximately 43 cm, with a length of 38 cm.

Elevation mark

Top: -4.570 m

Bottom: -5.010 m

Layer Number

№01

Layer Characteristics

Layer of very dense grey loam.

Layer Location

Located in the right part of the profile. Overlain by Layer No. 23 at the top and resting on Layer No. 25 at the bottom.

Layer dimensions

The average layer thickness is approximately 3 cm, with a length of 34 cm.

Elevation mark

Top: -4.740 m

Bottom: -4.770 m

Layer Number

№25

Layer Characteristics

Layer of medium-density loam-sandy loam of bright yellow color (identical to Layer No. 09).

Layer Location

Located in the right part of the profile. Overlain by Layer No. 01 at the top and resting on Layer No. 10 at the bottom.

Layer dimensions

The average layer thickness is approximately 36 cm, with a length of 34 cm.

Elevation mark

Top: -4.780 m

Bottom: -5.160 m

Layer Number

№28

Layer Characteristics

Layer of very dense sandy loam, gray-brown in color.

Layer Location

Situated in the central part of the profile. Overlain by Layer No. 23 at the top and resting on Layer No. 10 at the bottom.

Layer dimensions

The average layer thickness is approximately 11 cm, with a length of 60 cm.

Elevation mark

Top: -5.060 m

Bottom: -5.170 m

Layer Number

№27

Layer Characteristics

Dense loam, light yellow-brown in color.

Layer Location

Located in the left part of the profile. Overlain by Layer No. 26 at the top and resting on Layer No. 10 at the bottom.

Layer dimensions

The average layer thickness is approximately 27 cm, with a length of 100 cm.

Elevation mark

Top: -5.020 m

Bottom: -5.300 m

Layer Number

№10

Layer Characteristics

Uniform organic layer (reed), loose and bright brownish-brown in color, occurring in layers interspersed with burnt strata.

Layer Location

Extends along the entire length of the profile. Overlain by Layer No. 23 and underlain by Layer No. 11.

Layer dimensions

Average layer thickness is approximately 45 cm; length is 230 cm.

Elevation mark

Top: -5.120 m

Bottom: -5.550 m

Layer Number

№29

Layer Characteristics

Dense gray loam.

Layer Location

Extends along the entire length of the profile. Overlain by Layers No. 10 and 27, and underlain by Layer No. 10.

Layer dimensions

Average layer thickness is approximately 22 cm; length is 233 cm.

Elevation mark

Top: -5.210 m

Bottom: -5.430 m

Layer Number

№11

Layer Characteristics

Thick layer of dense gray loam with a significant amount of bright orange iron oxide, occurring in horizontal interlayers.

Layer Location

Extends along the entire length of the profile. Overlain by Layer No. 10 and underlain by Layer No. 12.

Layer dimensions

Average layer thickness is approximately 34 cm; length is 224 cm.

Elevation mark

Top: -5.540 m

Bottom: -5.880 m

Layer Number

№12

Layer Characteristics

A substantial disturbed deposit (organic matter, burnt strata, loam of various colors) of dark brown color. Fragments of mudbrick blocks (El. No. 13) are present within the layer. This layer does not contain any structural remains; it represents a disturbed deposit composed of ash, clay, and a large quantity of broken ceramics and animal bones. The layer was formed gradually, as evidenced by numerous interlayers.

Layer Location

Extends along the entire length of the profile. Overlain by Layer No. 11 at the top and resting on Layer No. 30 at the bottom.

Layer dimensions

The average layer thickness is approximately 88 cm, with a length of 211 cm.

Elevation mark

Top: -5.890 m

Bottom: -6.780 m

Layer Number

№13

Layer Characteristics

Bright yellow dense loam (brick).

Layer Location

Located in the right part of the profile, within Layer No. 12.

Layer dimensions

Blocks of amorphous form

Elevation mark

Top: -6.670 m

Bottom: -7.010 m

Layer Number

№31

Layer Characteristics

Bright yellow dense loam (brick).

Layer Location

Located in the central part of the profile, overlain by Layer No. 12 and resting on Layer No. 30.

Layer dimensions

An amorphous spot measuring 30 × 10 cm.

Elevation mark

Top: -6.760 m

Bottom: -6.950 m

Layer Number

№30

Layer Characteristics

The bright yellow sandy layer is notably dense. It is most likely a sedimentary sand layer formed during the existence of the riverbed or the canal. It does not contain any cultural materials or evidence of human activity.

Layer Location

Extends along the entire length of the profile, overlain by Layer No. 12, and rests on Layer No. 38.

Layer dimensions

Average layer thickness is approximately 40 cm; length is 198 cm.

Elevation mark

Top: -6.770 m

Bottom: -7.200 m

Layer Number

№38

Layer Characteristics

Very dense greenish-grey loam (silt) with inclusions of iron oxide and gypsum mineral. This layer represents the lower part of the riverbed or canal and does not contain traces of habitation or cultural materials (natural soil layer). This is the original surface upon which urban

construction was initiated. Accordingly, Layer No. 12, situated above Layer No. 38, from which samples for carbon-14 analysis were taken, is the oldest.

Layer Location

Extends along the entire length of the profile, overlain by Layer No. 30, and constitutes the lowest layer of the stratigraphy (natural soil).

Layer dimensions

Average layer thickness is approximately 40 cm; length is 198 cm.

Elevation mark

Top: -7.200 m

Bottom: -7.600 m

Western stratigraphic profile

General parameters.

Profile dimensions: length at the top is 4.27 m, length at the bottom is 1.53 m, height is 7.62 m (upper elevation 74.813 m, lower elevation 67.213 m). The profile contains 13 layers; samples for radiocarbon dating were taken from Layer No. 12. The sequence of layer description proceeds from the top downward. (see Appendix – Drawing Documentation, fig. 3, 6-7, 41-49)

Layer Number

№14

Layer Characteristics

Pit (see 2023 report). During the clearing of the pit fill, in addition to the dark brown sandy loam, osteological material was identified, including sheep bones, bird bones, and individual fragments attributable to cattle.

The ceramic assemblage within this fill is represented by a variety of handmade vessel fragments, primarily belonging to water-carrying jugs, pots, braziers, and cauldrons. Many of these fragments exhibit traces of exposure to fire.

Among the osteological material, a vertebra of a large river fish was identified, apparently belonging to a large catfish. In the same layer, ribs of large river fish specimens were found.

At the 32.362 mark, an ash fill layer was observed, beneath which, at the 32.167 mark, a rounded pit bottom was revealed.

Layer Location

The refuse pit is situated in the southwestern corner of the stratigraphic test pit. The refuse pit is bounded to the east and north by a dense, greenish-hued loam layer (90). Represents a multi-layered accumulation of diverse layers. At the 33.146 level, a fill of dark brown sandy loam is observed.

Layer dimensions

The average layer thickness is approximately 70 cm, with a length of 95 cm.

Elevation mark

Top: -3.820 m

Bottom: -4.820 m

Layer Number

№39

Layer Characteristics

Dense grayish-brown loam.

Layer Location

Extends along the entire length of the profile, overlain by Layer No. 14, and rests on Layer No. 40.

Layer dimensions

The average layer thickness is approximately 70 cm, with a length of 180 cm.

Elevation mark

Top: -4.320 m

Bottom: -5.020 m

Layer Number

№40

Layer Characteristics

Loose, light grayish-yellow sandy loam.

Layer Location

Extends along the entire length of the profile, overlain by Layer No. 39, and rests on Layer No. 41.

Layer dimensions

The average layer thickness is approximately 24 cm, with a length of 178 cm.

Elevation mark

Top: -5.020 m

Bottom: -5.250 m

Layer Number

№41

Layer Characteristics

Cloddy, loose sandy loam of gray-brown color. It has a lenticular shape, widening towards the center.

Layer Location

Located in the eastern half of the profile, overlain by Layer No. 40, and resting on Layer No. 03.

Layer dimensions

The average layer thickness is approximately 10 cm, with a length of 136 cm.

Elevation mark

Top: -5.220 m

Bottom: -5.310 m

Layer Number

№03

Layer Characteristics

Layer of very dense grey loam, compressed in the central part. This is a thin interlayer separating two periods of use of this area. Possibly an exposed surface.

Layer Location

Extends along the entire length of the profile, overlain by Layer No. 41, and resting on Layer No. 09.

Layer dimensions

The average layer thickness is approximately 4 cm, with a length of 177 cm.

Elevation mark

Top: -5.300 m

Bottom: -5.340 m

Layer Number

№09

Layer Characteristics

Layer of medium-density sandy loam, yellow-brown in color.

Layer Location

Extends along the entire length of the profile, overlain by Layer No. 03, and resting on Layer No. 10.

Layer dimensions

The average layer thickness is approximately 26 cm, with a length of 177 cm.

Elevation mark

Top: -5.340 m

Bottom: -5.600 m

Layer Number

№10

Layer Characteristics

Uniform organic layer (reed), loose and bright brownish-brown in color, occurring in layers interspersed with burnt strata.

Layer Location

Extends along the entire length of the profile, overlain by Layer No. 09, and rests on Layer No. 11.

Layer dimensions

The average layer thickness is approximately 25 cm, with a length of 171 cm.

Elevation mark

Top: -5.610 m

Bottom: -5.850 m

Layer Number

№11

Layer Characteristics

A substantial layer of dense gray loam containing abundant bright orange iron oxide, occurring in horizontal interlayers. Contains raw brick blocks inside, El. No. 42.

Layer Location

Extends along the entire length of the profile, overlain by Layer No. 10, and rests on Layer No. 12.

Layer dimensions

The average layer thickness is approximately 38 cm, with a length of 171 cm.

Elevation mark

Top: -5.850 m

Bottom: -6.230 m

Layer Number

№42

Layer Characteristics

Two rows of bricks (36 × 36 × 10 cm) made from dense grayish-brown loam with numerous orange inclusions (iron oxide).

Layer Location

Located in the central part of the profile, within Layer No. 11.

Layer dimensions

The average layer thickness is approximately 17 cm; length: 122 cm.

Elevation mark

Top: -5.970 m

Bottom: -6.230 m

Layer Number

№12

Layer Characteristics

A substantial disturbed deposit (organic matter, burnt strata, loam of various colors) of dark brown color. Fragments of mudbrick blocks (El. No. 43) and ash lenses are present within the layer. This layer does not contain any structural remains; it represents a disturbed deposit composed of ash, clay, and a large quantity of broken ceramics and animal bones. The layer was formed gradually, as evidenced by numerous interlayers. In the lower part of the layer, a rounded depression was identified, containing a substantial amount of ash and charcoal.

Layer Location

Extends along the entire length of the profile, overlain by Layer No. 11, and rests upon Layer No. 38.

Layer dimensions

The average layer thickness is approximately 100 cm; length: 161 cm.

Elevation mark

Top: -6.220 m

Bottom: -7.450 m

Layer Number

№43

Layer Characteristics

Bright grayish-brown loam with inclusions of vivid orange iron oxide (fragments of clay blocks).

Layer Location

Located in the central part of the profile, within layer No. 12.

Layer dimensions

Two blocks measuring 14 × 5 cm.

Elevation mark

Top: -6.610 m.

Bottom: -6.970 m.

Layer Number

№38

Layer Characteristics

Very dense greenish-grey loam (silt) with inclusions of iron oxide and gypsum mineral. This layer represents the lower part of the riverbed or canal and does not contain traces of habitation or cultural materials (natural soil layer). This is the original surface upon which urban construction was initiated. Accordingly, Layer No. 12, situated above Layer No. 38, from which samples for carbon-14 analysis were taken, is the oldest.

Layer Location

Extends along the entire length of the profile, overlain by Layer No. 30, and constitutes the lowest layer of the stratigraphy (natural soil).

Layer dimensions

Average layer thickness is approximately 47 cm; length is 153 cm.

Elevation mark

Top: -7.110 m.

Bottom: -7.600 m

Conclusion

The History of the Kesken-Kuyuk Kala Settlement in Light of Stratigraphic and Planigraphic Investigations during the 2025 Field Season

Stratigraphic investigations at the site of Kesken-Kuyuk Kala, continued during the 2024 field season, have enabled archaeologists to reach the level of the natural subsoil and to trace the earliest phases of urban development within the boundaries of the city's shahristan, dating to the 5th–6th centuries CE. Anchored by two radiocarbon-dated benchmarks, these investigations—combined with previously acquired and available data—make it possible to examine in detail the chronological framework of human activity associated with the founding and development of the settlement from the mid-5th to the early 7th century CE. The recovered materials reflect an initial phase of habitation in the swampy floodplain of the lower Syr Darya and the onset of construction activities aimed at creating an artificial foundation atop former alluvial deposits, utilizing organic layers including reed and ash.

Notably, stratigraphic analysis encompassing all major profiles (northern, southern, eastern, and western) revealed a diverse and complex sequence of cultural layers. These include phases of intensive construction as well as periods of abandonment and destruction by fire, organized into successive construction horizons that serve as a reference framework for interpreting the urban history of the site. Particularly remarkable is the presence of voluminous organic deposits, which may indicate the deliberate use of household refuse and locally available plant materials as a technological strategy for ground stabilization prior to construction. Taken together, this evidence positions Kesken-Kuyuk Kala as a resilient urban center with a continuous history of settlement, building, and transformation spanning more than six centuries, within a dynamically evolving floodplain landscape.

The most significant outcome of the 2024 season was the identification and documentation of the eighth construction horizon—the earliest known cultural layer at the site, lying directly above the natural subsoil composed of compact clay and sandy-alluvial sediments from an ancient Syr Darya riverbed. Stratigraphic and geochemical analyses of the underlying layers (30) and (38), which include iron and gypsum minerals, point to prolonged moisture exposure, seasonal flooding, and a reductive hydrological environment during the initial formation of the area. The development of layer (12)—corresponding to the eighth construction horizon and characterized by organic content, ash, and traces of domestic activity—represents a deliberate and technologically informed phase of natural surface preparation and stabilization preceding construction. Thus, the 2024 materials not only complete the stratigraphic sequence of the site but also offer unique insight into

the initial stage of urban expansion in the Aral floodplain under the unstable geoecological conditions of the early medieval period.

Stratigraphic Trench 1 (*included the continuation of analysis of three profiles—southern, eastern, and western—while the northern profile was used as a technical trench to excavate soil and access the deeper stratigraphic layers).*

The results of stratigraphic and chronological investigations conducted during previous field seasons at the site of Kesken-Kuyuk Kala make it possible to reconstruct the history of the medieval city as a complex and prolonged process. This history includes seven clearly defined construction horizons covering the period from the mid-6th century to the 13th century CE, with possible partial reoccupation of the site in the 12th–13th (?) centuries and traces of economic activity continuing into the 20th century. The latest evidence of human presence is recorded in the so-called dispersed horizon, formed after the 10th–11th centuries and associated with temporary or seasonal use of the city ruins (up to the 20th century), but already outside the framework of a fully functioning urban environment.

The preceding first construction horizon, dating to the 10th–11th centuries CE, demonstrates the continued use of previously built structures, especially the walls from the second construction horizon, which were actively repaired and partially reconstructed in plan. The second construction horizon, dating to the 8th–9th centuries CE, reflects the peak of urban development: quarters were formed, mudbrick was extensively used, and inner spaces were leveled. All three of these horizons exhibit topological continuity—planning elements, including the layout of streets and walls, remain consistent from the 8th to the 11th centuries, indicating the stability of the urban structure.

The next, third construction horizon, also dating to the 8th–9th centuries CE, is marked by the beginning of large-scale construction using *pakhsa* blocks, erected atop the earlier fortification system without consideration of its major elements—the moat and wall. Archaeological materials suggest that this stage saw the abandonment of the citadel's role as the defensive core of the city.

The preceding fourth construction horizon is characterized by the loss of the defensive function of the outer moat and its initial use as a domestic refuse dump, later covered with reed, possibly reflecting attempts to neutralize moisture. The moat loses its depth and comes to be perceived as a flat surface suitable for construction. All these processes indicate the loss of the functional autonomy of the central fortified part of the city (the citadel) and its integration into the urban fabric of the *shahristan*.

The fifth, sixth, and seventh construction horizons are recorded on the basis of repeated reconstructions of the defensive wall, presumably surrounding the citadel. The earliest of these, documented during previous field seasons, is the seventh horizon, dated to the mid-6th to the first half of the 7th century CE—a period when walls were constructed from yellow sand-tempered mudbrick (approximately 30×30×6 cm), probably forming part of the citadel's outer perimeter, reinforced by a moat and towers. It is in this period that the original urban layout of the fortified center was established. The wall was repeatedly repaired and expanded, as observed in the subsequent phases (fifth and sixth horizons), which show changes in brick dimensions and masonry configuration. Despite the relative simplicity of architectural solutions (e.g., absence of loopholes and merlons), the defensive system clearly fulfilled its function, and the repeated reconstructions testify to continuous and deliberate maintenance of the defensive perimeter.

To facilitate understanding of the construction horizon sequence and the transition from pre-2024 research to the 2024 field season, a description of the seventh construction horizon from the 2023 report is provided below.

Seventh Construction Horizon *(2023 Field Season Description)*

Dating: The cumulative calibrated date range with a probability of 93.7% spans a century—from 536 CE to 642 CE (mid-6th to mid-7th centuries). Within this, the 68.3% probability range is 551–559 CE.

In the deepest part of the trench, at a depth of 68.932 cm, blocks of sand-tempered mudbrick with a yellowish hue (30×30×6 cm) were found laid in a single course (103) (see Layer 13 – 2024 field season), possibly representing a wall pavement (*otmostka*), with an infill of irregularly shaped mudbrick fragments observed between this and the sand-tempered blocks.

Between the sixth and seventh construction horizons (or the second and third phases of wall reconstruction), a layer of decayed reed is observed, which not only separates the two wall structures but clearly overlays the third phase. Thus, the second phase of masonry (sixth construction horizon) rests on a reed layer (100) (see Layer 10 – 2024 field season), which predates it and was possibly intentionally laid by builders to separate earlier masonry from the subsequent brick courses. These structural elements of the wall existed during the accumulation of numerous alternating horizontal dark brown layers (104) (see Layer 12 – 2024 field season), found in the trench's deepest part, interpreted as the fill of a moat (or pit?).

All this appears to belong to a single chronological phase in the city's life, during which the wall was constructed and the aforementioned moat infill layers began to form. It seems that this

constitutes a single construction horizon in the site's history. Earlier layers may be investigated in the following field season.

Seventh Construction Horizon

(*Additions and revisions based on the 2024 field season*) (see Appendix – Drawing Documentation, fig. 50)

The materials collected during the 2024 field season significantly refined the stratigraphic structure of the seventh construction horizon, previously identified as one of the active phases in the architectural development of Kesken-Kuyuk Kala. The assemblage of layers and features—specifically units 01, 03, 09, 10, 11, 29, 33, 34, 42, 44, and 46—enables a reconstruction of this horizon as a complex, multi-component engineering and construction phase spanning from the mid-6th to the early 7th century CE.

The core of this horizon consists of construction and substructural layers directly associated with early fortification elements or platform-related architectural features. The central structural element is a double row of sun-dried mudbricks—unit (42) in the western profile and (46) in the northern profile—measuring 36×36×10 cm, composed of dense grey-brown loam with iron oxide inclusions. This feature was documented in the central sections of both the western and northern profiles and is embedded within unit (11), a thick horizon of compact grey loam characterized by prominent orange-colored iron hydroxide intercalations. The brickwork likely served as a foundation for a wall or a technical platform.

Directly above this element lies unit (10), a uniform organic layer composed of reed, loose in texture and brownish in color, interspersed with charred lenses. It measures 25–46 cm in thickness. Similar reed layers were identified in other sections of the stratigraphic trench, suggesting their deliberate use as a hydrological barrier or as a stratigraphic separator between structural features. Noteworthy is the pronounced stratification and evidence of heat alteration, potentially indicating a preparatory stage in the formation of the construction base. Unit (10) entirely overlies the construction layer (11)—i.e., the seventh construction horizon—and effectively serves as a transition to the activity associated with the sixth construction horizon. A wall foundation built atop unit (10) has been recorded in two chronological phases corresponding to the fifth and sixth construction horizons (see 2023 field report).

On the basis of the updated 2024 data, it is now clear that the wall was constructed in two rather than three phases. Thus, the seventh construction horizon—refined through the 2024 excavations—constitutes a complex stratigraphic unit comprising remains of substantial architectural features (units 44 and 46), organic and sandy-loamy deposits (unit 11) reflecting not

only construction activity but also engineering site preparation including waterproofing, surface leveling, and reinforcement. In addition, the organic "transitional" layer (unit 10) distinctly separates the seventh and sixth construction horizons, offering a clear chronological demarcation between these important developmental phases. Collectively, the data allow us to interpret the seventh construction horizon as a stage in the establishment of a durable built environment within a humid deltaic landscape, preceding the later phases of urban development at the site.

Chronologically, the seventh construction horizon—dated to the mid-6th to early 7th century CE based on radiocarbon and stratigraphic evidence—marks the beginning of the earliest cultural deposits associated with the initial urban phase of Kesken-Kuyuk Kala. These layers directly overlie the natural substrate, composed of alluvial and silty sediments from an ancient Syr Darya riverbed, and were a major focus of the 2024 excavations, during which the stratigraphic trench was extended down to the sterile geological horizon. The deepening of the trench and recording of all depositional sequences down to the primary sandy-clayey substrate enabled a more detailed reconstruction of the landscape conditions, early occupation stages, and clarification of the stratigraphic position of the earliest architectural remains.

Eighth Construction Horizon

The dating of this horizon is based on two radiocarbon samples taken from unit (12). The first sample, from the western profile at an elevation of 67.483 m above sea level, yielded a calibrated range (95.4% probability) of 429–559 CE (mid-5th to late 6th century), and a more probable interval (68.3%) of 436–537 CE.

The second sample, from the eastern profile at 68.213 m, provided a 95.4% probability range of 435–600 CE (mid-5th to late 6th / early 7th century), and a 68.3% range of 481–587 CE.

The eighth construction horizon, identified during the 2024 excavations at a depth of just under six meters and measuring up to 1.4 meters in thickness, represents the earliest phase of settlement activity at Kesken-Kuyuk Kala. It directly overlies a dense, bright-yellow sand deposit and the natural substrate—a compact greenish-brown loam with iron oxide and gypsum inclusions (unit 38)—interpreted as an ancient riverbed or a seasonally flooded area.

The primary feature of this horizon is unit (12), a thick, organic-rich dark brown layer containing numerous inclusions of ash, charcoal, fragments of sun-dried bricks (?), pottery, and animal bones. Up to 125 cm thick, this layer is traceable across the entire trench. Its internal structure, composed of ash-rich lenses, clayey ash patches, and structural debris, indicates gradual accumulation. In the eastern section, a rounded pit filled with compact ash and charcoal—

unassigned a separate number—is interpreted as either a preparatory hearth or an insulating pit intended for soil stabilization.

Several additional structural and lithological components are also associated with this horizon. Unit (13) consists of amorphous fragments of sun-dried blocks without signs of bonding, likely remains of collapsed or unfinished structures. Unit (31), a yellow brick fragment measuring 30×10 cm, rests on a sandy sub-layer (unit 30) and may have functioned as a footing or leveling element. Unit (43), a block of grey-brown clay with iron oxide traces, is possibly the remnant of a destroyed wall or technical fill. Unit (46), an inclusion of loose, orange sandy loam with a rounded form, may indicate attempts at drainage or ground reinforcement. Units (35) and (36)—light grey sandy loam and dense yellow-brown sandy silt, respectively—are layered in the western part of the horizon and represent preparatory groundwork. Lastly, unit (37), a bright yellow sand layer with iron oxide inclusions, likely served as the final stage in the anthropogenic surface preparation, functioning as a drainage or leveling layer.

A *terminus post quem* for the formation of unit (12) can be proposed based on the lowest sample from the western profile (67.483 m), which lies directly above the natural substrate and dates to the mid-5th to late 6th century. The *terminus ante quem*, according to the radiocarbon result from the uppermost eastern sample (68.213 m), likely falls at the end of the 6th century.

Altogether, these elements characterize the eighth construction horizon as the initial phase of urban development at Kesken-Kuyuk Kala. It marks the earliest occupation of the marshy floodplain, necessitating prior engineering works such as drainage, leveling, and stabilization using organic material, ash, loam, and sand. The architectural remains are sparse and fragmented, indicating the experimental or pioneering nature of this construction. Thus, the eighth horizon captures the moment of urban genesis—a transitional layer between anthropogenic activity and the natural environment—and represents a unique stratigraphic marker of early urbanism in the lower Syr Darya region.

A key factor in understanding the functional character of the eighth construction horizon lies in the composition of its anthropogenic inclusions—chiefly organic remains, ash, ceramics, and, most notably, animal bones. The high concentration of these materials within layer (12) suggests that the layer was not only the result of engineering stabilization but also reflects specific forms of economic activity associated with the initial occupation of a marshy floodplain. Thus, the archaeozoological analysis of the faunal material from the eighth construction horizon becomes a critical source for reconstructing early medieval livestock management systems, dietary practices, slaughtering techniques, and the degree of territorial adaptation by the first inhabitants of Kesken-Kuyuk Kala.

The archaeozoological assemblage retrieved from layer (12)—the principal component of the eighth construction horizon—offers significant insights into the early phases of land use and human-environment interaction at the dawn of urban history in the region. With a thickness of up to 125 cm, this layer, rich in organic material, ash, charcoal, ceramic fragments, and animal bones, represents a gradual and multi-component accumulation process. It reflects both anthropogenic efforts to stabilize the foundation and intensive subsistence activity during the initial colonization of the Syr Darya floodplain.

Findings from the faunal analysis suggest that, even at this early settlement stage, a stable and differentiated livestock management system was already in place. This system showed clear species specialization and complex exploitation strategies. The livestock economy was dominated by large and small ruminants. Remains of cattle (Bos taurus) are represented by 154 bone fragments from a minimum of 14 individuals, while small ruminants (Ovis aries/Capra hircus) are represented by 135 elements, including 42 sheep and 4 goat bones from at least 16 individuals. The faunal profile is skewed toward adult and elderly animals, suggesting prolonged use not primarily for meat but for secondary products—such as milk, wool, manure (?), and traction power in agricultural contexts.

The horse also held a prominent place in the economic structure of the settlement in the mid-5th to late 6th centuries. A total of 97 horse bones were recovered, belonging to nine individuals. More than 89% of these remains came from adult or aged animals, indicating that horses were mainly used for riding and draught purposes rather than consumption.

Significantly, many of the animal bones (including cattle, small ruminants, and horse) show clear evidence of mechanical modification: cut marks, chopping traces, charring, and gnawing. Butchery marks and heat alteration attest to systematic carcass processing, including dismemberment and cooking or roasting—sometimes over open flames. Over 95 bones bear dog tooth marks, suggesting a constant presence of dogs at the settlement. This implies not only their role in security but also their involvement in waste disposal systems.

Of interest is the limited presence of wild fauna. Isolated finds include bones of kulan (Equus hemionus), deer (Cervidae), saiga (Saiga tatarica), and large freshwater fish, notably catfish (Silurus glanis). These finds indicate the occasional exploitation of natural resources through hunting and fishing—activities more characteristic of the early stages of sedentism, when the human community still maintained dynamic interactions with the natural, largely unmodified landscape.

Accordingly, the archaeozoological evidence from the eighth construction horizon portrays the early inhabitants of Kesken-Kuyuk Kala as having a multifaceted and adaptive way of life.

Even during the formation of the initial cultural layer (layer 12), a structured economy can be observed, incorporating multi-purpose use of domestic animals, intensive meat processing, the integration of dogs into daily settlement life, and occasional access to wild fauna and aquatic resources. This reflects a high degree of environmental adaptation to the specific conditions of the marshy deltaic landscape of the lower Syr Darya, and positions layer (12) not merely as an engineered platform, but also as a reflection of the initial socio-economic and ecological interactions between humans and their environment.

The substantial thickness of layer (12)—up to 125 cm in some areas—and its chronological span of approximately 130–150 years (mid-5th to late 6th centuries CE) can be attributed to a combination of natural and anthropogenic factors operating in the context of initial settlement of a floodplain environment.

Firstly, one must consider the natural geomorphological conditions of the delta zone in the lower Syr Darya basin. This area is characterized by unstable hydrology, with seasonal flooding, high groundwater levels, and prolonged soil saturation. The widespread presence of *plavni*—low-lying floodplain and deltaic zones prone to seasonal inundation and covered in dense vegetation such as shrubs, reeds (*Phragmites*), cattails (*Typha*), and sedges—is a hallmark of such environments. The dominant flora consists of amphibious species capable of surviving constant waterlogging, with submerged root systems and emergent vegetative mass. It was in such zones that early occupation of the site occurred, and layer (12) was formed. Any attempt to stabilize the subsoil for construction would have required substantial investment in both engineering works and artificial fill. Consequently, the accumulation of organic and mineral components was a prolonged process of gradual compaction under wet, poorly drained conditions.

Secondly, the layer's thickness reflects the long duration and cyclical nature of the processes that took place in this area. Layer (12) is not a homogeneous mass; rather, it is composed of a series of horizontal strata, including ash lenses, clayey and charcoal-rich inclusions, structural fragments, and domestic refuse. This pattern indicates staged, possibly seasonal or episodic, use of the area, with periods of activity alternating with phases of accumulation and burial.

Thirdly, the intensity of economic activities during the formation of this horizon was a significant factor. The abundance of ash, faunal remains, broken ceramics, charcoal, and construction debris suggests that this layer resulted from a combined use of space: both as a productive or utilitarian zone (possibly linked to primary processing of livestock products) and as a prepared construction platform.

Finally, layer (12) can be interpreted as the product of a deliberate adaptive strategy developed by settlers in response to the challenging natural conditions of the deltaic environment. Its

considerable thickness and rich mixture of organic matter, ash, sandy loam, and silty clay indicate not a random accumulation but an intentional technological practice aimed at stabilizing a mobile, waterlogged subsoil. The use of ash, compact earth, and possibly plant remains as construction organics helped to compensate for the low bearing capacity of alluvial soils and create a stable anthropogenic surface suitable for subsequent building activity in the context of an early medieval settlement.

Therefore, the thickness of layer (12) reflects not only the duration of cultural accumulation but also its multifunctional nature and the intensity of anthropogenic impact. It thus serves as a critical stratigraphic and cultural-economic marker of the initial phase of urbanization at Kesken-Kuyuk Kala.

The absence of identified built structures within layer (12), despite its significant thickness and rich archaeological content, suggests that no permanent architecture was constructed in this particular area during the studied chronological period (mid-5th to late 6th century CE). The presence of ash lenses, ceramic fragments, animal bones, and isolated pieces of sun-dried brick instead points to a functional designation as a utilitarian or possibly production-related space, rather than a residential or administrative zone.

It is plausible that within the broader spatial organization of the early settlement, the area of the stratigraphic trench was a peripheral or transitional zone, used intermittently or seasonally for practical purposes such as storage, organic waste processing, or placement of lightweight temporary structures that left no archaeologically traceable remains. Alternatively, it may have been a purposefully prepared open activity area, leveled and drained but not incorporated into active construction, possibly due to environmental constraints such as excess moisture or a different spatial logic in the settlement layout.

Thus, the lack of construction features in layer (12) should not necessarily be interpreted as a void or vacant area, but rather as indicative of the specific use of this space—one that was either not yet designated for building or was used for other functions during the formative stages of settlement.

The Natural Substrate (Sterile Horizon)

Directly beneath layer (12) lies layer (30), a compact, homogeneous, fine-grained sand of bright yellow coloration with a subtle ochre tint, indicative of the initial oxidation processes affecting iron-bearing minerals within the sandy alluvium. The mineralogical composition of this layer is dominated by quartz and feldspars, with admixtures of iron hydroxides that impart its characteristic warm hue. Its granular-massive structure, the absence of organic inclusions, and its

sharply horizontal bedding support its interpretation as a natural alluvial deposit formed under low-energy hydrodynamic conditions—likely during a period of floodplain stabilization or partial desiccation within the delta environment. This layer constitutes the natural platform upon which the anthropogenic and organic deposits of the eighth construction horizon were subsequently laid.

At the base of the entire stratigraphic sequence lies layer (38), a very dense, heavy greenish-brown clay loam enriched with secondary minerals, including gypsum, ferrous oxide (FeO), and iron hydroxides ($Fe(OH)_3$). The presence of carbonate and gypsum inclusions, along with concentric ferruginous concretions up to 2 cm in diameter, indicates prolonged water-saturated and reductive conditions. Its distinctive structure—featuring bands of variable compaction and zones marked by pseudomycelia (white gypsum veining)—permits the interpretation of layer (38) as a slow-settling deposit formed in an anaerobic environment, such as oxbow lakes, abandoned river channels, or stagnant lagoonal zones within the delta. Moreover, the greenish-grey tint results from the presence of ferrous iron (Fe^{2+}) in its reduced form, characteristic of waterlogged, oxygen-depleted conditions.

Taken together, these characteristics allow for a confident interpretation of layer (38) as a natural geological horizon formed under the dynamic and unstable hydrological regime of the lower Syr Darya. Its geochemical and physical attributes underscore the environmental instability that characterized the earliest phases of human activity in the area: high groundwater levels, frequent inundations, and saturation with salts and iron compounds. These challenging conditions necessitated considerable effort by the initial settlers to stabilize the surface in preparation for construction.

It is precisely at the boundary between layers (38) and (30) that the anthropogenic transformation of the landscape begins—documented in the stratigraphic composition of the eighth construction horizon.

The irregularity of the surface between the natural substrate (layer 38) and the overlying alluvial sand (layer 30)—manifested in the form of localized depressions and basins—is attributed in part to early human activity. In the lower portion of layer (12), these depressions are preserved, capturing traces of initial land use in the form of pits, hollows, and other surface irregularities. This stratigraphic pattern likely does not reflect intentional leveling but rather localized intervention in the natural topography, representing some of the earliest attempts to adapt to and inhabit a wet, uneven surface.

Appendix – Results of Archaeozoological Analysis of Animal Bone Remains

Introduction

Research on archaeozoological data concerning the formation and dynamics of livestock husbandry in the Aral Sea region during antiquity and the Middle Ages remains limited. To date, the osteological collection from the Zhankent settlement, dated to the Oghuz period, has been studied by L.L. Gaiduchenko and introduced into academic discourse [Gaiduchenko, 2014, pp. 161–178]. However, research on bone remains discovered at several medieval sites in the middle reaches of the Syr Darya River remains insufficient for drawing comprehensive conclusions regarding economic activities (animal husbandry, hunting, fishing) and the paleo-economy of that period, including the dietary patterns of the local population [Taleev, Erzhegitova, Shagirbaev, 2020, pp. 201–209; Makarova, 1974, pp. 201–207]. In this context, laboratory analysis of osteological materials from ancient and medieval sites in the lower reaches of the Syr Darya constitutes an important tool for reconstructing the ancient paleoecology and cultural-economic systems of the region, enabling a more accurate reconstruction of environmental conditions and the identification of the population's economic interactions with their environment.

This report presents the results of the study of the archaeozoological collection from the Kesken-Kuyuk Kala settlement (2024 excavation). Bone materials were obtained from several areas and elements (94, 12, and 10). Laboratory analysis revealed a large quantity of bones from domestic animals, as well as birds and fish, indicating the complexity of the subsistence strategies of the medieval inhabitants of the city. The Kesken-Kuyuk Kala settlement is located in the Kazalinsky District of Kyzylorda Region, 22 km northwest of the village of Bozkul (45°31'04.75" N, 61°27'27.69" E).

Research Methods

A total of 483 mammal bones, 5 fish bones, and 2 bird bones were examined, of which 438 (89.4%) were identified to species level (Table 1, 6; Fig. 1B–7B; Fig. 1C–22C). In the course of studying the collection, the following were recorded: the composition of skeletal elements for each species, the degree of fragmentation of each element, the condition of the epiphyses (fused or unfused), and the state of the dentition. For the analysis of the distribution of skeletal parts, the bones of each group of domestic ungulates were grouped as follows (Table 3). The 'Head' section includes the cranial bones, mandible, and hyoid bone. A separate group of 'Isolated Teeth' is identified. The 'Trunk' includes the vertebrae, ribs, and sternum. The 'Upper Limb Section' includes the scapula, pelvis, humerus, radius, ulna, femur, tibia, and patella. The 'Lower Limb Section' comprises the carpal and tarsal bones, metacarpal, metatarsal, and metapodial bones, sesamoid bones, and phalanges 1–3. The number of jaws and teeth is limited; therefore, the age

composition was determined in general terms: juveniles (molars 1 or 2 are absent in the jaws), subadults (molar 3 is absent in the jaws), and adults (molar 3 is present). A number of bones could not be identified to species due to severe fragmentation and were assigned to the group 'unidentified mammals.' Based on the thickness of the bone walls and other structural features, they were divided into two groups. Bones with thin walls were assigned to the group 'small unidentified mammals,' while those with thick walls were classified as 'large unidentified mammals.' The bones of the first group may have belonged to small ungulates (sheep, goat, saiga, etc.), while the bones of the second group may have belonged to large ungulates (cattle, camel, and horse). The description of the animal bone remains was conducted using the manual by A.I. Akaevsky [Akaevsky et al., 2005, pp. 65–120]. The determination of the individual age of the slaughtered specimens was based on the condition of the dental system and the state of the epiphyses [Silver, 1970, pp. 286–295]. The preservation of the bones was assessed using the method of N.G. Erokhin and O.P. Bachura [Erokhin, Bachura, 2011, pp. 62–69]. Bone measurements and morphometric analysis were conducted according to standard methodologies. Bones of domestic ungulates were measured following the methodology of A. Driesch [Driesch, 1976, pp. 56–101]. The bones are well preserved; the bone tissue is dense, and the bone surfaces show no signs of weathering.

Archaeozoological results

Cattle – Bos taurus. This species is represented by 154 bones from at least 14 individuals, accounting for nearly 35% of all bones (Table 1). The vast majority of bones (79.3%) are fragmented (Table 2). The distribution of skeletal elements is relatively uniform, with only the proportion of cranial bones noticeably lower than that of other skeletal parts (Table 3). Among the slaughtered individuals, adults predominate. Of the 12 individuals, 10, or 74%, are adults. Juveniles and subadults are represented by four individuals (Table 4). This suggests that the cattle herd was primarily maintained for milk production. Forty-two cattle bones exhibit traces of gnawing by a predator, apparently a dog. One bone was gnawed by rodents. Numerous skeletal elements display traces of cutting and chopping. One pelvic bone exhibits evidence of eburnation or hip joint pathology. Two lower jaws display malocclusion. Some bones were chopped longitudinally. A type 4 depression in the form of a hole is present on the proximal end of the metacarpal bone. Among the remains, three charred and one calcined elements were identified (Table 5).

Small ruminants – Ovis aries and Capra hircus. Forty-two bones were attributed to sheep, four to goats, and eighty-nine were identified as small ruminants (Table 1). The vast majority of bones (88.9%) are fragmented (Table 2). Among the skeletal elements, bones of the upper limbs

predominate, that is, the most 'meaty' parts (Table 3). The proportions of the remaining sections are significantly smaller. Among the slaughtered individuals, adults predominate. Of the 16 individuals, they account for 14 individuals, or 87.5%. Juvenile and subadult specimens are represented by two individuals. This indicates the complex utilization of small ruminants for both wool and meat production. Twenty-three bones exhibit traces of dog gnawing; one bone is calcined, having been burnt to a white color. Six bones show evidence of processing, fifteen bones bear cut marks, and twenty-three bones display chop marks.

Horse – Equus caballus. This species is represented by 97 bones from nine individuals (Table 1). The horse bones, as well as those of other ungulates, are highly fragmented (75.5%) (Table 2). Among the skeletal elements, limb bones predominate, while the proportions of other elements are noticeably lower (Table 3). Among the slaughtered individuals, adults (two individuals) and old (six individuals) predominate, comprising 89%. Subadults are represented by one individual. The high proportion of adult and old animals indicates that horses were used as draft or riding animals. Twenty-five horse bones bear traces of carnivore gnawing, apparently by dogs. One bone exhibiting characteristic gnaw marks from a hoofed animal was identified.

Camel – Camelus bactrianus. Seven skeletal elements were recovered: the diaphyses of the tibia and radius, as well as talus bones. Camel bones are frequently encountered at ancient and medieval sites in the Syr Darya delta.

Dog – Canis familiaris. Fourteen skeletal elements are attributed to this species. Among them are a complete femur, a mandible, and a calcaneus. The remaining bones are fragmented. All of the bones originate from at least three adult individuals. The bones exhibit traces of bites from a medium-sized predator, possibly a dog.

Kulan – Equus hemionus. Twenty skeletal elements are attributed to this perissodactyl species. Most of the bones have been preserved intact. Among them are a complete metatarsal, pastern bones, coronet bones, and hooves. The fragmented bones (pelvis, femur) display traces of cut marks. Currently, this species does not inhabit the territory of Kazakhstan.

Red deer – Cervus elaphus. A fragment of an antler shaft is attributed to this species. Deer bones were found at the Kyshkala settlement (layer of the 14th century), Karatobe, or ancient Sauran (layer of the 9th–10th centuries). At present, deer are not found in the Syr Darya deltas. In antiquity, the species inhabited the tugai regions along the Syr Darya rivers. According to zoologists, this species is a subspecies of the red deer (Cervus elaphus) and is referred to as the Bukhara (hangul), or tugai deer (Lat. Cervus elaphus bactrianus).

Saiga – Saiga tatarica. The species is represented by complete and partially complete horn cores, as well as distal rings of the humerus. Judging by the robustness of the horn, the bones

belong to adult individuals. Currently, the saiga is widely distributed across the territory of Kazakhstan. In antiquity, this animal was abundant in this region.

Wild boar – Sus scrofa. The species is represented by six bones: a fragment of the upper jaw, a fragment of the skull and a vertebra from a juvenile individual, an isolated canine from a subadult individual, a partially complete lower jaw, and the distal end of the humerus from an adult individual.

Birds – Aves. Two complete metatarsal bones from different individuals are attributed to birds. A comparison of morphological characteristics indicates that the bones are very similar to those of the domestic chicken.

Fish – Pisces. Seven bones from different individuals are attributed to fish. Among them are a fragment of a large jaw and a vertebral disc. Preliminary analysis suggests that these elements originate from the common catfish (Silurus glanis).

Conclusion

Almost all bone remains identifiable to genus and species belong to domestic ungulates (92.9%). The majority of the assemblage (37.8%) consists of large cattle bones. Small ruminants account for the second largest proportion of bones (33.1%), followed by horse remains at 23.8%. Sheep are predominant among the small ruminants. Camel and dog remains are also present. Wild animals are very scarce and are represented only by species used for meat. The bone material is highly fragmented (82.8%) and constitutes typical 'kitchen' refuse. Different parts of the carcasses of various domestic ungulate species were utilized in different ways, as indicated by the proportions of remains from various skeletal regions. It should be noted that the predominant age group among domestic ungulates consists of adult and elderly individuals. This suggests the absence of a pronounced 'meat' orientation in animal husbandry. The high proportion of adult animals indicates that small ruminants were bred primarily for wool production, cattle for dairy products, and horses were used for riding and as draft animals. Dog bones discovered in the cultural layer of the settlement, along with a large number of bones gnawed by dogs (95 specimens), indicate that dogs were continuously present within the site. At present, it is not possible to estimate their population. The discovery of bones gnawed by ungulates (cattle and/or sheep) suggests that some animals were kept within the site for a certain period [Rassadnikov 2012, p. 87; Rassadnikov 2017, pp. 165–167]. The presence of numerous cut marks, chopping traces, and evidence of bone processing, as well as observed gnawing damage (likely caused by dogs and rodents), indicates specific butchering patterns, carcass dismemberment, and subsequent processing of meat products. The fragmentation of bones indicates intensive technological processing, which is characteristic of the comprehensive utilization of animal carcasses. The

discovery of remains of camel, kulan, red deer, and saiga reflects the presence of both domestic and wild animals in the region. These data enable the reconstruction of ancient ecosystems and confirm that the subsistence economy of the population was multifaceted, incorporating elements of hunting and the utilization of natural resources. The results of the study indicate that the economic system of this region constituted a complex and multicomponent mechanism, in which, alongside animal husbandry, hunting, and fishing, there was careful selection and processing of skeletal remains. The data obtained make a significant contribution to the reconstruction of ancient paleoecology, the cultural-economic system, and the dietary practices of the population, thereby facilitating a deeper understanding of the adaptive mechanisms of ancient communities under changing environmental conditions.

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Appendix A – Tables

Species	Number of bones		%%		Number of individuals
		Domestic animals			
Cattle – *Bos taurus*	154		37,8		14
Small ruminants – *Ovis* and *Capra*	89		21,9		11
Sheep – *Ovis aries*	42	135	10,3	33,2	4
Goat – *Capra hircus*	4		1,0		1
Horse – *Equus caballus*	97		23,8		9
Camel – *Camelus bactrianus*	7		1,7		2
Dog – *Canis familiaris*	14		3,4		3
Total domestic	407		100		44
		Wild Animals			
Kulan – *Equus hemionus*	20		64,5		3
Red Deer – *Cervus elaphus*	1		3,2		1
Saiga Antelope – *Saiga tatarica*	4		12,9		3
Wild Boar – *Sus scrofa*	6		19,3		3
Total Wild	31		100		10
		Bones Indeterminate to Species			
Mammals – *Mammalia indet.*	45		9,2		–
Bird – *Aves*	2		0,4		–
Fish – *Pisces*	5		1,0		–
Total			490		

Table A1 – Kesken-Kuyuk Kala – 2024. Species Composition of Animal Bone Remains

Skeletal Elements	Cattle	Horse	Small Ruminants	Sheep	Goat	Camel	Dog	Kulan	Boar	Deer	Saiga	Total
Horn	1	0	0	0	1	0	0	0	0	1	3	6
Skull	7	1	2	1	0	0	0	0	1	0	0	12
Upper jaw	4	3	0	0	0	0	0	0	1	0	0	8
Lower jaw	20	2	15	7	1	0	1	0	1	0	0	47
Tooth	4	9	0	3	0	0	0	0	1	0	0	17
Vertebra	13	10	5	0	0	0	1	0	1	0	0	30
Rib	23	12	9	0	0	0	0	0	0	0	0	44
Sacrum	0	1	0	0	0	0	0	0	0	0	0	1
Scapula	14	4	7	16	0	0	0	0	0	0	0	41
Humerus	12	2	6	5	1	0	1	0	1	0	1	29
Radius	11	4	15	0	0	4	0	0	0	0	0	34
Ulna	2	6	0	0	0	0	0	0	0	0	0	8
Pelvis	9	5	3	0	0	0	0	6	0	0	0	23
Femur	11	12	5	0	0	0	3	3	0	0	0	34
Patella	1	0	0	0	0	0	0	0	0	0	0	1
Tibia	8	6	13	5	0	1	5	0	0	0	0	38

Skeletal Elements	Cattle	Horse	Small Ruminants	Sheep	Goat	Camel	Dog	Kulan	Boar	Deer	Saiga	Total
Talus	1	3	0	1	0	2	0	0	0	0	0	7
Calcaneus	1	2	0	1	0	0	1	0	0	0	0	5
CKZ	0	2	0	0	0	0	0	0	0	0	0	2
Carpal	1	0	0	0	0	0	0	0	0	0	0	1
Tarsal	0	0	0	0	0	0	0	2	0	0	0	2
Styloid	0	4	0	0	0	0	0	0	0	0	0	4
Metapodium	1	3	3	0	0	0	2	0	0	0	0	9
Metacarpal	5	1	0	2	1	0	0	0	0	0	0	9
Metatarsal	5	1	6	1	0	0	0	2	0	0	0	15
Phalanx I	0	2	0	0	0	0	0	3	0	0	0	5
Phalanx II	0	1	0	0	0	0	0	1	0	0	0	2
Phalanx III	0	1	0	0	0	0	0	3	0	0	0	4
Total	154	97	89	42	4	7	14	20	6	1	4	438

Table A 2 – Kesken-Kuyuk Kala – 2024. Composition of skeletal elements of domestic and wild animals

Skeletal regions	Cattle		Horse		Small Ruminants	
	Abs.	%	Abs.	%	Abs.	%
Head	32	20,8	6	6,2	27	20,0
Teeth	4	2,6	9	9,3	3	2,2
Thoracic region	36	23,4	23	23,7	14	10,4
Proximal parts of the limbs	70	45,4	44	45,4	78	57,8
Distal parts of the limbs	12	7,8	15	15,5	13	9,6
Total	154	100	97	100	135	100

Table A3 – Kesken-Kuyuk Kala – 2024. Composition of skeletal regions of domestic ungulates

Condition of the dentition of the lower jaw	Age	Abs.	%
	Small ruminants		
rm4 present	Over 30 months	6	37,5
m3 present	Over 24 months	8	50,1
m2 present, m3 absent	12–24 months	1	6,2
m1 present, m2 absent	3–12 months	1	6,2
Total number of individuals		16	100
	Cattle		
Permanent pm3	Over 34 months	6	42,8
m3 present	Over 28 months	4	28,8
m2 present, m3 absent	18–28 months	2	14,3
m1 present, m2 absent	6–18 months	2	14,3
Total number of individuals		14	100
Horse			
Old individuals	Over 10 years	6	66,6
Adult individuals	Over 5 years	2	22,2
Subadult individuals	2–5 years	1	11,2
Total number of individuals		9	100
Camel			
Adult individuals		2	100

Table A4 – Kesken-Kuyuk Kala Settlement – 2024. Age structure of domestic animals

Bone Modifications	Kesken Kuyuk	
	Abs.	%%
Artifact/Preform	6	2,4
Cut Marks	25	9,9
Chopping	112	44,3
Burnt	9	3,6
Calcined	1	0,4
Gnawed (by dog/predator)	95	37,5
Gnawed by Rodents	3	1,2
Osteophagy	2	0,8
Total Modified	253	
Total Modified by Humans	153	60,5
Total Modified by Animals	100	39,5

Bone Pathology	Kesken Kuyuk	
	Abs.	%
Laesio circumscripta tali	2	22,2
Depression of Articular Surface	1	11,1
Periosteal Destruction	2	22,2
Exostosis (Osteophytes)	1	11,1
Malocclusion	1	11,1
Eburnation	2	22,2
Total with pathologies	9	100,0

Table A5 – Kesken-Kuyuk Kala Settlement – 2024. Proportion of species and bone types with modified and pathological changes

№	Site	Region	El.	Species	Bone	Specimen
1	Kesken-Kuyuk	Sh	94	Bos taurus	femur	1
2	Kesken-Kuyuk	Sh	94	Bos taurus	vertebrae	1
3	Kesken-Kuyuk	Sh	94	Bos taurus	maxilla	1
4	Kesken-Kuyuk	Sh	94	Bos taurus	humerus	1
5	Kesken-Kuyuk	Sh	94	Bos taurus	vertebrae	1
6	Kesken-Kuyuk	Sh	94	Bos taurus	scapula	1
7	Kesken-Kuyuk	Sh	94	Bos taurus	tibia	1
8	Kesken-Kuyuk	Sh	94	Bos taurus	vertebrae	1
9	Kesken-Kuyuk	Sh	94	Bos taurus	ulna	1
10	Kesken-Kuyuk	Sh	94	Bos taurus	humerus	1
11	Kesken-Kuyuk	Sh	94	Bos taurus	vertebrae	1
12	Kesken-Kuyuk	Sh	94	Bos taurus	tibia	1
13	Kesken-Kuyuk	Sh	94	Bos taurus	os coxae	1
14	Kesken-Kuyuk	Sh	94	Bos taurus	metacarpale	1
15	Kesken-Kuyuk	Sh	94	Bos taurus	costae	3
16	Kesken-Kuyuk	Sh	94	Bos taurus	mandibula	1
17	Kesken-Kuyuk	Sh	94	Bos taurus	mandibula	1
18	Kesken-Kuyuk	Sh	94	Bos taurus	mandibula	1
19	Kesken-Kuyuk	Sh	94	Bos taurus	os coxae	1
20	Kesken-Kuyuk	Sh	94	Bos taurus	mandibula	1
21	Kesken-Kuyuk	Sh	94	Bos taurus	vertebrae	1
22	Kesken-Kuyuk	Sh	94	Bos taurus	scapula	1
23	Kesken-Kuyuk	Sh	94	Equus caballus	femur	1
24	Kesken-Kuyuk	Sh	94	Equus caballus	vertebrae	1
25	Kesken-Kuyuk	Sh	94	Equus caballus	os coxae	1
26	Kesken-Kuyuk	Sh	94	Equus caballus	mandibula	1
27	Kesken-Kuyuk	Sh	94	Equus caballus	costae	1
28	Kesken-Kuyuk	Sh	94	Equus caballus	costae	2
29	Kesken-Kuyuk	Sh	94	Equus caballus	os coxae	1
30	Kesken-Kuyuk	Sh	94	Equus caballus	os coxae	1
31	Kesken-Kuyuk	Sh	94	Equus caballus	tibia	1
32	Kesken-Kuyuk	Sh	94	Equus caballus	ulna	1
33	Kesken-Kuyuk	Sh	94	Equus caballus	vertebrae	1
34	Kesken-Kuyuk	Sh	94	Equus caballus	calcaneus	1
35	Kesken-Kuyuk	Sh	94	Camelus bactrianus	radius	1
36	Kesken-Kuyuk	Sh	94	Equus caballus	costae	1
37	Kesken-Kuyuk	Sh	94	Bos taurus	costae	1
38	Kesken-Kuyuk	Sh	94	Canis familiaris	calcaneus	1
39	Kesken-Kuyuk	Sh	94	Ovis aries	talus	1
40	Kesken-Kuyuk	Sh	94	Ovis aries	humerus	1
41	Kesken-Kuyuk	Sh	94	Ovis aries	humerus	1
42	Kesken-Kuyuk	Sh	94	Ovis aries	scapula	1
43	Kesken-Kuyuk	Sh	94	Ovis aries	scapula	1
44	Kesken-Kuyuk	Sh	94	Ovis aries	scapula	1
45	Kesken-Kuyuk	Sh	94	Ovis aries	scapula	1

46	Kesken-Kuyuk	Sh	94	Capra hircus	mandibula	1
47	Kesken-Kuyuk	Sh	94	Ovis et Capra	tibia	1
48	Kesken-Kuyuk	Sh	94	Ovis et Capra	radius	2
49	Kesken-Kuyuk	Sh	94	Ovis et Capra	radius	4
50	Kesken-Kuyuk	Sh	94	Ovis et Capra	radius	2
51	Kesken-Kuyuk	Sh	94	Equus caballus	cranium	1
52	Kesken-Kuyuk	Sh	94	Ovis et Capra	vertebrae	1
53	Kesken-Kuyuk	Sh	94	Ovis et Capra	scapula	1
54	Kesken-Kuyuk	Sh	94	Ovis et Capra	costae	2
55	Kesken-Kuyuk	Sh	94	Ovis et Capra	costae	2
56	Kesken-Kuyuk	Sh	94	Ovis aries	tibia	1
57	Kesken-Kuyuk	Sh	94	Aves	metatarsalia	1
58	Kesken-Kuyuk	Sh	94	Saiga tatarica	cornu	2
59	Kesken-Kuyuk	Sh	94	Pisces	vertebrae	1
60	Kesken-Kuyuk	Sh	94	Pisces	mandibula	1
61	Kesken-Kuyuk	Sh	94	Pisces	squamae	1
62	Kesken-Kuyuk	Sh	94	Mammalia	undefined	2
63	Kesken-Kuyuk	Sh	12	Equus caballus	ossa tarsi	2
64	Kesken-Kuyuk	Sh	12	Equus caballus	metatarsalia	1
65	Kesken-Kuyuk	Sh	12	Equus caballus	phalanx 1	1
66	Kesken-Kuyuk	Sh	12	Equus caballus	phalanx 2	1
67	Kesken-Kuyuk	Sh	12	Equus caballus	phalanx 3	1
68	Kesken-Kuyuk	Sh	12	Equus caballus	phalanx 3	1
69	Kesken-Kuyuk	Sh	12	Equus caballus	femur	1
70	Kesken-Kuyuk	Sh	12	Equus caballus	ulna	1
71	Kesken-Kuyuk	Sh	12	Equus caballus	dentes	1
72	Kesken-Kuyuk	Sh	12	Equus caballus	mt-3/4	1
73	Kesken-Kuyuk	Sh	12	Bos taurus	cranium	1
74	Kesken-Kuyuk	Sh	12	Bos taurus	costae	1
75	Kesken-Kuyuk	Sh	12	Capra hircus	cornu	1
76	Kesken-Kuyuk	Sh	12	Ovis aries	tibia	1
77	Kesken-Kuyuk	Sh	12	Ovis et Capra	radius	1
78	Kesken-Kuyuk	Sh	12	Bos taurus	humerus	2
79	Kesken-Kuyuk	Sh	12	Bos taurus	mandibula	1
80	Kesken-Kuyuk	Sh	12	Bos taurus	metacarpale	1
81	Kesken-Kuyuk	Sh	12	Equus caballus	femur	2
82	Kesken-Kuyuk	Sh	94	Ovis et Capra	mandibula	1
83	Kesken-Kuyuk	Sh	94	Ovis et Capra	mandibula	1
84	Kesken-Kuyuk	Sh	94	Ovis et Capra	mandibula	1
85	Kesken-Kuyuk	Sh	94	Ovis et Capra	mandibula	1
86	Kesken-Kuyuk	Sh	94	Ovis et Capra	mandibula	1
87	Kesken-Kuyuk	Sh	94	Ovis et Capra	os coxae	1
88	Kesken-Kuyuk	Sh	94	Ovis et Capra	tibia	1
89	Kesken-Kuyuk	Sh	94	Ovis et Capra	costae	1
90	Kesken-Kuyuk	Sh	94	Ovis aries	metacarpale	1
91	Kesken-Kuyuk	Sh	94	Ovis aries	metacarpale	1

92	Kesken-Kuyuk	Sh	94	Ovis aries	metatarsalia	1
93	Kesken-Kuyuk	Sh	94	Capra hircus	metacarpale	1
94	Kesken-Kuyuk	Sh	94	Ovis et Capra	tibia	1
95	Kesken-Kuyuk	Sh	94	Ovis et Capra	tibia	1
96	Kesken-Kuyuk	Sh	94	Ovis et Capra	humerus	1
97	Kesken-Kuyuk	Sh	94	Ovis et Capra	radius	1
98	Kesken-Kuyuk	Sh	94	Ovis aries	scapula	1
99	Kesken-Kuyuk	Sh	94	Ovis aries	scapula	1
100	Kesken-Kuyuk	Sh	94	Ovis aries	scapula	10
101	Kesken-Kuyuk	Sh	94	Ovis aries	tibia	1
102	Kesken-Kuyuk	Sh	94	Saiga tatarica	humerus	1
103	Kesken-Kuyuk	Sh	94	Canis familiaris	mandibula	1
104	Kesken-Kuyuk	Sh	94	Pisces	mandibula	1
105	Kesken-Kuyuk	Sh	94	Equus caballus	femur	1
106	Kesken-Kuyuk	Sh	94	Equus caballus	os coxae	1
107	Kesken-Kuyuk	Sh	94	Bos taurus	humerus	1
108	Kesken-Kuyuk	Sh	94	Bos taurus	ossa carpi	1
109	Kesken-Kuyuk	Sh	94	Bos taurus	costae	7
110	Kesken-Kuyuk	Sh	94	Bos taurus	femur	1
111	Kesken-Kuyuk	Sh	94	Bos taurus	femur	1
112	Kesken-Kuyuk	Sh	94	Bos taurus	cranium	1
12	Kesken-Kuyuk	Sh	94	Bos taurus	costae	1
114	Kesken-Kuyuk	Sh	94	Bos taurus	costae	1
115	Kesken-Kuyuk	Sh	94	Bos taurus	mandibula	1
116	Kesken-Kuyuk	Sh	94	Bos taurus	mandibula	1
117	Kesken-Kuyuk	Sh	94	Bos taurus	mandibula	1
118	Kesken-Kuyuk	Sh	94	Bos taurus	mandibula	1
119	Kesken-Kuyuk	Sh	94	Bos taurus	mandibula	1
120	Kesken-Kuyuk	Sh	94	Bos taurus	scapula	1
121	Kesken-Kuyuk	Sh	94	Bos taurus	humerus	3
122	Kesken-Kuyuk	Sh	94	Bos taurus	femur	1
123	Kesken-Kuyuk	Sh	94	Bos taurus	os coxae	1
124	Kesken-Kuyuk	Sh	94	Bos taurus	vertebrae	1
125	Kesken-Kuyuk	Sh	94	Bos taurus	radius	1
126	Kesken-Kuyuk	Sh	94	Bos taurus	talus	1
127	Kesken-Kuyuk	Sh	94	Cervus elaphus	cornu	1
128	Kesken-Kuyuk	Sh	94	Equus caballus	ulna	1
129	Kesken-Kuyuk	Sh	94	Equus caballus	femur	1
130	Kesken-Kuyuk	Sh	94	Equus caballus	mandibula	1
131	Kesken-Kuyuk	Sh	94	Equus caballus	femur	1
132	Kesken-Kuyuk	Sh	94	Equus caballus	ulna	1
133	Kesken-Kuyuk	Sh	94	Equus caballus	sacrum	1
134	Kesken-Kuyuk	Sh	94	Equus caballus	scapula	1
135	Kesken-Kuyuk	Sh	94	Equus caballus	costae	1
136	Kesken-Kuyuk	Sh	94	Equus caballus	phalanx 1	1
137	Kesken-Kuyuk	Sh	94	Equus caballus	os centrale	1

138	Kesken-Kuyuk	Sh	94	Mammalia	undefined	10
139	Kesken-Kuyuk	Sh	12	Ovis aries	tibia	1
140	Kesken-Kuyuk	Sh	12	Ovis et Capra	mandibula	1
141	Kesken-Kuyuk	Sh	12	Ovis et Capra	mandibula	1
142	Kesken-Kuyuk	Sh	12	Ovis et Capra	radius	1
143	Kesken-Kuyuk	Sh	12	Ovis et Capra	mandibula	1
144	Kesken-Kuyuk	Sh	12	Equus caballus	maxilla	1
145	Kesken-Kuyuk	Sh	12	Equus caballus	maxilla	1
146	Kesken-Kuyuk	Sh	12	Equus caballus	dentes	3
147	Kesken-Kuyuk	Sh	12	Bos taurus	metacarpale	1
148	Kesken-Kuyuk	Sh	12	Bos taurus	vertebrae	1
149	Kesken-Kuyuk	Sh	12	Bos taurus	ulna	1
150	Kesken-Kuyuk	Sh	12	Bos taurus	mandibula	1
151	Kesken-Kuyuk	Sh	12	Bos taurus	radius	2
152	Kesken-Kuyuk	Sh	12	Bos taurus	os coxae	1
153	Kesken-Kuyuk	Sh	12	Bos taurus	scapula	1
154	Kesken-Kuyuk	Sh	12	Bos taurus	humerus	1
155	Kesken-Kuyuk	Sh	12	Bos taurus	os coxae	1
156	Kesken-Kuyuk	Sh	12	Bos taurus	costae	1
157	Kesken-Kuyuk	Sh	12	Bos taurus	dentes	1
158	Kesken-Kuyuk	Sh	12	Equus caballus	femur	1
159	Kesken-Kuyuk	Sh	12	Equus caballus	os coxae	1
160	Kesken-Kuyuk	Sh	12	Equus caballus	femur	1
161	Kesken-Kuyuk	Sh	12	Equus caballus	radius	1
162	Kesken-Kuyuk	Sh	12	Equus caballus	tibia	1
163	Kesken-Kuyuk	Sh	12	Equus caballus	os coxae	1
164	Kesken-Kuyuk	Sh	12	Equus caballus	mt-3/4	1
165	Kesken-Kuyuk	Sh	12	Equus caballus	vertebrae	2
166	Kesken-Kuyuk	Sh	12	Equus caballus	os coxae	1
167	Kesken-Kuyuk	Sh	12	Equus caballus	os coxae	1
168	Kesken-Kuyuk	Sh	12	Equus caballus	phalanx 1	1
169	Kesken-Kuyuk	Sh	12	Equus caballus	phalanx 3	1
170	Kesken-Kuyuk	01	Absent	Camelus bactrianus	talus	1
171	Kesken-Kuyuk	01	Absent	Camelus bactrianus	radius	1
172	Kesken-Kuyuk	01	Absent	Camelus bactrianus	tibia	1
173	Kesken-Kuyuk	01	Absent	Equus caballus	humerus	1
174	Kesken-Kuyuk	01	Absent	Equus caballus	talus	1
175	Kesken-Kuyuk	01	Absent	Equus caballus	calcaneus	1
176	Kesken-Kuyuk	01	Absent	Equus caballus	phalanx 3	1
177	Kesken-Kuyuk	01	Absent	Equus caballus	phalanx 1	1
178	Kesken-Kuyuk	01	Absent	Equus caballus	metapodium	1
179	Kesken-Kuyuk	01	Absent	Equus caballus	metatarsalia	1
180	Kesken-Kuyuk	01	Absent	Equus caballus	mt-3/4	1
181	Kesken-Kuyuk	01	Absent	Equus caballus	scapula	1
182	Kesken-Kuyuk	01	Absent	Equus caballus	dentes	1
183	Kesken-Kuyuk	01	Absent	Equus caballus	tibia	1

184	Kesken-Kuyuk	01	Absent	Equus caballus	vertebrae	1
185	Kesken-Kuyuk	01	Absent	Equus caballus	costae	2
186	Kesken-Kuyuk	01	Absent	Equus caballus	tibia	1
187	Kesken-Kuyuk	01	Absent	Equus caballus	tibia	1
188	Kesken-Kuyuk	01	Absent	Equus caballus	vertebrae	1
189	Kesken-Kuyuk	01	Absent	Equus caballus	vertebrae	1
190	Kesken-Kuyuk	01	Absent	Equus caballus	maxilla	1
191	Kesken-Kuyuk	01	Absent	Equus caballus	radius	1
192	Kesken-Kuyuk	01	Absent	Bos taurus	cornu	1
193	Kesken-Kuyuk	01	Absent	Bos taurus	cranium	2
194	Kesken-Kuyuk	01	Absent	Bos taurus	mandibula	3
195	Kesken-Kuyuk	01	Absent	Bos taurus	vertebrae	1
196	Kesken-Kuyuk	01	Absent	Bos taurus	vertebrae	2
197	Kesken-Kuyuk	01	Absent	Bos taurus	radius	1
198	Kesken-Kuyuk	01	Absent	Bos taurus	scapula	1
199	Kesken-Kuyuk	01	Absent	Bos taurus	os coxae	1
200	Kesken-Kuyuk	01	Absent	Bos taurus	humerus	3
201	Kesken-Kuyuk	01	Absent	Bos taurus	tibia	1
202	Kesken-Kuyuk	01	Absent	Bos taurus	metatarsalia	1
203	Kesken-Kuyuk	01	Absent	Bos taurus	costae	4
204	Kesken-Kuyuk	01	Absent	Bos taurus	scapula	1
205	Kesken-Kuyuk	01	Absent	Bos taurus	patella	1
206	Kesken-Kuyuk	01	Absent	Bos taurus	femur	1
207	Kesken-Kuyuk	01	Absent	Bos taurus	femur	2
208	Kesken-Kuyuk	01	Absent	Ovis aries	mandibula	1
209	Kesken-Kuyuk	01	Absent	Ovis aries	mandibula	1
210	Kesken-Kuyuk	01	Absent	Ovis aries	mandibula	1
211	Kesken-Kuyuk	01	Absent	Ovis aries	mandibula	1
212	Kesken-Kuyuk	01	Absent	Ovis aries	calcaneus	1
213	Kesken-Kuyuk	01	Absent	Ovis aries	tibia	1
214	Kesken-Kuyuk	01	Absent	Ovis aries	humerus	1
215	Kesken-Kuyuk	01	Absent	Ovis aries	humerus	1
216	Kesken-Kuyuk	01	Absent	Capra hircus	humerus	1
217	Kesken-Kuyuk	01	Absent	Ovis et Capra	radius	3
218	Kesken-Kuyuk	01	Absent	Ovis et Capra	femur	2
219	Kesken-Kuyuk	01	Absent	Ovis et Capra	metatarsalia	3
220	Kesken-Kuyuk	01	Absent	Ovis et Capra	metapodium	2
221	Kesken-Kuyuk	01	Absent	Ovis et Capra	vertebrae	1
222	Kesken-Kuyuk	01	Absent	Ovis et Capra	costae	1
223	Kesken-Kuyuk	01	Absent	Ovis et Capra	scapula	3
224	Kesken-Kuyuk	01	Absent	Canis familiaris	tibia	1
225	Kesken-Kuyuk	01	Absent	Canis familiaris	femur	1
226	Kesken-Kuyuk	01	Absent	Canis familiaris	vertebrae	1
227	Kesken-Kuyuk	01	Absent	Canis familiaris	metapodium	2
228	Kesken-Kuyuk	01	Absent	Aves	metatarsalia	1
229	Kesken-Kuyuk	01	Absent	Saiga tatarica	cornu	1

230	Kesken-Kuyuk	01	Absent	Equus caballus	phalanx 1	1
231	Kesken-Kuyuk	01	Absent	Equus caballus	phalanx 2	1
232	Kesken-Kuyuk	01	Absent	Equus caballus	os coxae	1
233	Kesken-Kuyuk	01	Absent	Mammalia	undefined	8
234	Kesken-Kuyuk	12	Absent	Ovis et Capra	tibia	1
235	Kesken-Kuyuk	12	Absent	Ovis et Capra	tibia	1
236	Kesken-Kuyuk	12	Absent	Ovis et Capra	tibia	1
237	Kesken-Kuyuk	12	Absent	Ovis et Capra	tibia	1
238	Kesken-Kuyuk	12	Absent	Ovis et Capra	tibia	1
239	Kesken-Kuyuk	12	Absent	Ovis et Capra	metatarsalia	1
240	Kesken-Kuyuk	12	Absent	Ovis et Capra	metapodium	1
241	Kesken-Kuyuk	12	Absent	Ovis aries	mandibula	1
242	Kesken-Kuyuk	12	Absent	Ovis aries	mandibula	1
243	Kesken-Kuyuk	12	Absent	Ovis et Capra	mandibula	1
244	Kesken-Kuyuk	12	Absent	Ovis et Capra	mandibula	1
245	Kesken-Kuyuk	12	Absent	Ovis et Capra	humerus	1
246	Kesken-Kuyuk	12	Absent	Ovis et Capra	humerus	4
247	Kesken-Kuyuk	12	Absent	Ovis et Capra	scapula	1
248	Kesken-Kuyuk	12	Absent	Ovis et Capra	radius	1
249	Kesken-Kuyuk	12	Absent	Camelus bactrianus	talus	1
250	Kesken-Kuyuk	12	Absent	Bos taurus	costae	4
251	Kesken-Kuyuk	12	Absent	Bos taurus	metatarsalia	2
252	Kesken-Kuyuk	12	Absent	Bos taurus	mandibula	1
253	Kesken-Kuyuk	12	Absent	Bos taurus	maxilla	2
254	Kesken-Kuyuk	12	Absent	Bos taurus	mandibula	1
255	Kesken-Kuyuk	12	Absent	Bos taurus	maxilla	1
256	Kesken-Kuyuk	12	Absent	Bos taurus	mandibula	2
257	Kesken-Kuyuk	12	Absent	Bos taurus	dentes	1
258	Kesken-Kuyuk	12	Absent	Bos taurus	metatarsalia	1
259	Kesken-Kuyuk	12	Absent	Bos taurus	metacarpale	1
260	Kesken-Kuyuk	12	Absent	Bos taurus	radius	1
261	Kesken-Kuyuk	12	Absent	Bos taurus	radius	2
262	Kesken-Kuyuk	12	Absent	Bos taurus	cranium	2
263	Kesken-Kuyuk	12	Absent	Bos taurus	dentes	1
264	Kesken-Kuyuk	12	Absent	Bos taurus	femur	1
265	Kesken-Kuyuk	12	Absent	Bos taurus	femur	1
266	Kesken-Kuyuk	12	Absent	Bos taurus	radius	1
267	Kesken-Kuyuk	12	Absent	Bos taurus	radius	1
268	Kesken-Kuyuk	12	Absent	Bos taurus	cranium	1
269	Kesken-Kuyuk	12	Absent	Bos taurus	vertebrae	1
270	Kesken-Kuyuk	12	Absent	Bos taurus	scapula	2
271	Kesken-Kuyuk	12	Absent	Bos taurus	os coxae	2
272	Kesken-Kuyuk	12	Absent	Equus caballus	os coxae	1
273	Kesken-Kuyuk	12	Absent	Equus caballus	femur	1
274	Kesken-Kuyuk	12	Absent	Canis familiaris	femur	1
275	Kesken-Kuyuk	12	Absent	Sus scrofa	maxilla	1

276	Kesken-Kuyuk	12	Absent	Sus scrofa	mandibula	1
277	Kesken-Kuyuk	12	Absent	Sus scrofa	humerus	1
278	Kesken-Kuyuk	12	Absent	Sus scrofa	vertebrae	1
279	Kesken-Kuyuk	12	Absent	Ovis et Capra	scapula	1
280	Kesken-Kuyuk	12	Absent	Canis familiaris	femur	1
281	Kesken-Kuyuk	12	Absent	Canis familiaris	tibia	3
282	Kesken-Kuyuk	12	Absent	Equus caballus	metacarpale	1
283	Kesken-Kuyuk	12	Absent	Equus caballus	metapodium	1
284	Kesken-Kuyuk	12	Absent	Equus caballus	metapodium	1
285	Kesken-Kuyuk	12	Absent	Equus caballus	dentes	3
286	Kesken-Kuyuk	12	Absent	Equus caballus	radius	2
287	Kesken-Kuyuk	12	Absent	Equus caballus	vertebrae	1
288	Kesken-Kuyuk	12	Absent	Equus caballus	tibia	1
289	Kesken-Kuyuk	12	Absent	Equus caballus	ulna	1
290	Kesken-Kuyuk	12	Absent	Equus caballus	os centrale	1
291	Kesken-Kuyuk	12	Absent	Equus caballus	costae	5
292	Kesken-Kuyuk	12	Absent	Camelus bactrianus	radius	2
293	Kesken-Kuyuk	12	Absent	Mammalia	undefined	17
294	Kesken-Kuyuk	Sh	10	Equus caballus	humerus	1
295	Kesken-Kuyuk	Sh	10	Equus caballus	scapula	1
296	Kesken-Kuyuk	Sh	10	Equus caballus	scapula	1
297	Kesken-Kuyuk	Sh	10	Equus caballus	ulna	1
298	Kesken-Kuyuk	Sh	10	Equus caballus	femur	1
299	Kesken-Kuyuk	Sh	10	Equus caballus	dentes	1
300	Kesken-Kuyuk	Sh	10	Equus caballus	talus	2
301	Kesken-Kuyuk	Sh	10	Equus caballus	mt-3/4	1
302	Kesken-Kuyuk	Sh	10	Equus caballus	femur	4
303	Kesken-Kuyuk	Sh	10	Equus caballus	vertebrae	1
304	Kesken-Kuyuk	Sh	10	Equus caballus	vertebrae	1
305	Kesken-Kuyuk	Sh	10	Bos taurus	femur	1
306	Kesken-Kuyuk	Sh	10	Bos taurus	femur	1
307	Kesken-Kuyuk	Sh	10	Bos taurus	vertebrae	1
308	Kesken-Kuyuk	Sh	10	Bos taurus	radius	1
309	Kesken-Kuyuk	Sh	10	Bos taurus	radius	1
310	Kesken-Kuyuk	Sh	10	Bos taurus	scapula	3
311	Kesken-Kuyuk	Sh	10	Bos taurus	vertebrae	1
312	Kesken-Kuyuk	Sh	10	Bos taurus	scapula	1
313	Kesken-Kuyuk	Sh	10	Bos taurus	metacarpale	1
314	Kesken-Kuyuk	Sh	10	Bos taurus	metapodium	1
315	Kesken-Kuyuk	Sh	10	Bos taurus	metatarsalia	1
316	Kesken-Kuyuk	Sh	10	Bos taurus	os coxae	1
317	Kesken-Kuyuk	Sh	10	Bos taurus	calcaneus	1
318	Kesken-Kuyuk	Sh	10	Bos taurus	scapula	1
319	Kesken-Kuyuk	Sh	10	Bos taurus	scapula	1
320	Kesken-Kuyuk	Sh	10	Bos taurus	dentes	1
321	Kesken-Kuyuk	Sh	10	Bos taurus	mandibula	2

322	Kesken-Kuyuk	Sh	10	Bos taurus	tibia	1
323	Kesken-Kuyuk	Sh	10	Bos taurus	tibia	2
324	Kesken-Kuyuk	Sh	10	Bos taurus	tibia	2
325	Kesken-Kuyuk	Sh	10	Sus scrofa	dentes	1
326	Kesken-Kuyuk	Sh	10	Sus scrofa	cranium	1
327	Kesken-Kuyuk	Sh	10	Equus caballus	os coxae	1
328	Kesken-Kuyuk	Sh	10	Equus caballus	metatarsalia	1
329	Kesken-Kuyuk	Sh	10	Pisces	squamae	1
330	Kesken-Kuyuk	Sh	10	Canis familiaris	humerus	1
331	Kesken-Kuyuk	Sh	10	Canis familiaris	tibia	1
332	Kesken-Kuyuk	Sh	10	Ovis et Capra	vertebrae	3
333	Kesken-Kuyuk	Sh	10	Ovis aries	mandibula	1
334	Kesken-Kuyuk	Sh	10	Ovis et Capra	mandibula	2
335	Kesken-Kuyuk	Sh	10	Ovis et Capra	mandibula	1
336	Kesken-Kuyuk	Sh	10	Ovis et Capra	mandibula	1
337	Kesken-Kuyuk	Sh	10	Ovis et Capra	tibia	1
338	Kesken-Kuyuk	Sh	10	Ovis et Capra	mandibula	1
339	Kesken-Kuyuk	Sh	10	Ovis aries	dentes	1
340	Kesken-Kuyuk	Sh	10	Ovis aries	dentes	1
341	Kesken-Kuyuk	Sh	10	Ovis aries	dentes	1
342	Kesken-Kuyuk	Sh	10	Ovis et Capra	metatarsalia	2
343	Kesken-Kuyuk	Sh	10	Ovis aries	humerus	1
344	Kesken-Kuyuk	Sh	10	Ovis et Capra	femur	3
345	Kesken-Kuyuk	Sh	10	Ovis et Capra	tibia	3
346	Kesken-Kuyuk	Sh	10	Ovis et Capra	costae	3
347	Kesken-Kuyuk	Sh	10	Ovis aries	cranium	1
348	Kesken-Kuyuk	Sh	10	Ovis et Capra	scapula	1
349	Kesken-Kuyuk	Sh	10	Ovis et Capra	cranium	2
350	Kesken-Kuyuk	Sh	10	Ovis et Capra	os coxae	1
351	Kesken-Kuyuk	Sh	10	Ovis et Capra	os coxae	1
352	Kesken-Kuyuk	Sh	10	Mammalia	undefined	8

Table A6 – Kesken-Kuyuk Kala – 2024. Archaeozoological database: archaeological contexts, taxa, skeletal element, and bone count.

Appendix B – Diagrams

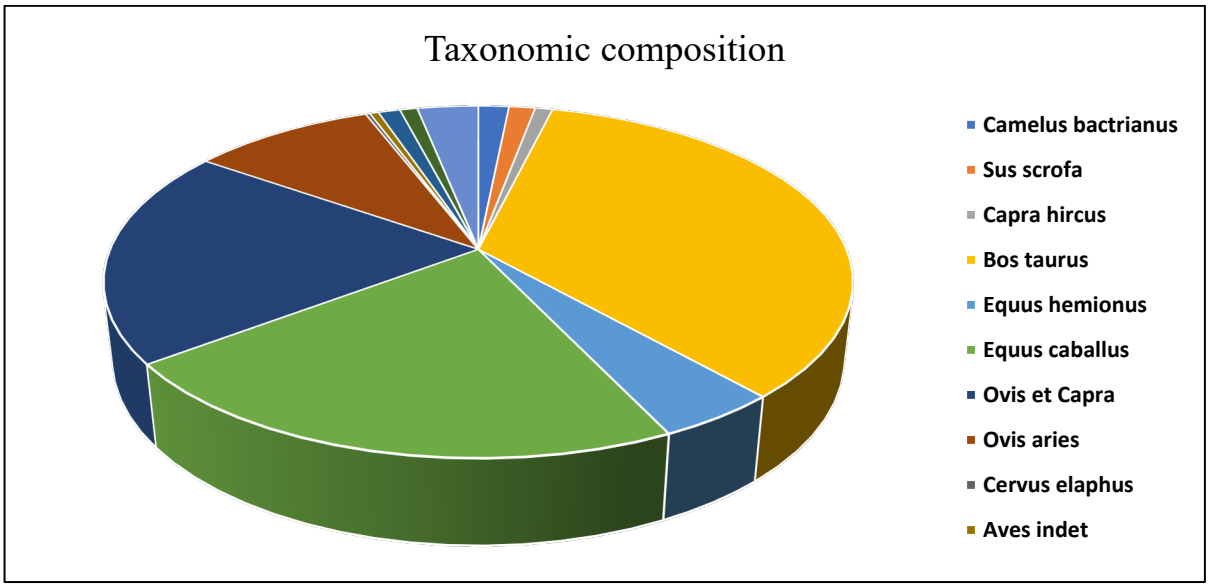


Figure B1. Kesken-Kuyuk Kala, 2024. Taxonomic composition of animal bone remains.

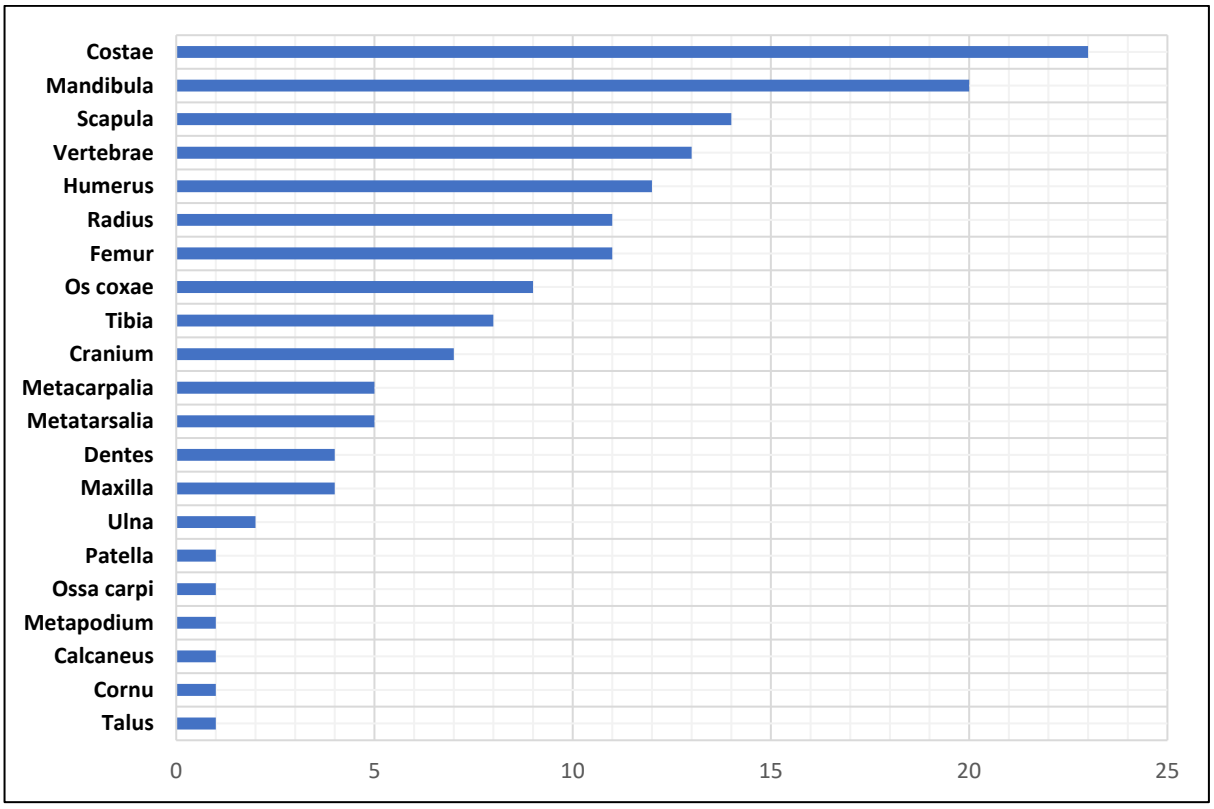


Figure B2. Kesken-Kuyuk Kala, 2024. Composition of cattle skeletal elements.

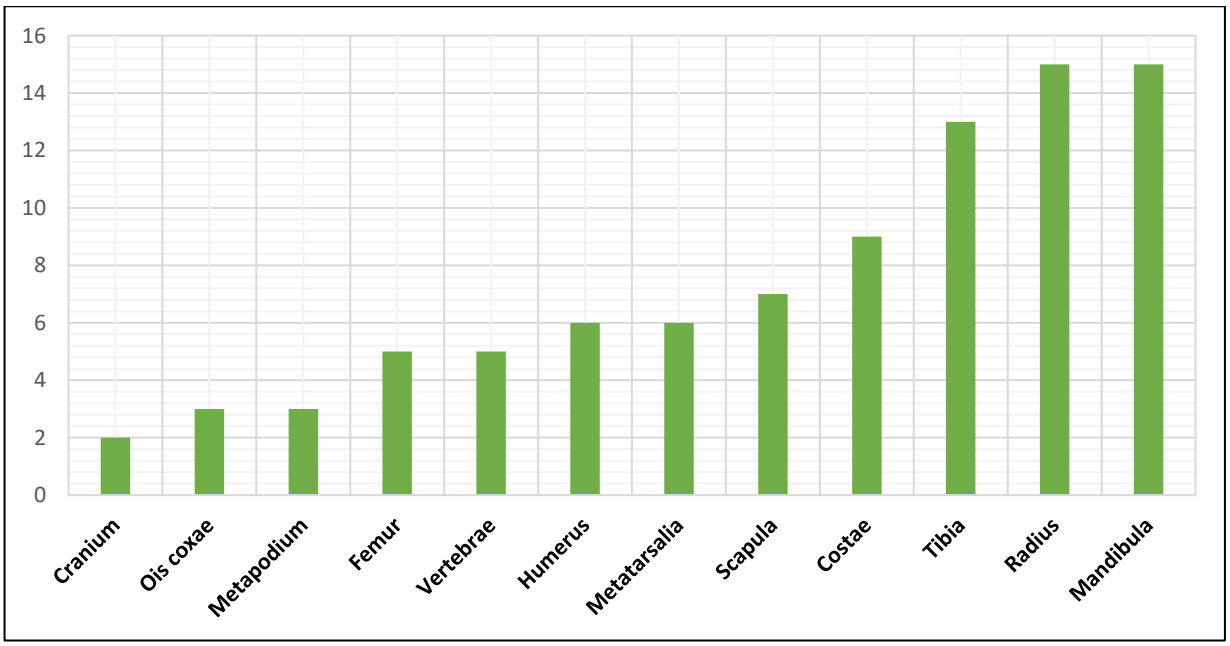


Figure B3. Kesken-Kuyuk Kala, 2024. Composition of small ruminant skeletal elements.

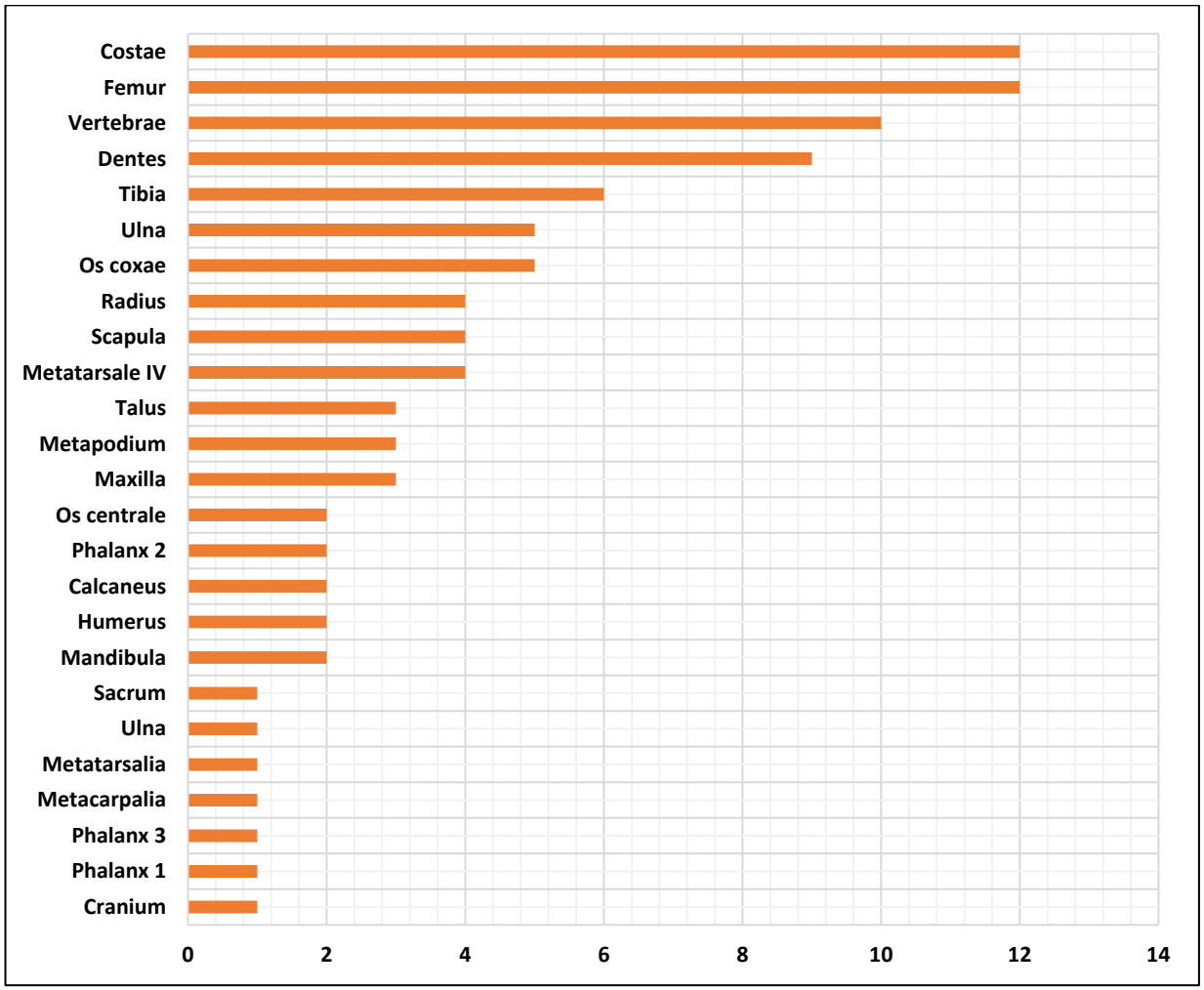


Figure B4. Kesken-Kuyuk Kala, 2024. Composition of horse skeletal elements.

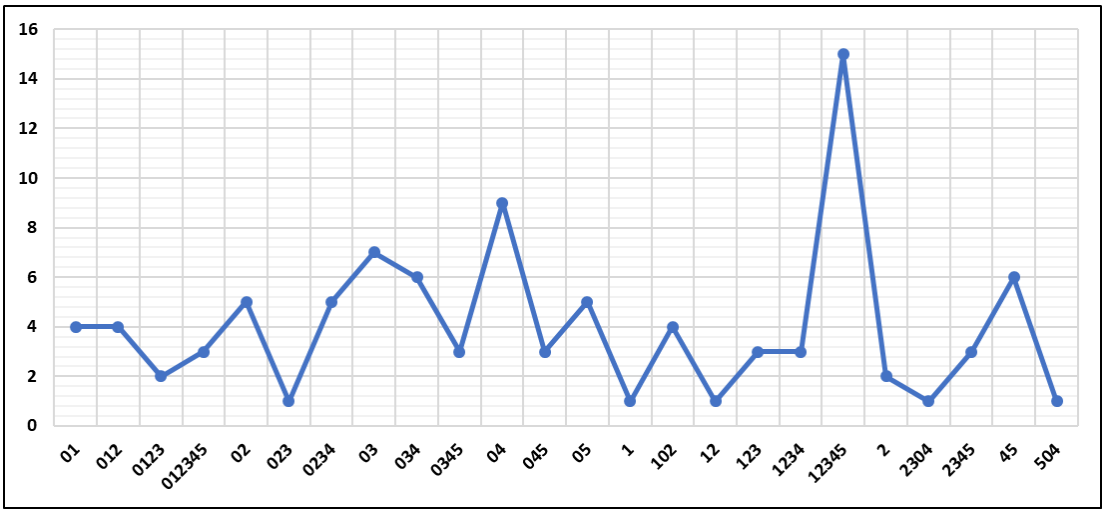


Figure B5. Kesken-Kuyuk Kala, 2024. Degree of preservation of horse bone remains.

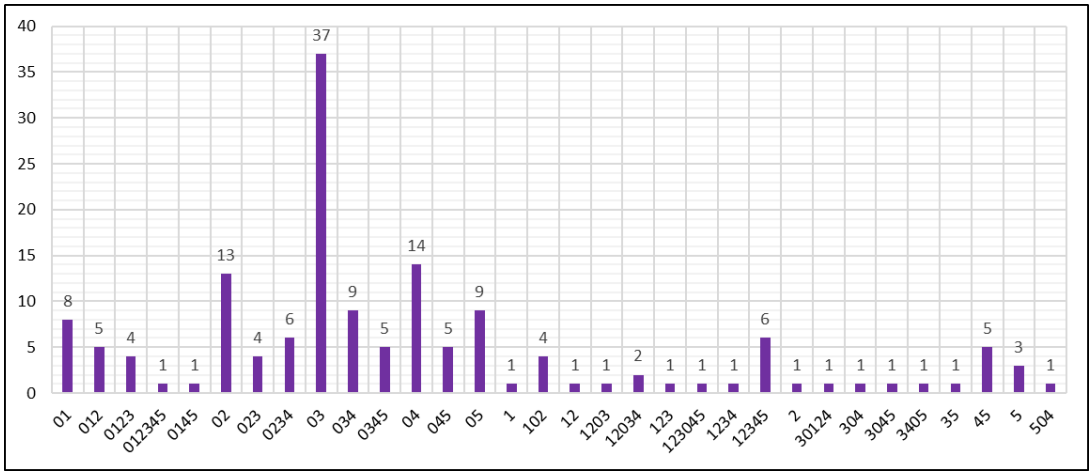


Figure B6. Kesken-Kuyuk Kala, 2024. Degree of preservation of large cattle bone remains.

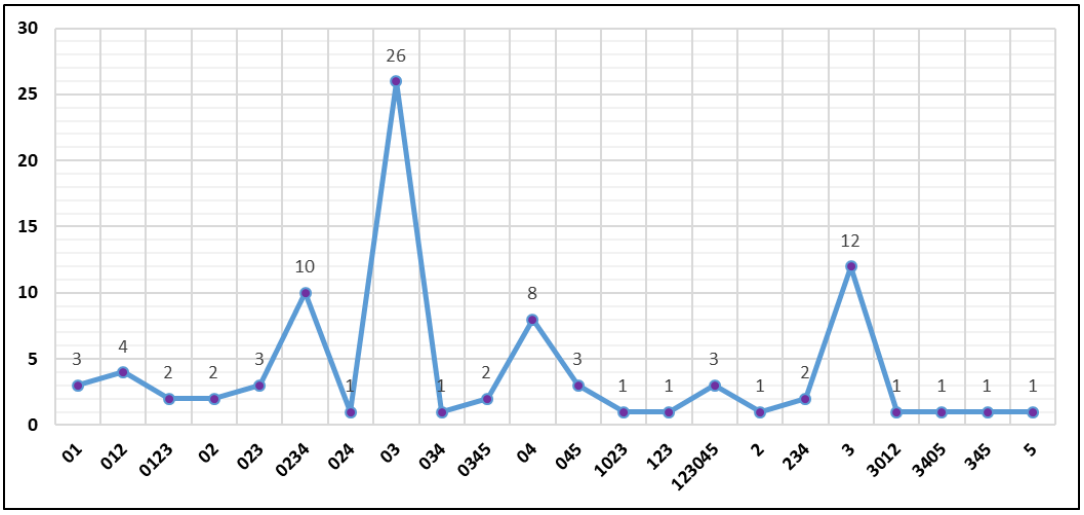


Figure B7. Kesken-Kuyuk Kala, 2024. Degree of preservation of small cattle bone remains.

Appendix B – Illustrations

Figure B1. Kesken-Kuyuk Kala, 2024. Osteological assemblage.

Figure B2. Kesken-Kuyuk Kala, 2024. Elements of the skeleton of small cattle.

Figure B3. Kesken-Kuyuk Kala, 2024. Metapodia of small cattle. Traces of dog gnawing.

Figure B4. Kesken-Kuyuk Kala, 2024. Camel bone remains. Note the traces of modification (gnawing marks).

Figure B5. Kesken-Kuyuk Kala, 2024. Skeletal elements of large cattle.

Figure B6. Kesken-Kuyuk Kala, 2024. Skeletal elements. Large cattle: tibiae, radii, and metapodial bones.

Figure B7. Kesken-Kuyuk Kala, 2024. Skeletal elements of horse.

Figure B8. Kesken-Kuyuk Kala 2024. Dog bone remains.

Figure B9. Kesken-Kuyuk Kala 2024. Sheep tibia. New bone formation on the diaphyseal surface.

Figure B10. Kesken-Kuyuk Kala 2024. Saiga horn cores.

Figure B11. Kesken-Kuyuk Kala 2024. Deer antler fragment.

Figure B12. Kesken-Kuyuk Kala 2024. Cranial remains of wild boar.

Figure B13. Kesken-Kuyuk Kala 2024. Mandible of an adult wild boar.

Figure B14. Kesken-Kuyuk Kala 2024. Elements of a kulan skeleton.

Figure B15. Kesken-Kuyuk Kala 2024. Sheep tibia. Note the traces of modification on the surface of the diaphysis.

Figure B16. Kesken-Kuyuk Kala 2024. Tibia of a small ruminant. Note the traces of modification on the surface of the diaphysis.

Figure B17. Kesken-Kuyuk Kala 2024. Tibia of a small ruminant. Note the traces of modification on the surface of the diaphysis.

Figure B18. Kesken-Kuyuk Kala 2024. Tibia of a small ruminant. Note the traces of modification on the surface of the diaphysis.

Figure B19. Kesken-Kuyuk Kala, 2024. Tibia of a small ruminant. Note the traces of modification on the surface of the diaphysis.

Figure B20. Kesken-Kuyuk Kala, 2024. Sheep tibia. Traces of modification on the cranial surface.

Figure B21. Kesken-Kuyuk Kala, 2024. Fish skeletal fragments.

Figure B22. Kesken-Kuyuk Kala, 2024. Bird metatarsal bones (chicken).

Appendix – Description and Illustration of Ceramics and Finds

General statistics of ceramic material.

Element.	Rims.	Bases.	Bodies.	Ornamented body.	Handles.	Lids	Other	Total
Ks_24_94	4	1	25	1	-	-	1	**32**
Ks_KS_24_12	16	10	91	12	7	4	8	**148**
Ks_KS_24_10	12	5	73	4	1	-	4	**99**
								279

Description of ceramic material and finds at the settlement in 2024.

Ks_24_94.

Rims.

During the excavations, a fragment of a vessel rim was discovered, presumably from a deep bowl, manufactured from moderately mixed, dense red clay. The break reveals visible inclusions of fine sand particles, mica, and minerals. The interior surface of the sherd exhibits a grayish hue, presumably resulting from uneven firing. The walls of the fragment are coated with a light slip of yellowish hue on both the interior and exterior surfaces. The rim is straight, with slightly outward-flaring edges, and is oval in cross-section. The rim diameter is 20 cm, and the wall thickness is 1.3 cm (Figure 1).

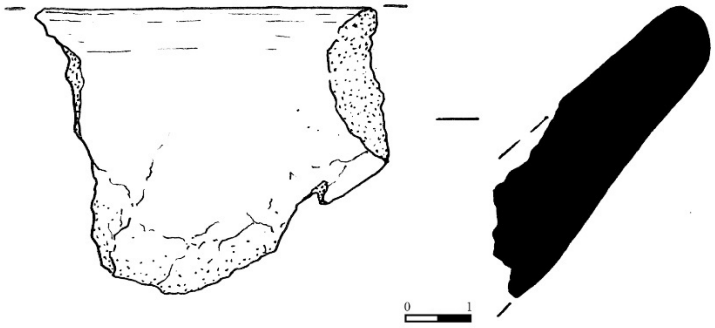


Figure 1

A fragment of a rim from a vessel, presumably from a deep bowl, was found. It is made of well-mixed, dense red clay, with numerous visible inclusions of small sand and chamotte particles in the fracture. The surface of the fragment, on both the exterior and interior, is covered with a light pink-beige slip. Dark gray spots are also visible, and the vessel exhibits burnishing on both the exterior and interior surfaces. The vessel rim is flared, with straight edges and an oval cross-section. The rim diameter is 19 cm, and the wall thickness is 1.1–1.3 cm (Figure 2).

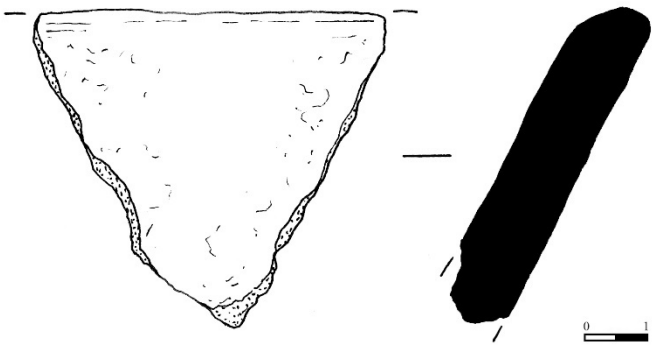


Figure 2

A fragment of a vessel rim was discovered, presumably from a large bowl, manufactured from dense, moderately mixed gray clay, with minor visible inclusions of small and large sand particles in the break. A light gray slip is visible on both the exterior and interior surfaces of the vessel. The rim is straight with a flared lip; the edges in section are flattened-oval in shape. The diameter is approximately 27 cm, and the wall thickness is 1.2–1.6 cm (Figure 3).

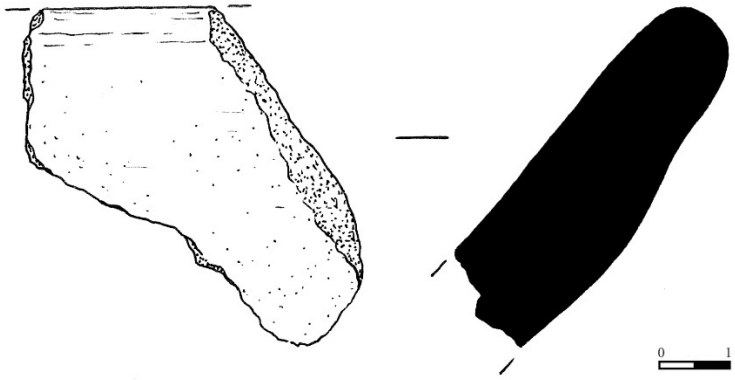


Figure 3

A fragment of a vessel rim was discovered, presumably from a pot, made of moderately mixed, loose red fabric. Due to uneven firing, the fabric is dark in color on the interior. Numerous inclusions of both fine and coarse sand, chamotte, and mica are visible in the break. The surface of the fragment, on both the exterior and interior sides, is covered with a layer of lighter-colored paste of a more liquid consistency, exhibiting beige or grayish tones. The rim features a low, slightly outward-bent neck; the edges are flattened-oval in cross-section. The rim diameter is approximately 20 cm, and the wall thickness ranges from 0.9 to 1.3 cm. On the exterior, at the break of the neck, there is an applied, ear-shaped pseudo-handle measuring 3 × 1.5 × 0.9 cm (Figure 4).

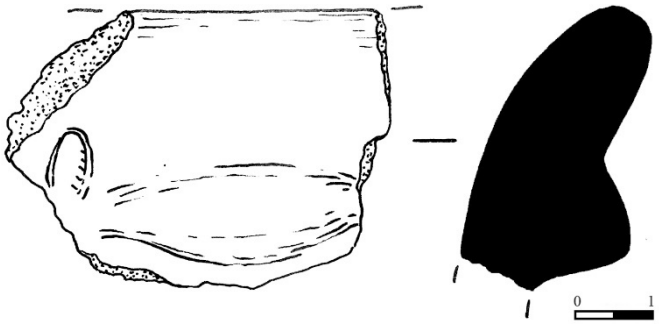


Figure 4

Ornamented sides.

A fragment of the side wall of a hand-made vessel was found, produced from moderately mixed, loose red clay. Due to uneven firing, the color of the clay varies to gray. Numerous inclusions of both small and large particles of sand and mica are visible in the break. The exterior surface is covered with a layer of light slip of beige-pink hue, while the interior bears a gray slip. The surface also exhibits striped, matte burnishing. The exterior of the fragment features incised ornamentation that covers the entire surface, executed in a geometric style consisting of slanted straight zigzag lines forming triangles, within which alternating dots are applied. Wall thickness is 0.6–0.7 cm (Figure 5).

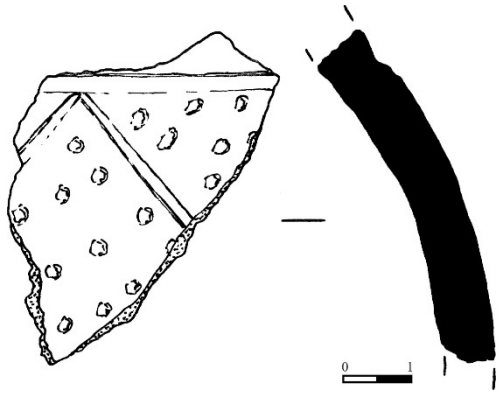


Figure 5.

Other.

A fragment of the wall from a large hand-made vessel was encountered, produced from moderately mixed, loose red clay, with numerous visible inclusions of both small and large sand particles in the break. Due to uneven firing, the color of the fabric inside the wall exhibits a grayish tint; the wall thickness is 0.8–0.9 cm. The outer surface of the fragment is covered with a light gray slip, while the inner surface displays a pinkish-beige hue. On the exterior of the fragment, there is a large, protruding, sub-triangular applique measuring 4.8 × 6 × 2.2 cm (Figure 6).

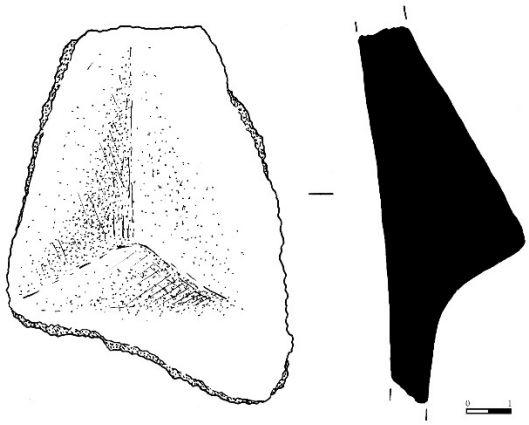


Figure 6

Ks_KS_24_12.

Rims.

A rim fragment from a hand-built vessel was found, presumably from a large pot, made of moderately mixed, loose red fabric with numerous visible inclusions of both small and large sand particles in the break. The interior surface of the vessel is coated with a layer of gray slip, exhibiting traces of soot and smoke. Striped burnishing without gloss is also visible. The exterior surface of the fragment is covered with a light red color of a yellow-beige hue. The rim is slightly flared outward, with a high, straight neck measuring 4.8 cm in height. The rim edges are flattened-oval in cross-section. On the exterior of the neck, there is ornamentation consisting of alternating small impressed strokes forming a horizontal 'herringbone' pattern. The rim diameter is approximately 26 cm, and the vessel wall thickness ranges from 0.8 to 1.8 cm (Figure 7).

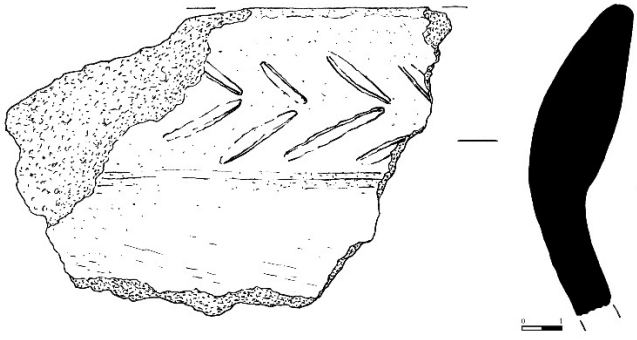


Figure 7

A fragment of a rim from a hand-made vessel was also discovered, presumably part of the neck of a large, pot-shaped vessel. The fragment is composed of moderately mixed, loose grey clay, with numerous visible inclusions of both small and large sand particles in the break. The inner surface is coated with a layer of grey slip, with traces of soot also visible, while the outer surface is partially covered with a dense, dark grey slip. Rim of a vessel with

a straight, slightly outward-flaring neck, 4.6 cm in height; the rim is oval in cross-section. On the exterior surface of the neck, there is an attached oval-shaped protrusion with a depression pressed into its center. The dimensions of the applique are 3.1 × 2 × 1.4 cm. The entire exterior surface of the neck is also decorated with alternating inclined zigzag lines. The diameter of the rim is approximately 29 cm, and the thickness of the vessel walls is 0.8–1.5 cm (Figure 8).

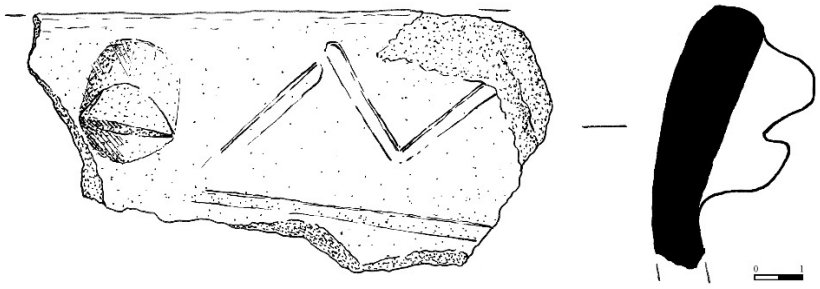


Figure 8

A fragment of a rim from a hand-made vessel was encountered, presumably from a pot, manufactured from moderately mixed, loose, gray-colored clay with numerous visible inclusions of both small and large sand particles in the break. The exterior surface of the vessel is covered with a layer of dark gray slip, while the interior surface is burnished without gloss; traces of soot and smoke are also visible. The rim is slightly everted, with edges that are flattened-oval in cross-section. On the exterior, in the central part of the rim, there is a continuous impressed line encircling the entire diameter, above which alternating small, oval-shaped impressed dents are present. The rim diameter is 24 cm, and the vessel wall thickness is 0.9–1.6 cm (Figure 9).

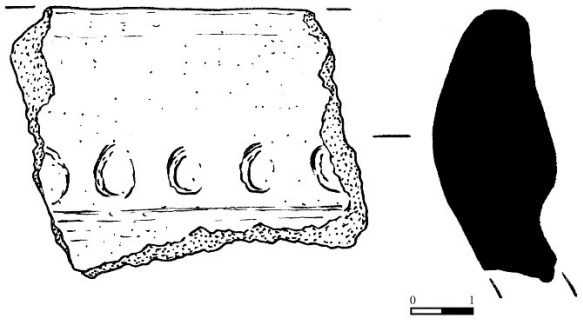


Figure 9

A fragment of the rim from a bowl-type vessel with high sides was also discovered. It is made of well-mixed, dense red clay with minor admixtures of fine sand particles and white inclusions. The surface of the fragment, both internally and externally, is covered with a layer of dense red-brick colored slip, and burnishing is also evident. Rim with high, slightly outwardly flared edges, of a flattened-oval cross-section. The rim diameter is 12 cm. The

vessel walls contain through-holes made for the restoration of chips on the vessel. The wall thickness is 0.5–0.7 cm (Figure 10).

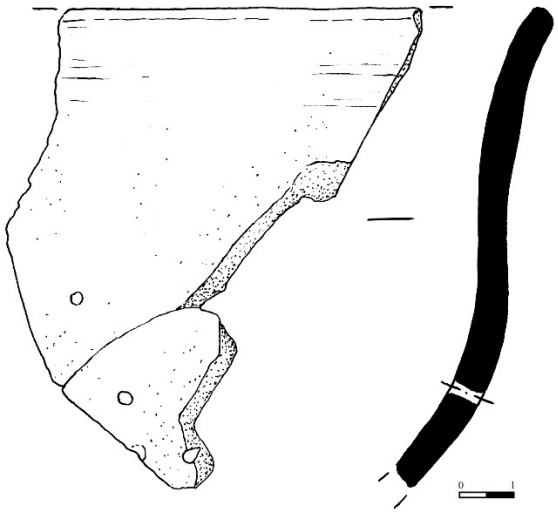


Figure 10

A fragment of a vessel rim was found, presumably from a small vase, with an outwardly flared, funnel-shaped lip. It is made of medium-mixed, loose, grey-colored clay; due to uneven firing, the clay exhibits beige-colored spots. The surface on both the exterior and interior is covered with a partially preserved layer of light gray engobe with a beige tint; burnishing with a sheen is also evident. The rim edges, in section, are of a flattened-oval shape. The length of the bent rim is 5.3 cm, the rim diameter is 19 cm, the body diameter of the vase is 11 cm, and the wall thickness is 0.7–1.4 cm (Figure 11).

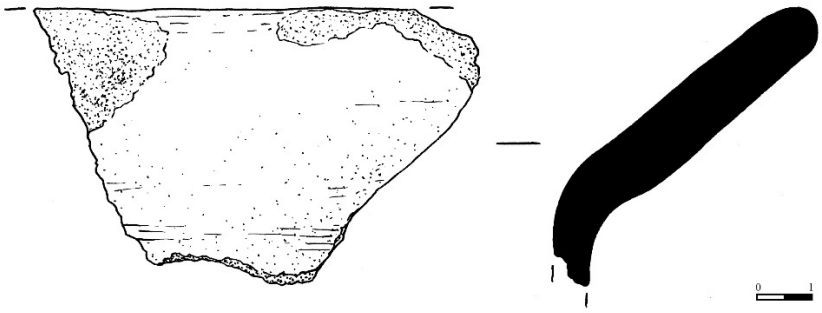


Figure 11

A fragment of the rim from a small hand-made pot was discovered, produced from well-mixed, dense grey clay with minor visible inclusions of fine sand particles in the break. The exterior surface of the vessel is covered with a light grey slip, while the interior exhibits orange-beige stains; the exterior also shows areas of burnishing with a sheen and soot stains. The vessel features slightly outward-flaring rims and an oval-flattened cross-section, with a diameter of 12 cm and a wall thickness of 0.6–0.8 cm (Figure 12).

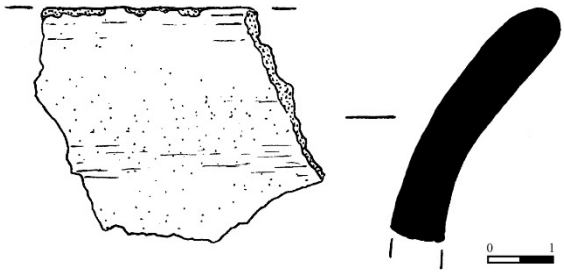


Figure 12

A rim fragment from a large hemispherical bowl was found, made of well-mixed, dense, grey-colored clay with numerous visible inclusions of both small and large sand particles, as well as white inclusions visible in the break. The surface of the fragment is covered with a light grey slip on both the interior and exterior. On the exterior, there are dark spots resulting from uneven firing, and striated burnishing with a sheen is also visible. The rim edges in section are flattened-oval in shape, with a diameter of 32 cm and a wall thickness of 0.8–1 cm (Figure 13).

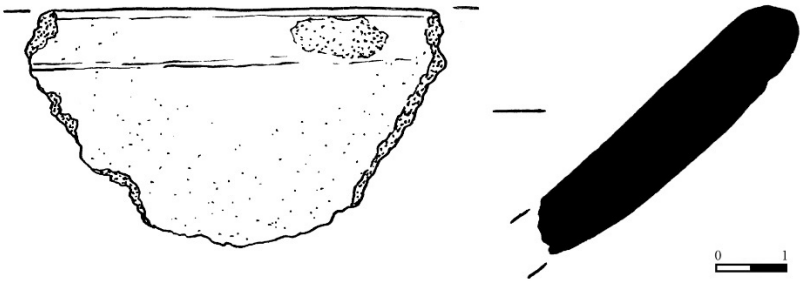


Figure 13

Ornamented sides.

A fragment of a wall from a hand-made vessel was encountered, produced from a moderately mixed, dense grey paste with numerous visible inclusions of small sand and chamotte particles in the break. The exterior surface of the fragment is covered with a dense layer of nearly white slip; the exterior also features incised ornamentation in the form of alternating straight lines. The wall thickness is 0.6–0.7 cm (Figure 14).

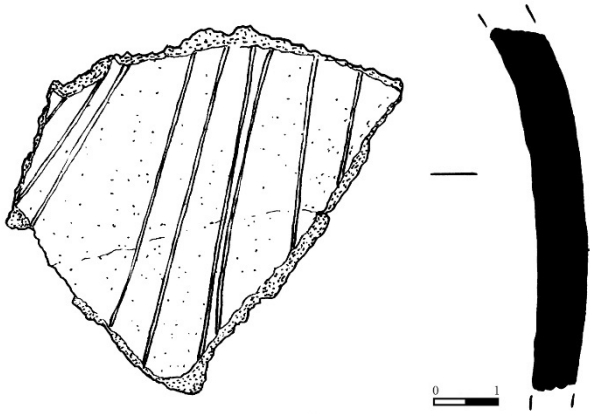


Figure 14

A fragment of the side wall of a hand-made vessel was discovered, produced from medium-mixed, dense red clay. Minor inclusions of small and large particles of sand and mica are visible in the break. Due to uneven firing, a grey layer is visible inside. The outer surface of the fragment is covered with a layer of light red slip. Grey spots are also present. On the exterior, there is incised ornamentation executed in a geometric style, consisting of alternating straight zigzag lines. The wall thickness is 1.1 cm (Figure 15).

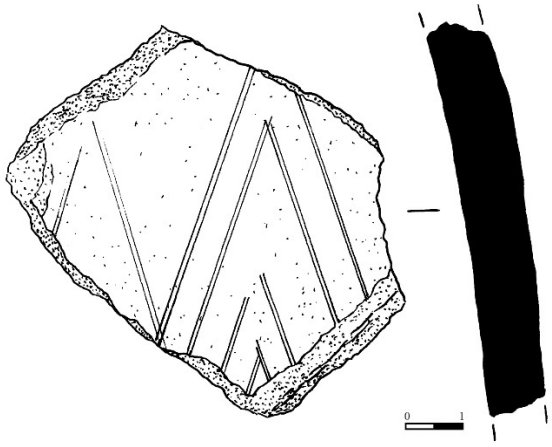


Figure 15

A fragment of the wall from a hand-made vessel was found, produced from moderately mixed, loose, grey-colored clay, with numerous visible inclusions of both small and large sand particles in the fracture. The outer surface of the fragment is covered with a layer of dense, light-grey slip; spots of soot and smoke are also visible. The vessel wall thickness is 0.8–1 cm; the exterior features incised ornamentation in the form of alternating zigzag lines (Figure 16).

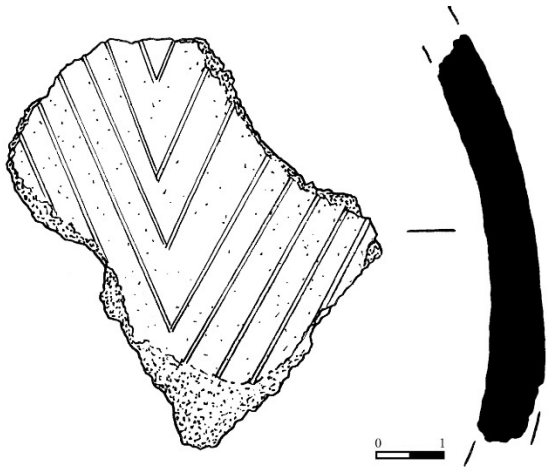


Figure 16

During the excavations, a fragment of a vessel wall was also discovered. It was produced on a potter's wheel from well-kneaded, dense red clay, with minor visible inclusions of small sand particles in the break. The exterior surface of the fragment is covered with a light slip. Ornamentation is also present on the outside, consisting of alternating, slightly inclined vertical lines applied with a comb-like tool. The thickness of the wall is 0.6–0.8 cm (Figure 17).

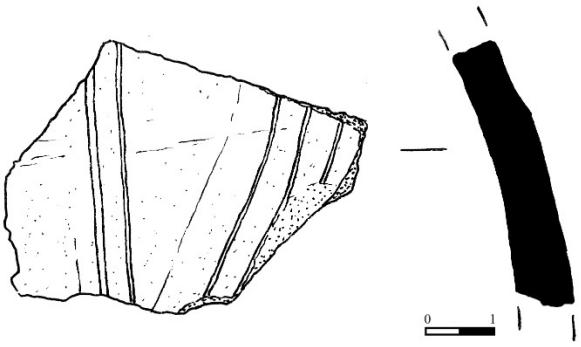


Figure 17

Handles.

A fragment of a loop-shaped handle from a vessel was found, made of medium-mixed, loose, gray clay with numerous inclusions of fine sand particles. The surface of the handle is covered with a dark gray slip. At the top of the handle, there is an upward-projecting, flattened-oval applique in cross-section, rising 2 cm above the handle. The handle itself is sub-rectangular-oval in cross-section, 2.3 cm wide and 2.4 cm thick. The handle is attached to a partially preserved vessel wall approximately 1 cm thick. The preserved height of the handle with the applique is 6.6 cm (Figure 18).

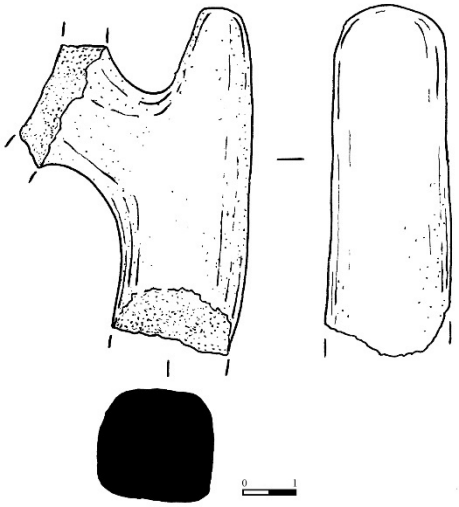


Figure 18

A fragment of a loop-shaped vessel handle was also found, made from moderately mixed, loose grey clay, with numerous visible inclusions of both small and large particles of sand and chamotte in the break. The surface of the handle is covered with a layer of dark grey slip; in some areas, the color changes to brown due to uneven firing. Partial burnishing with a sheen is observed. At the top of the handle, there is a protruding applique rising approximately 0.6 cm above the handle. The handle has an oval cross-section, with a width of 2.7 cm, a thickness of 2.5 cm, and a preserved length of 5.6 cm (Figure 19).

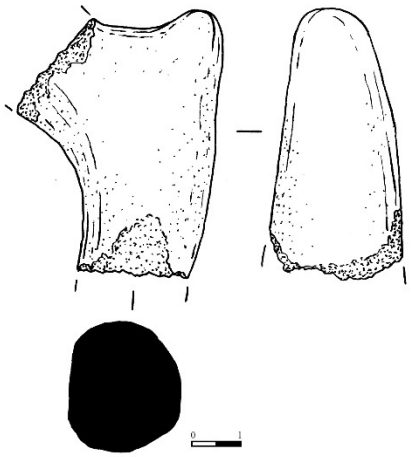


Figure 19

A fragment of a looped vessel handle was discovered, representing its top part. It is made of medium-mixed, dense, grey-colored clay, with minor visible inclusions of small sand particles in the break. The surface of the handle is covered with a partially preserved layer of light grey slip. The handle has a flattened-oval cross-section, measuring 3 cm in width and 1.5 cm in thickness (Figure 20).

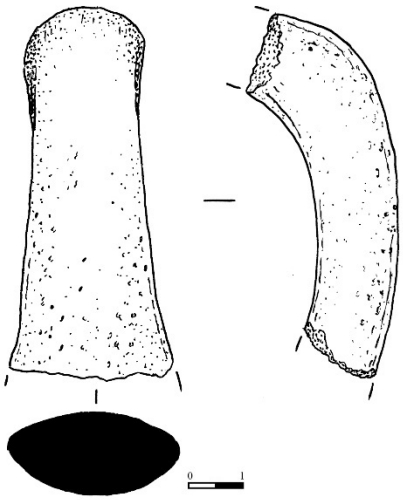


Figure 20

A fragment of a large handle from a jug-type vessel was encountered, representing its lower part. It is made of medium-mixed, loose, red-colored clay with numerous visible inclusions of small sand particles and mica in the break. Due to uneven firing, the color of the clay has acquired a greyish tint. The surface of the handle is covered with a light beige-gray slip. The handle has an oval cross-section, measuring 3.1 cm in width and 1.9 cm in thickness. The thickness of the wall to which the handle is attached is 1.3 cm. At the point of attachment to the body, there is incised ornamentation in the form of alternating intersecting lines. The preserved height of the handle is 7.8 cm (Figure 21).

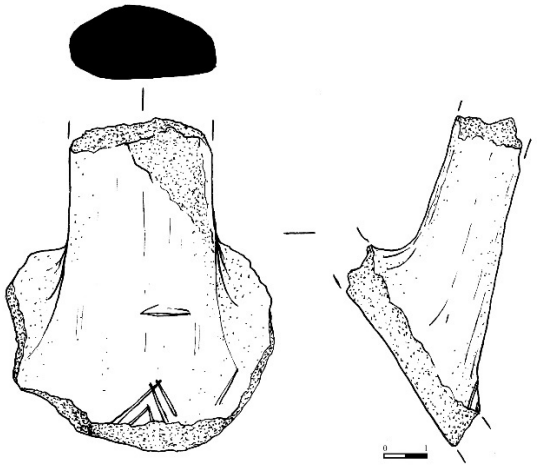


Figure 21.

Bases.

A fragment of a flat base from a hand-made vessel was found, manufactured from medium-mixed, loose, gray-colored clay, with numerous visible inclusions of both small and large sand particles in the breaks. The exterior surface of the fragment is partially covered with a preserved layer of dark slip; banded burnishing to a sheen is also visible. The edges

of the base are oval; the diameter is 5.7 cm, the wall thickness is 0.6–0.7 cm, the base thickness is 1.1 cm, and the preserved wall height is 4.9 cm (Figure 22).

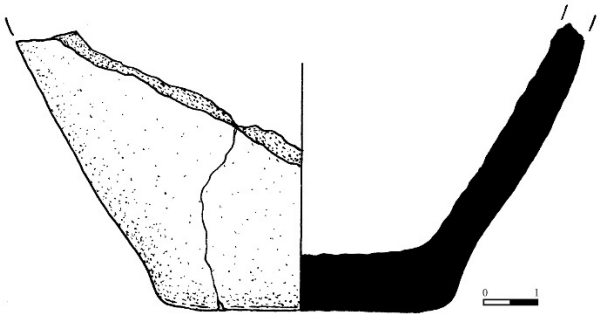


Figure 22

A fragment of a flat vessel base was discovered, manufactured from dense, moderately mixed red clay, with minor visible inclusions of small and large sand particles in the break. Due to uneven firing, the color of the clay inside the walls acquires a grayish tint. The external surface of the fragment exhibits a light red slip coating, as well as dark spots. The diameter of the base is 4.8 cm, and the wall thickness is 0.7–1.1 cm (Figure 23).

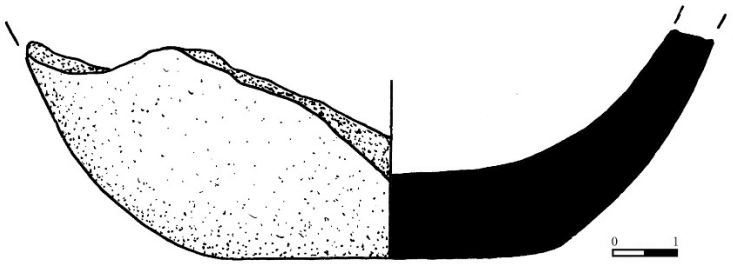


Figure 23.

Lids.

A fragment of a handmade ceramic lid was also discovered, produced from a densely mixed, compact red clay body with numerous large sand particles visible in the break. Due to uneven firing, the core exhibits a dark gray hue, which is clearly visible in the break. The exterior surface of the fragment is covered with a light slip, while traces of soot and smoke are preserved on the interior side. The edges of the lid are sub-rectangular in cross-section; the diameter of the lid is 19 cm, and the wall thickness is 1.1–1.3 cm. Impressed alternating zigzag lines are present on the exterior of the lid (Figure 24).

Figure 24

Fragment of a bone artifact.

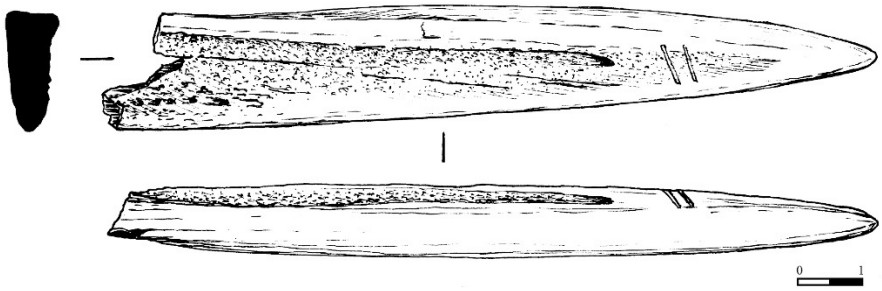


Figure 25

Bone fragment.

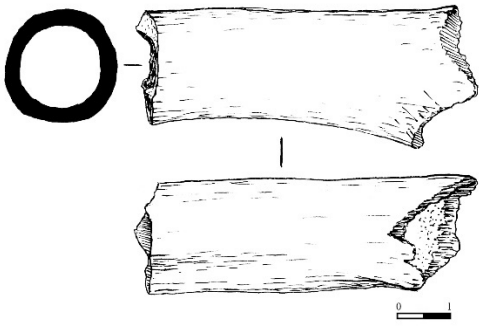


Figure 26

Ks_24_114.

Fragment of a stone artifact.

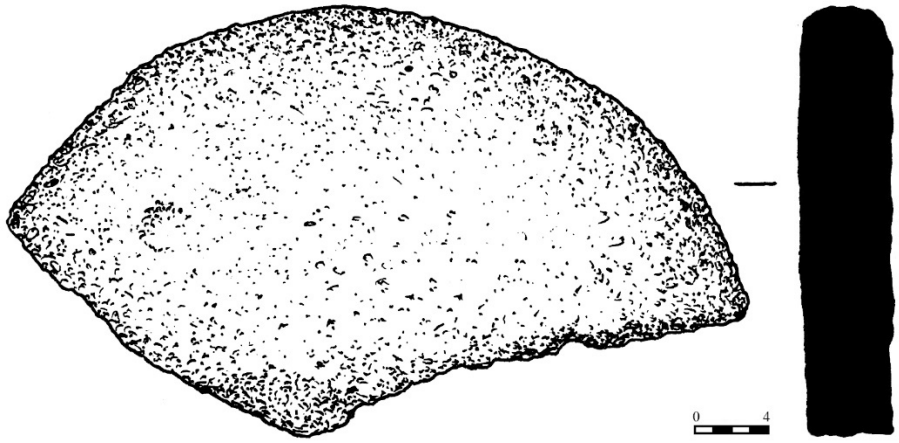


Figure 27

Fragment of a stone artifact.

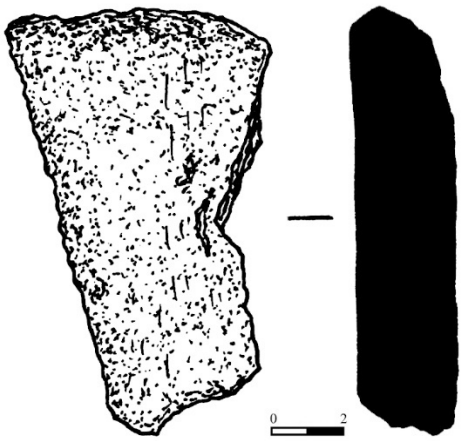


Figure 28

Ks_KS_24_10.

Rims.

A fragment of the rim from a large bowl was found, manufactured from dense, medium-mixed grey clay, with numerous visible inclusions of fine sand and mica particles in the breaks. The surface of the fragment is covered with a grey slip on both the interior and exterior; due to uneven firing, the color of the clay on the walls acquires a reddish tint, forming noticeable spots. The rim, with a thickened edge and an oval cross-section, forms a concentrically protruding band along the lip. The rim diameter is 32 cm, and the wall thickness is 0.6–1.1 cm (Figure 29).

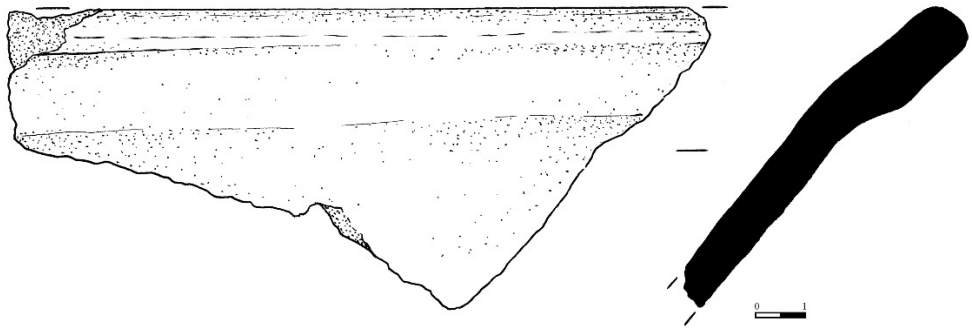


Figure 29

A fragment of a rim from a hand-made vessel was discovered, presumably from a large bowl. It is made of moderately mixed, loose, light-red clay with numerous visible inclusions of both small and large sand particles, as well as mica and chamotte visible in the break. The exterior surface is covered with a light gray slip, while the interior surface exhibits a light beige hue, with patches of soot also visible. The rim edges are thickened and roller-shaped, with a sub-rectangular to oval cross-section. Alternating ornamentation in the form of impressed, slightly rounded vertical lines is present along the exterior edge of the rim. The rim diameter is approximately 37 cm, and the wall thickness ranges from 0.7 to 1.6 cm (Figure 30).

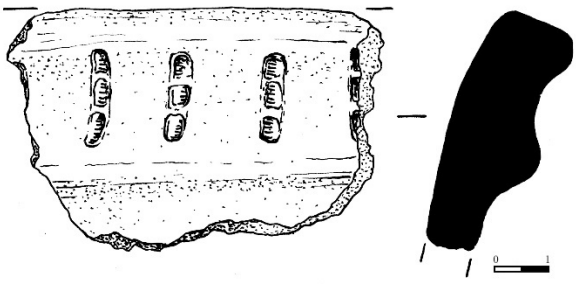


Figure 30

A fragment of a rim, presumably from a handmade pot-shaped vessel, was found. It was made from moderately mixed, loose red clay with numerous visible inclusions of both small and large sand particles in the break. The exterior surface is covered with a beige slip, while the interior surface is dark, almost black in color, with visible soot stains and evidence of burnishing. The rim edges are thickened and roller-shaped, with a sub-rectangular to oval cross-section. On the outer edge of the rim, there is alternating ornamentation in the form of incised vertical lines. The rim diameter is 37 cm along the outer edge, and the wall thickness is 0.9–1.6 cm (Figure 31).

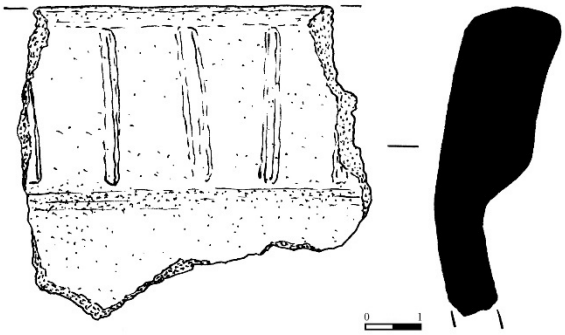


Figure 31

Ornamented sides.

A fragment of the wall from a hand-made vessel was encountered, produced from moderately mixed, dense grey clay, with minor visible inclusions of fine sand particles and mica in the break. The outer surface of the fragment is covered with a layer of grey slip; due to uneven firing, the color of the clay on the inner side exhibits a reddish tint. The exterior surface bears incised ornamentation in the form of alternating straight lines; the wall thickness is 0.7–0.8 cm (Figure 32).

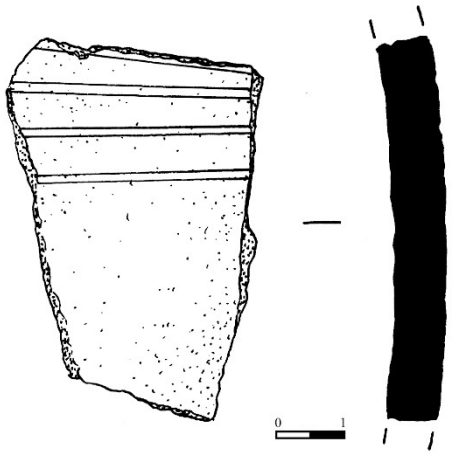


Figure 32

A fragment of the side wall of a hand-made vessel was also found, produced from medium-mixed, loose grey clay with numerous inclusions of both small and large sand particles. The outer surface of the fragment is covered with a layer of dark slip, and burnishing to a shine is also visible; the inner surface is coated with grey slip. The thickness of the wall is 0.5 cm; the exterior features incised ornamentation in the form of alternating zigzag lines (Figure 33).

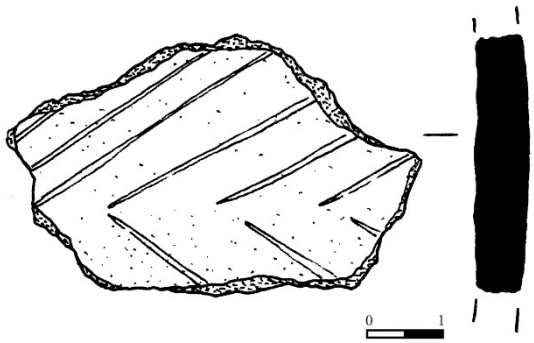


Figure 33

Lids.

A fragment of a hemispherical lid was discovered, manufactured from medium-mixed, loose, gray-colored clay. Inclusions of both small and large particles of sand and mica are visible in the breaks. Due to uneven firing, the color of the clay inside the sherd varies, ranging from dark to reddish hues. The surface of the fragment, on both the exterior and interior sides, is covered with a layer of light gray slip, with visible traces of soot. The edges of the lid are thickened and oval in cross-section, with a diameter of 25 cm and a wall thickness of 0.7–1 cm. Slightly incised alternating lines are visible on the outer surface of the lid (Figure 34).

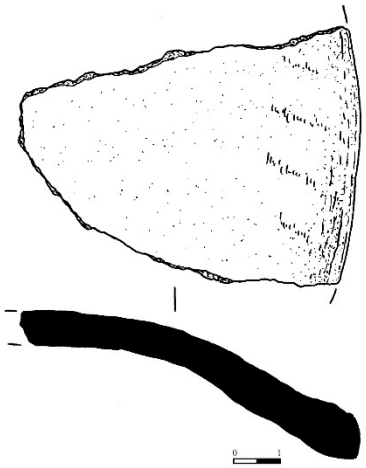


Figure 34
Fragment of a stone artifact.

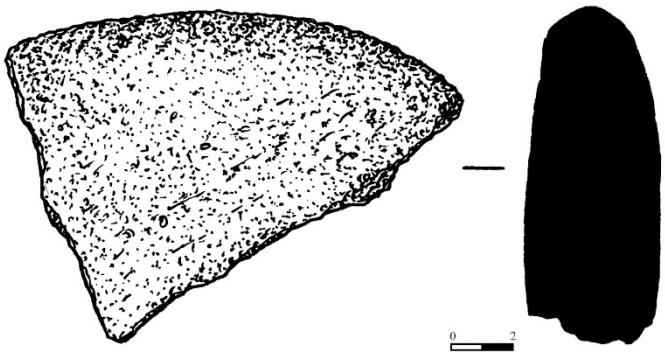


Figure 35
Fragment of a stone object with perforations.

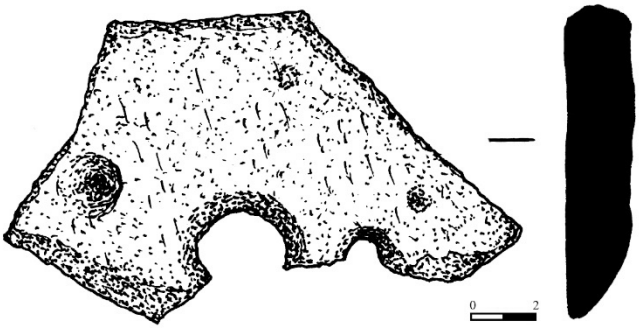


Figure 36

Tables

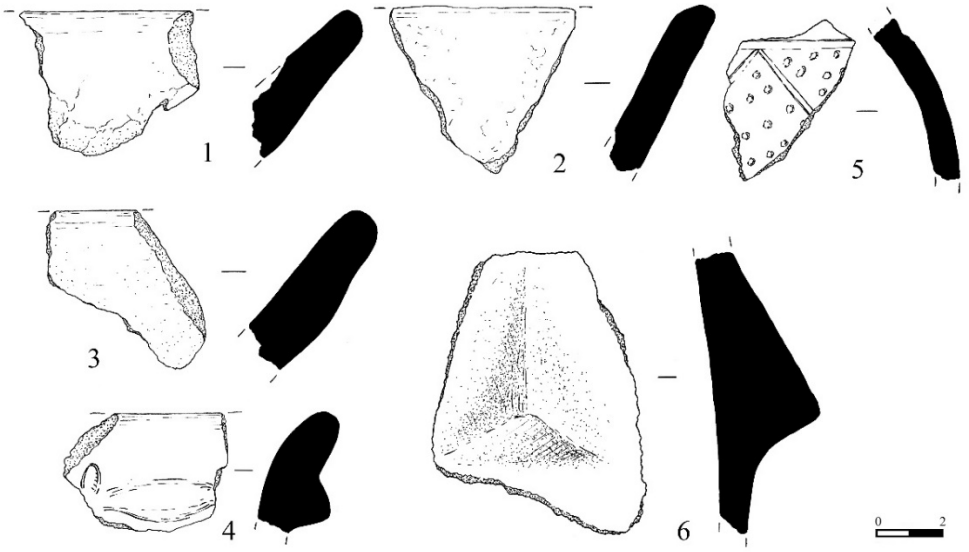


Table 1. 1) KS_24_94_1, 2) KS_24_94_2, 3) KS_24_94_3, 4) KS_24_94_4, 5) KS_24_94_5, 6) KS_24_94_6.

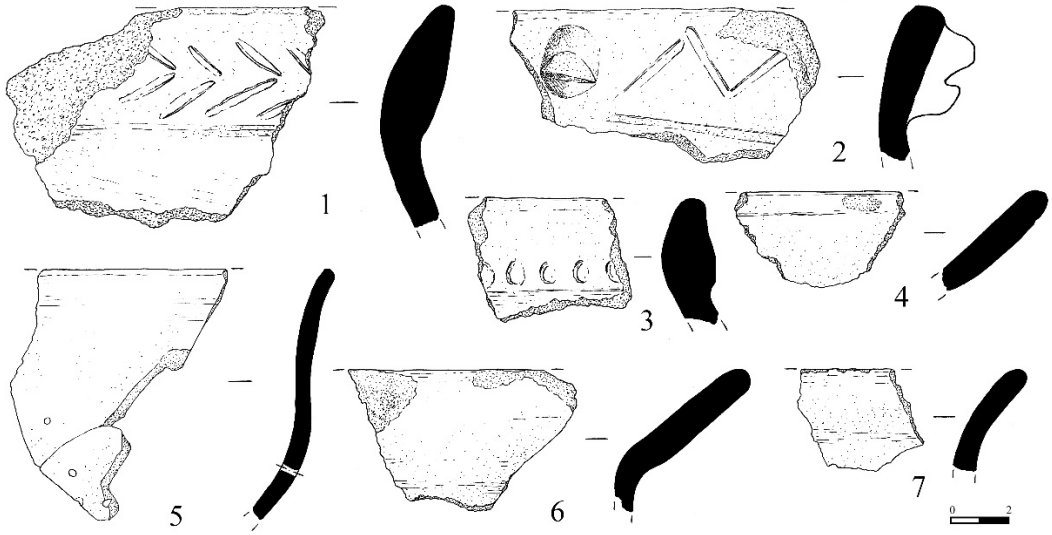
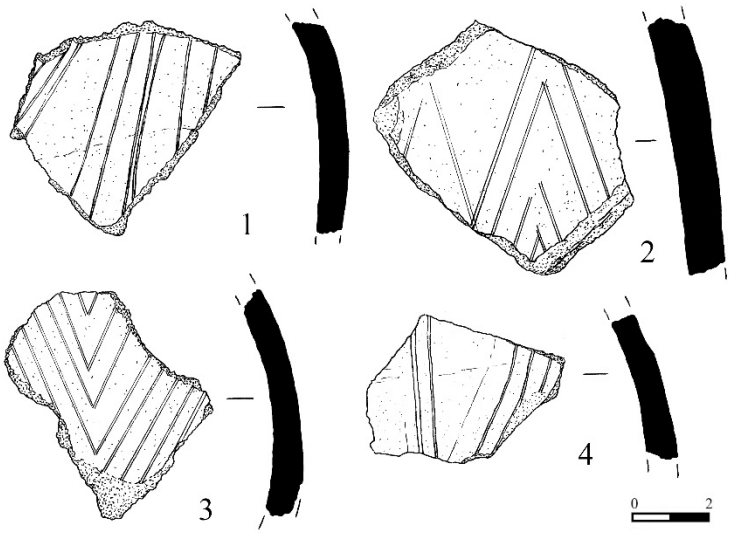


Table 2. 1) KS_KS_24_12_7, 2) KS_KS_24_12_8, 3) KS_KS_24_12_9, 4) KS_KS_24_12_13, 5) KS_KS_24_12_10, 6) KS_KS_24_12_11, 7) KS_KS_24_12_12.



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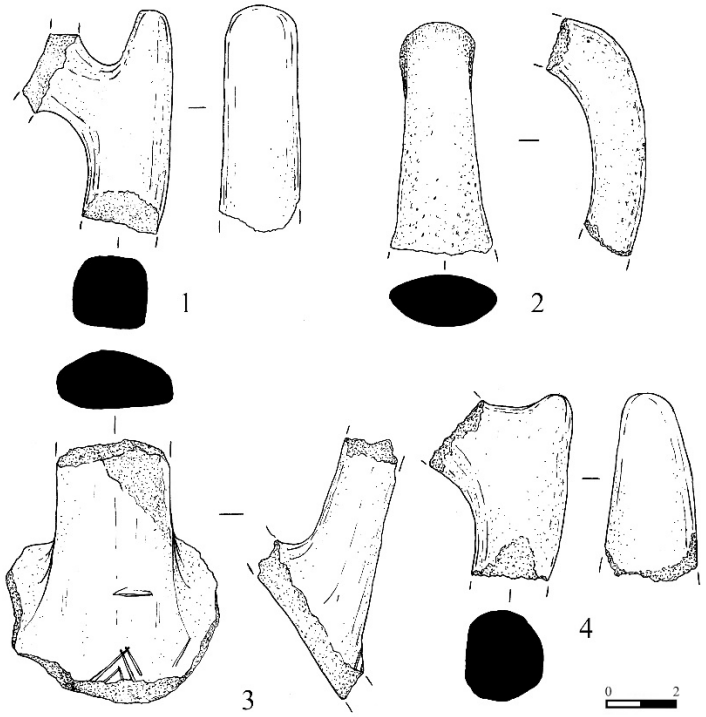

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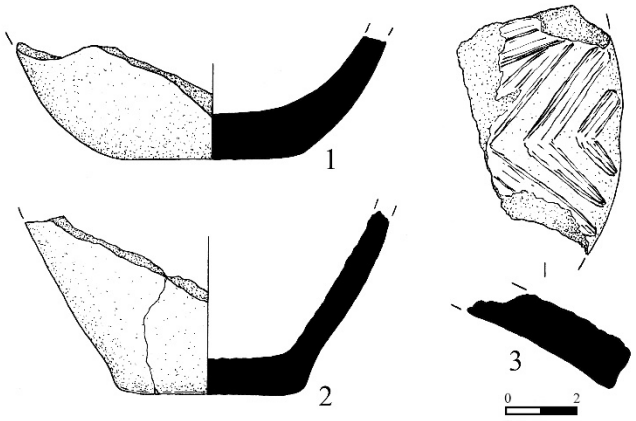

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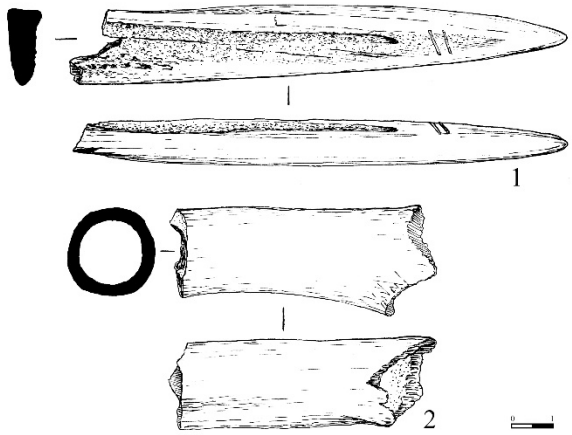

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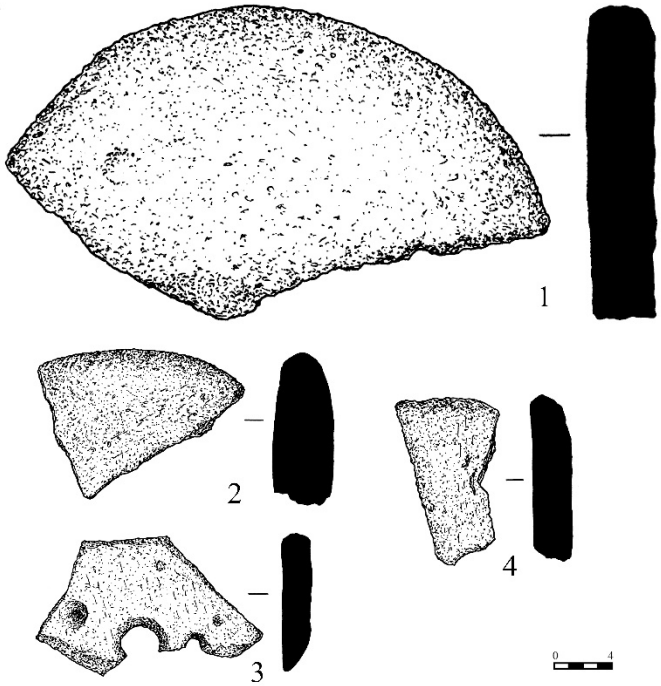

Table 7. 1) KS_24_114_27, 2) KS_KS_24_10_35, 3) KS_KS_24_10_36, 4) KS_24_114_28.

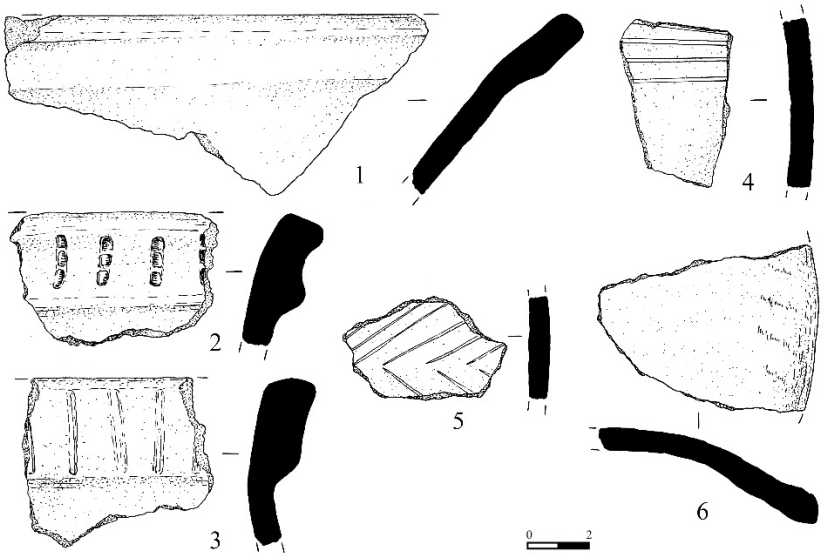

Table 7. 1) KS_KS_24_10_29, 2) KS_KS_24_10_30, 3) KS_KS_24_10_31, 4) KS_KS_24_10_32, 5) KS_KS_24_10_33, 6) KS_KS_24_10_34.

Appendix – Irrigation Studies

Introduction

This work was a collaboration between Rivers of the Silk Roads (RoSR) project team members and UNESCO's IICAS institute. The team consisted of Mark Macklin, Willem Toonen (fluvial geomorphology), James Thomas (GIS/modelling) from RoSR project and Denis Sorokin (archaeology) of the IICAS institute.

The fieldwork ran between the 12th to the 24th of October 2024. The team travelled to the lower Syr Darya delta where archaeological sites were visited, including the IICAS teams' site at Kesken Kuyuk Kala along with sampling river palaeochannels, ancient irrigation canals, and palaeo-lakeshores.

Background

Syr Darya delta

The Syr Darya delta covers an area of c. 11,656 km^2 (Zinabdin et al., 2022). The Syr Darya delta is formed of two major distributaries termed the western or lower delta and the eastern or upper delta (Figure 1). Within these major distributaries are numerous palaeochannels and ancient canals, which have been provisionally dated based on archaeological sites that appear to be associated with them. Most of the archaeological sites the lower (western) delta date to the first millennium CE, are clustered around three abandoned cities, of which Kesken Kuyuk Kala is the largest. In the upstream (eastern) delta, the river splits into numerous channels, which have been active at different times over the past four millennia and in some periods linked flow to the Amu Darya delta to the south. Soviet-era research focussed on the older channels, especially the upper (eastern) delta which appears to form the primary apex of Syr Darya delta during much of the later Holocene (Tolstov 1962: 137).

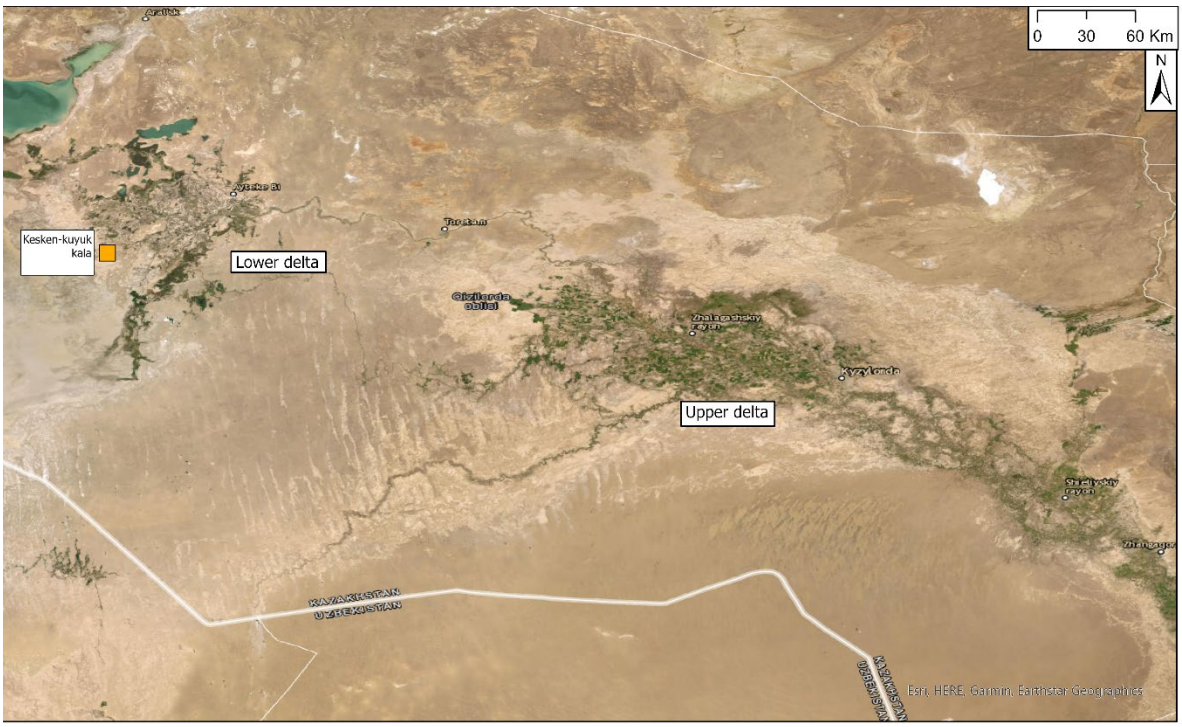

Figure 1. Map of upper (eastern) and lower (western) deltas of the Syr Darya with Kesekn-Kuyuk kala labelled.

Fieldwork Aims

This fieldwork set out to:

Date former river and canal systems around Keseken Kuyuk Kala.

Methodology

Sampling strategy

Target areas were identified from a desk study using satellite imagery, focusing primarily on avulsion points of the main paleochannel belts.

At the targeted sampling areas, the specific sampling location was decided by interpreting the local geomorphology and referencing this to the satellite imagery. In some cases, sand quarries or pits dug for sheltering livestock provided sections through the palaeochannel belts.

Proposed sampling locations from desk-based study.

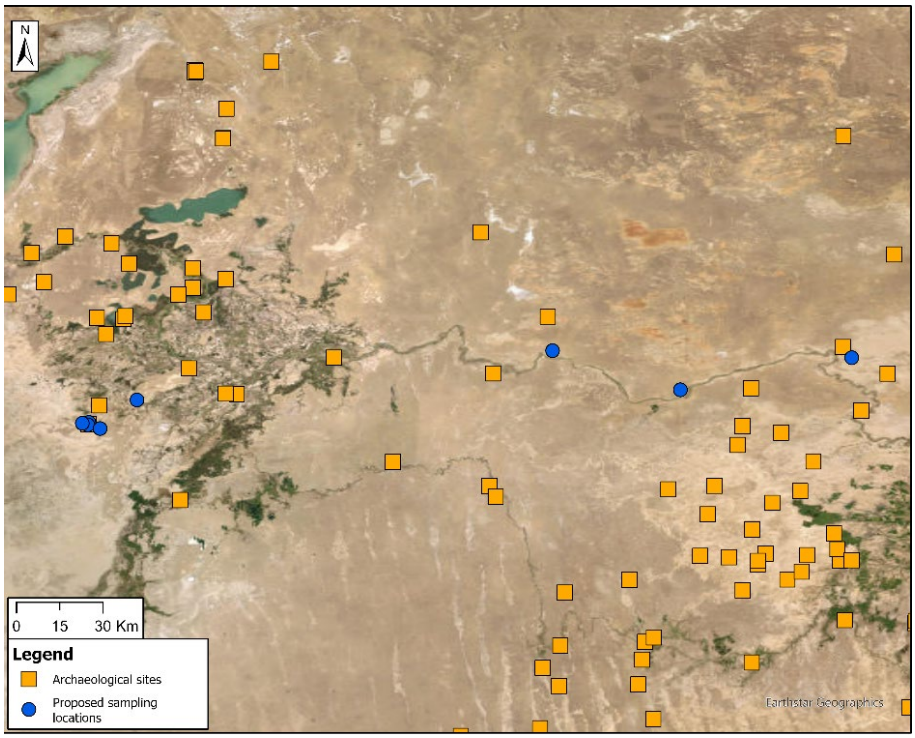

Figure 2. Map of Syr Darya with archaeological sites and proposed sampling locations.

Sampling method

1) Locate distributary/channel belt reach to date last phase of river activity and flow from most recent (youngest) scroll bar on a meandering palaeochannel.

2) A pit is dug through finer grained overbank sediments, and associated palaeosoil developed since river abandonment, to locate the most recent fluvial sands suitable for OSL analysis (Figures 3 and 4).

3) The OSL sample is taken by hammering a steel tube into the section. After extracting the tube both ends are sealed using paper and tape to stop any light exposure and the protect the sample in transport.

4) Sample depth is measured, and sample location is logged with co-ordinates using GPS.

5) The sedimentary sequence is logged and photographed, and the pit is back filled.

Figure 3. Pit with OSL sample located in the middle of the section.

Figure 4. OSL sample being extracted.

Syr Darya

OSL samples were collected from 6 out of 7 targeted areas (Figures 2 and 5). Additional shell samples were collected from former Aral Sea shoreline deposits that will be dated using radiocarbon. A total of 9 OSL and 9 radiocarbon samples were collected for dating.

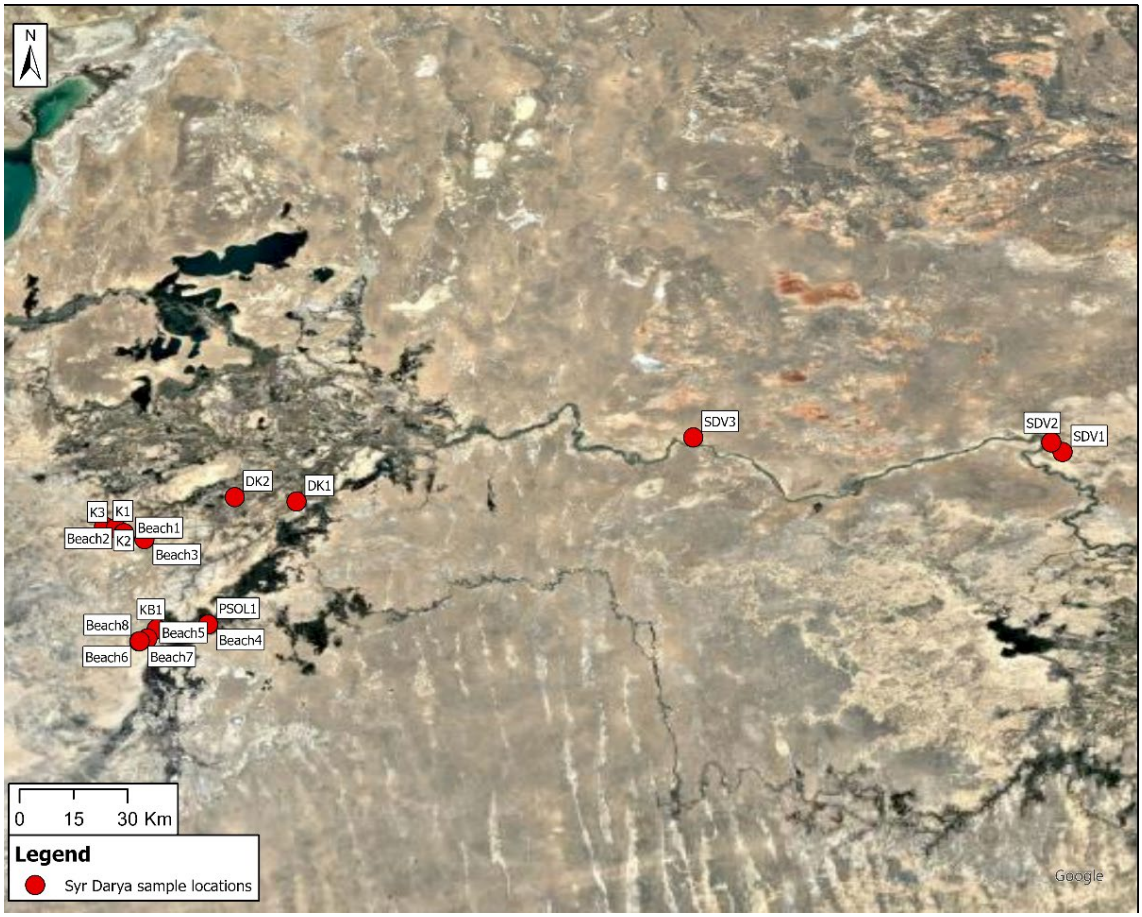

Figure 5. Location of Syr Darya river and delta OSL and radiocarbon sample sites.

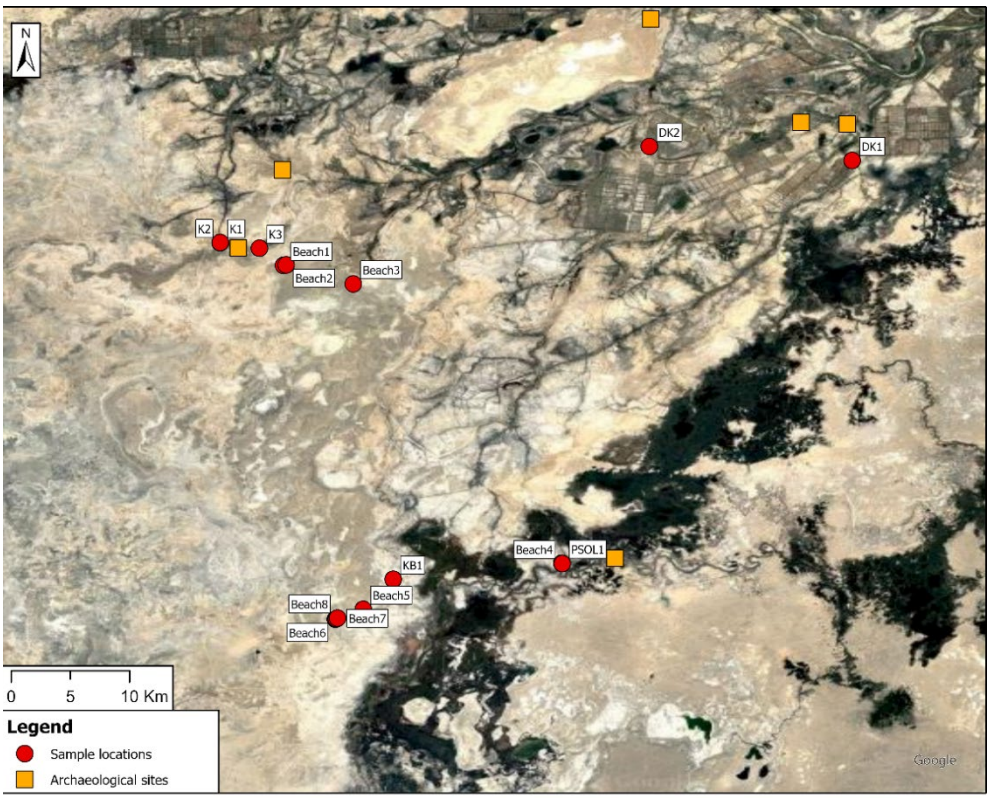

Figure 6. Location of lower (western) Syr Darya delta OSL and radiocarbon sample sites and archaeological sites.

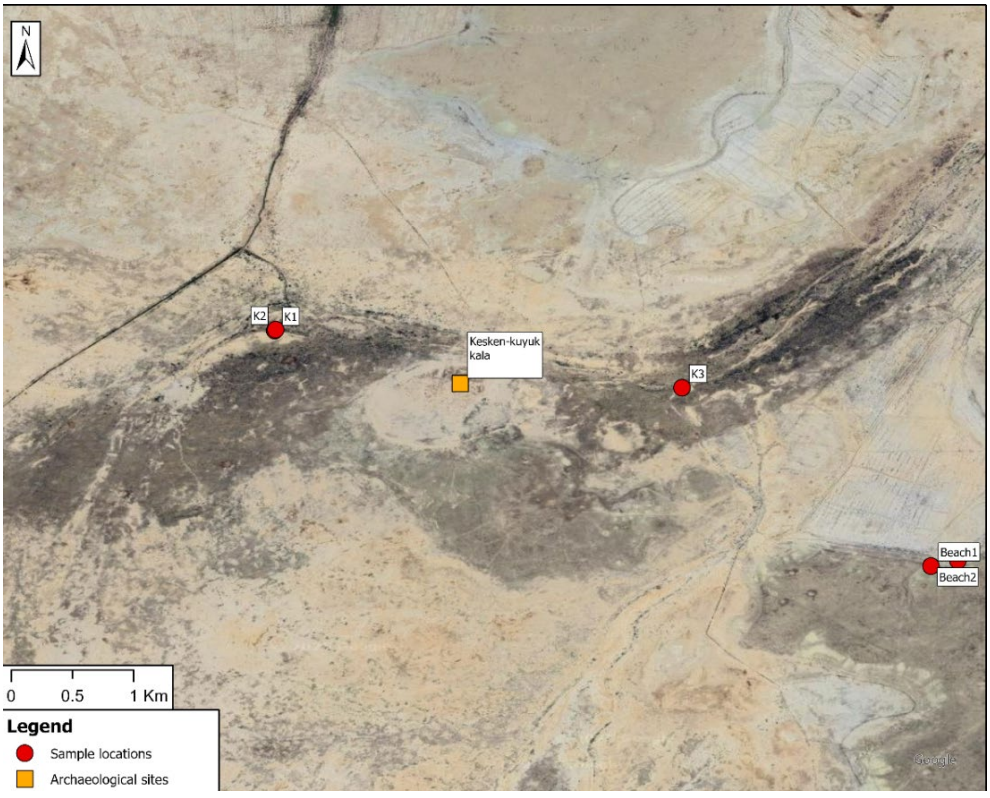

Figure 7. Location of OSL and radiocarbon sample sites around Kesen-kuyuk Kala.

Next Steps

Following the fieldwork undertaken in October 2024, samples will be sent to the UK for further analysis. OSL dating of river channel sediment will take place the University of Oxford, and radiocarbon dating will be conducted at Vilnius radiocarbon lab, Lithuania.

Sample	Name	Type	Storage	Depth (cm)	Region
OSL20	SDV1	Sediment	Metal tube	180	Syr Darya
OSL21	SDV2	Sediment	Metal tube	170	Syr Darya
OSL22	SDV3	Sediment	Metal tube	190	Syr Darya
OSL23	K1	Sediment	Metal tube	45	Syr Darya
OSL24	K2	Sediment	Metal tube	130	Syr Darya
OSL25	K3	Sediment	Metal tube	175	Syr Darya
OSL26	KB1	Sediment	Metal tube	240	Syr Darya
OSL27	DK1	Sediment	Metal tube	140	Syr Darya
OSL28	DK2	Sediment	Metal tube	225	Syr Darya
AMS1	Beach1	Shells	plastic bag	0	Syr Darya
AMS2	Beach2	Shells	plastic bag	0	Syr Darya
AMS3	Beach3	Shells	plastic bag	0	Syr Darya
AMS4	PSOL1	Sediment	Metal tube	220	Syr Darya
AMS5	Beach4	Shells	plastic bag	20	Syr Darya
AMS6	Beach5	Shells	plastic bag	0	Syr Darya
AMS7	Beach6	Shells	plastic bag	0	Syr Darya
AMS8	Beach7	Shells	plastic bag	0	Syr Darya
AMS9	Beach8	Shells	plastic bag	0	Syr Darya

Table 1. List of samples obtained during fieldwork in October 2024 in Syr Dayra delta.

Syr Darya

OSL and radiocarbon in the lower (western) Syr Darya delta will be used to create for the first time a high-resolution chronological framework of Holocene river dynamics in the region that will inform understanding of changing settlement occupation and patterns over the last 4,000 years.

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Appendix – Catalogue of Finds

inv. no.	Artifact codes	Name and description of the item
1	Bone artifact KS_24_12_25	Point made from deer antler. Point with a rectangular cross-section, featuring a polished surface and rounded edges along the sides of the straight facets. One of the facets displays a sawn edge measuring 4 cm in length and 0.8 cm in height. The length of the point is 12 cm; the width at the tip is 0.3 cm, and the width at the presumed attachment area is 1.2 cm. The attachment point is broken off and has not been preserved. Thickness: 0.5–0.8 cm. Grooved notches are visible along both edges of the projectile point. Notch 1: length 8 cm, width 0.4–1 cm, depth 0.2–0.4 cm; Notch 2: length 8 cm, width 0.2–0.4 cm, depth 0.2–0.3 cm.
2	Bone artifact KS_24_12_26	Blank made from a tubular sheep bone. The tubular bone, hollow inside, has been cleaned of bony septa. One edge is broken, while the other bears traces of chipping and sawing. The length of the blank is 6.2 cm, with a diameter of 2–2.5 cm.
3	Fragment of a millstone. KS_24_10_35	Fragment of a stone millstone. The millstone is made of quartzitic sandstone. The working surface of the millstone is flat and smoothed. The edge of the millstone has been rounded by chipping. The dimensions of the millstone are 13 × 10.5 × 3.6 cm.
4	Fragment of a millstone. KS_24_10_36	Fragment of a millstone of irregular shape, measuring 9.8 × 5.5 × 8.1 × 1–2 cm. In the central part and along the edges, circular holes have been drilled—two are through-holes, and one is a rounded depression. The first central through-hole, located at the center, has a diameter of 2.6–3.6 cm and a depth of 1.8 cm. The second through-hole, situated 1.2 cm from the first, has a diameter of 0.9–2.2 cm and a depth of 1.7 cm. The rounded depression, located 1.7 cm from the first hole, has a diameter of 2.3 cm and a depth of 1 cm.
5	Fragment of a millstone. KS_24_114_28	Fragment of a granite millstone (deirmen) with a flattened, disc-shaped form. Fragment of a millstone measuring 40 × 25 × 5 cm, made of coarse-grained granite. Part of the body is broken off.
6	Ceramic fragments 6 pieces. KS_24_94_1 KS_24_94_2 KS_24_94_3 KS_24_94_4 KS_24_94_5 KS_24_94_6	KS_24_94_1 Fragment of a vessel rim, presumably from a deep bowl. The rim is straight, with slightly outward-flaring edges, and is oval in cross-section. The rim diameter is 20 cm; wall thickness is 1.3 cm. KS_24_94_2 Fragment of a vessel rim. Rim of a vessel with a flared mouth; the edges are straight in section and oval in shape. The rim diameter is 19 cm; wall thickness is 1.1–1.3 cm.

inv. no.	Artifact codes	Name and description of the item
		KS_24_94_3 Fragment of a vessel rim. The rim is straight with a flared lip; the edges in section are flattened-oval in shape. The diameter is approximately 27 cm, and the wall thickness is 1.2–1.6 cm. KS_24_94_4 Fragment of a vessel rim, presumably from a pot. The rim features a low, slightly outward-bent neck; the edges are flattened-oval in cross-section. The rim diameter is approximately 20 cm, and the wall thickness ranges from 0.9 to 1.3 cm. On the exterior at the break of the neck, there is an applied, ear-shaped pseudo-handle measuring 3 × 1.5 × 0.9 cm. KS_24_94_5 Fragment of the body from a hand-molded vessel. The exterior of the fragment features incised ornamentation that covers the entire surface, executed in a geometric style consisting of slanted straight zigzag lines forming triangles, within which alternating dots are applied. The wall thickness is 0.6–0.7 cm. KS_24_94_6 Fragment of the wall from a large hand-molded vessel. On the exterior of the fragment, there is a large, protruding applique of sub-triangular shape, measuring 4.8 × 6 × 2.2 cm.
7	Ceramic fragments 6 pieces. KS_24_10_29 KS_24_10_30 KS_24_10_31 KS_24_10_32 KS_24_10_33 KS_24_10_34	KS_24_10_29 Rim fragment from a large bowl. The rim, with a thickened edge of oval cross-section, forms a concentrically protruding band along the lip. The rim diameter is 32 cm, and the wall thickness is 0.6–1.1 cm. KS_24_10_30 Rim fragment from a hand-molded vessel. The rim edges are thickened and roller-shaped, with a sub-rectangular to oval cross-section. On the exterior along the rim, there is alternating ornamentation in the form of impressed, slightly rounded vertical lines. The rim diameter is approximately 37 cm, and the wall thickness is 0.7–1.6 cm. KS_24_10_31 Fragment of a rim, presumably from a handmade pot-shaped vessel. The rim edges are thickened and roller-shaped, with a sub-rectangular to oval cross-section. On the exterior along the rim, there is alternating ornamentation consisting of incised vertical lines. The rim diameter is 37 cm along the outer edge, and the wall thickness is 0.9–1.6 cm.

inv. no.	Artifact codes	Name and description of the item
		KS_24_10_32 Fragment of the wall from a handmade vessel. The exterior surface bears incised ornamentation in the form of alternating straight lines; the wall thickness is 0.7–0.8 cm. KS_24_10_33 Fragment of the body from a hand-molded vessel. The wall thickness is 0.5 cm, with incised ornamentation on the exterior consisting of alternating zigzag lines. KS_24_10_34 Fragment of a hemispherical lid. The edges of the lid are thickened and oval in cross-section; the diameter is 25 cm, and the wall thickness is 0.7–1 cm. Slightly incised alternating lines are visible on the outer surface of the lid.
8	Ceramic fragments 18 pieces. KS_24_12_7 KS_24_12_8 KS_24_12_9 KS_24_12_10 KS_24_12_11 KS_24_12_12K S_24_12_13 KS_24_12_14 KS_24_12_15 KS_24_12_16 KS_24_12_17 KS_24_12_18 KS_24_12_19 KS_24_12_20 KS_24_12_21 KS_24_12_22 KS_24_12_23 KS_24_12_24	KS_24_12_7 Rim fragment from a hand-molded vessel. The rim is slightly flared outward, with a high, straight neck measuring 4.8 cm in height. The rim edges are flattened-oval in cross-section. On the exterior of the neck, there is ornamentation consisting of alternating small impressed strokes forming a horizontal 'herringbone' pattern. The rim diameter is approximately 26 cm, and the vessel wall thickness is 0.8–1.8 cm. KS_24_12_8 Fragment of a rim from a hand-made vessel, presumably part of the neck of a large pot-shaped vessel. Rim of a vessel with a straight, slightly outward-flaring neck, 4.6 cm in height; the rim is oval in cross-section. On the exterior surface of the neck, there is an attached oval-shaped protrusion with a depression pressed into its center. The dimensions of the applique are 3.1 × 2 × 1.4 cm. The entire outer surface of the neck is also decorated with alternating slanted zigzag lines. The rim diameter is approximately 29 cm, and the vessel wall thickness is 0.8–1.5 cm. KS_24_12_9 Rim fragment from a hand-molded vessel. The rim is slightly everted, with edges that are flattened-oval in cross-section. On the exterior, in the central part of the rim, there is a continuous impressed line encircling the entire diameter, above which alternating small, oval-shaped impressed dents are present. The rim diameter is 24 cm, and the vessel wall thickness is 0.9–1.6 cm. KS_24_12_10

inv. no.	Artifact codes	Name and description of the item
		Fragment of a rim from a bowl-type vessel with high sides. Rim with high, slightly outwardly flared edges, of a flattened-oval cross-section. The rim diameter is 12 cm. There are through-holes on the vessel walls, made for the restoration of chips on the vessel. The wall thickness is 0.5–0.7 cm. KS_24_12_11 Fragment of a rim from a vessel, presumably from a small vase, with an outwardly flared, funnel-shaped lip. The rim edges in section are of a flattened-oval shape. The length of the flared edge is 5.3 cm, the rim edge diameter is 19 cm, the vase body diameter is 11 cm, and the wall thickness is 0.7–1.4 cm. KS_24_12_12 Fragment of the rim from a small handmade pot. Vessel with slightly outward-flaring rims and a flattened-oval cross-section; diameter 12 cm, wall thickness 0.6–0.8 cm. KS_24_12_13 Fragment of the rim from a large hemispherical bowl. The rim edges have a flattened-oval cross-section; diameter 32 cm, wall thickness 0.8–1 cm. KS_24_12_14 Fragment of the wall from a handmade vessel, with incised ornamentation on the exterior in the form of alternating straight lines; wall thickness 0.6–0.7 cm. KS_24_12_15 Fragment of the side wall of a handmade vessel, with incised ornamentation on the exterior surface, executed in a geometric style consisting of alternating straight zigzag lines. Wall thickness is 1.1 cm. KS_24_12_16 Fragment of the wall of a handmade vessel, with visible soot and smoke stains. The vessel wall thickness is 0.8–1 cm; the exterior bears incised ornamentation in the form of alternating zigzag lines. KS_24_12_17 Fragment of a vessel wall. The exterior surface of the fragment is covered with a light slip; ornamentation is also present on the exterior in the form of alternating, slightly inclined vertical lines applied with a comb-like tool. The wall thickness is 0.6–0.8 cm. KS_24_12_18

inv. no.	Artifact codes	Name and description of the item
		Fragment of a loop-shaped vessel handle. At the top of the handle, there is an upward-projecting, flattened-oval applique in cross-section, rising 2 cm above the handle. The handle itself is sub-rectangular-oval in cross-section, 2.3 cm wide and 2.4 cm thick. The handle is attached to a partially preserved vessel wall approximately 1 cm thick. The preserved height of the handle with the applique is 6.6 cm. KS_24_12_19 Fragment of a loop-shaped handle from a vessel. The upper part of the handle features a protruding applique rising approximately 0.6 cm above the handle. The handle has an oval cross-section, 2.7 cm wide and 2.5 cm thick, with a preserved length of 5.6 cm. KS_24_12_20 Fragment of a loop-shaped handle from a vessel; the handle has a flattened oval cross-section, 3 cm wide and 1.5 cm thick. KS_24_12_21 Fragment of a large handle from a jug-type vessel. The handle has an oval cross-section, 3.1 cm wide and 1.9 cm thick. The wall to which the handle is attached is 1.3 cm thick. At the point of attachment to the body, there is incised ornamentation in the form of alternating intersecting lines. The preserved height of the handle is 7.8 cm. KS_24_12_22 Fragment of a flat base from a hand-molded vessel. The edges of the base are oval; the diameter is 5.7 cm, the wall thickness is 0.6–0.7 cm, the base thickness is 1.1 cm, and the preserved wall height is 4.9 cm. KS_24_12_23 Fragment of a flat base from a vessel. The external surface of the fragment exhibits a light red slip coating, as well as dark spots. The base diameter is 4.8 cm; wall thickness is 0.7–1.1 cm. KS_24_12_24 Fragment of a hand-molded ceramic lid. The edges of the lid are sub-rectangular in cross-section; the lid diameter is 19 cm, wall thickness is 1.1–1.3 cm, and the exterior of the lid bears impressed alternating zigzag lines.
9	Fragment of a millstone. KS_24_114_27	Fragment of a millstone measuring 40 × 25 × 5 cm, made of coarse-grained granite. Part of the body is broken off.

Figure 1 – Bone artifact KS_24_12_25

Figure 2 – Bone artifact KS_24_12_25

Figure 3 – Bone artifact KS_24_12_26

Figure 4 – Millstone fragment KS_24_10_35

Figure 5 – Millstone fragment KS_24_10_36

Figure 6 – Millstone fragment KS_24_114_28

Figure 7 – Ceramic fragments, 6 items KS_24_94_1-6

Figure 8 – Ceramic fragments, 6 pieces. KS_24_10_29–34

Figure 9 – Ceramic fragments, 18 pieces. KS 24 12 7–24

Figure 10 – Millstone fragment KS_24_114_27

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Vilnius Radiocarbon
Performed by

DATING CERTIFICATE

No. 2025-02-28-FTMC-UV35

01st April 2025

1. Applicant for analysis: Mr Nurbol Baimukhanov, International Institute for Central Asian Studies, 19, University boulevard street, Samarkand, Uzbekistan, 140129
2. Material of sample: Charcoal
3. Date of sample receiving: 2025-03-05
4. Analysis date: 2025-04-01
5. Equipment used for analysis: Low-Energy Accelerator (LEA, Ionplus AG, Zürich), Automated Graphitization Equipment AGE-3 (Ionplus AG, Zürich).
6. Method of analysis: Samples were pretreated with a standard acid-base-acid protocol. IAEA C3, IAEA C9, and NIST-OXII were used as reference materials.
7. Results of analysis:

Sample designation	Lab. code	Radiocarbon age, BP	pMC
KS_24_C14_1	FTMC-UV35-1	1570±24	82.25±0.25
KS_24_C14_2	FTMC-UV35-2	1535±26	82.61±0.27

The results are given in years before 1950 (radiocarbon age BP). The uncertainty in the age determination is given +/- one standard deviation. All radiocarbon ages are corrected for isotopic fractionation using the measured 13/12C-ratio. The radiocarbon ages must be translated to calibrated radiocarbon years.

8. Calibrated radiocarbon dates:

QUALITY SYSTEM CERTIFICATION DNV·GL ISO 9001

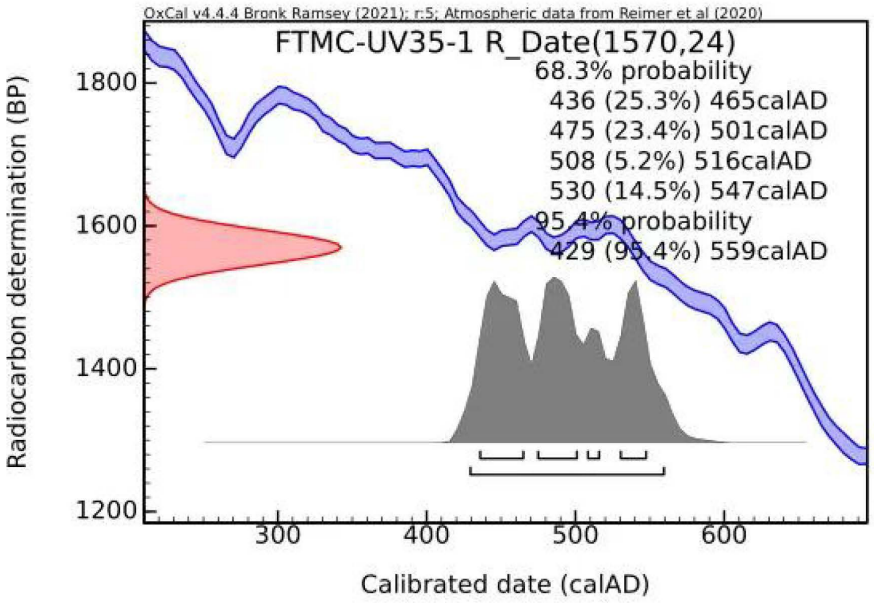

Fig. 1. Radiocarbon date 1570±24BP (red), part of the calibration curve (blue) and the calibrated probability density function (grey) calculated in OxCal.

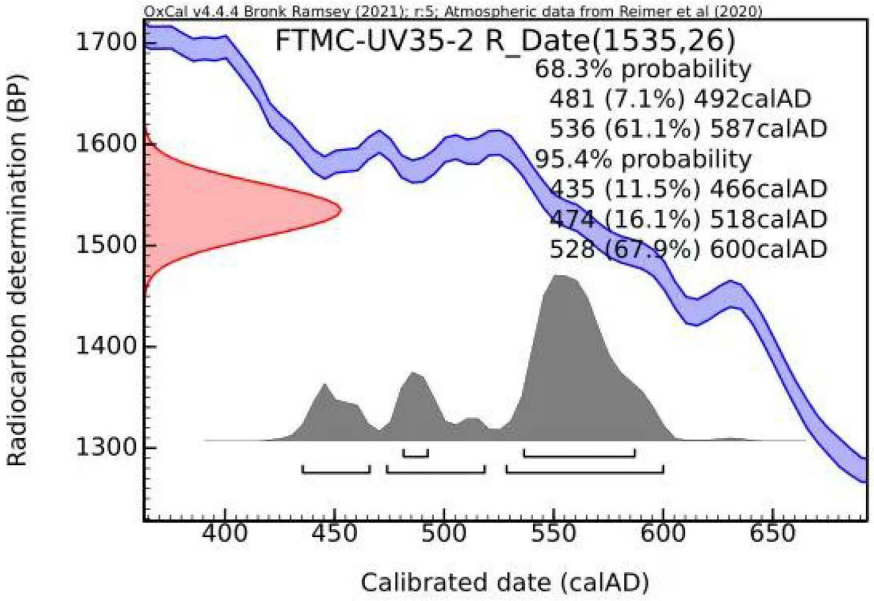

Fig. 2. Radiocarbon date 1535±26BP (red), part of the calibration curve (blue) and the calibrated probability density function (grey) calculated in OxCal.

Appendix – Photographic Appendix

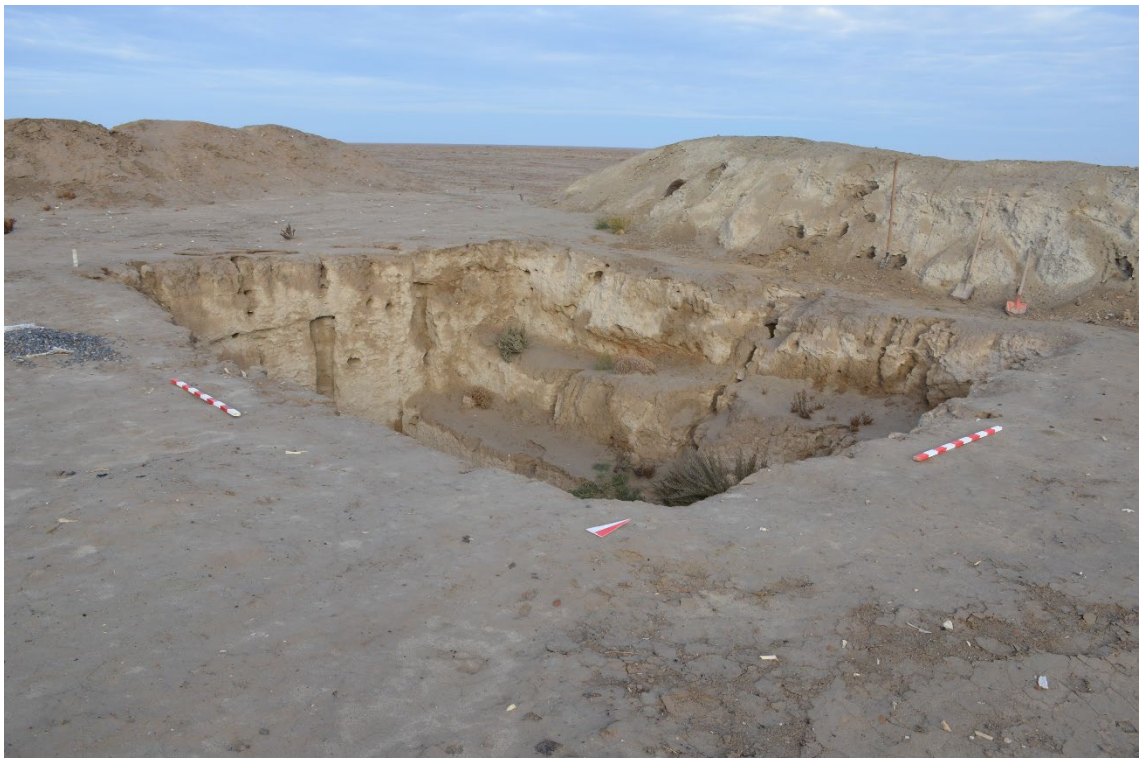

Figure 1 – General view of the excavation prior to the commencement of work. View to the northwest.

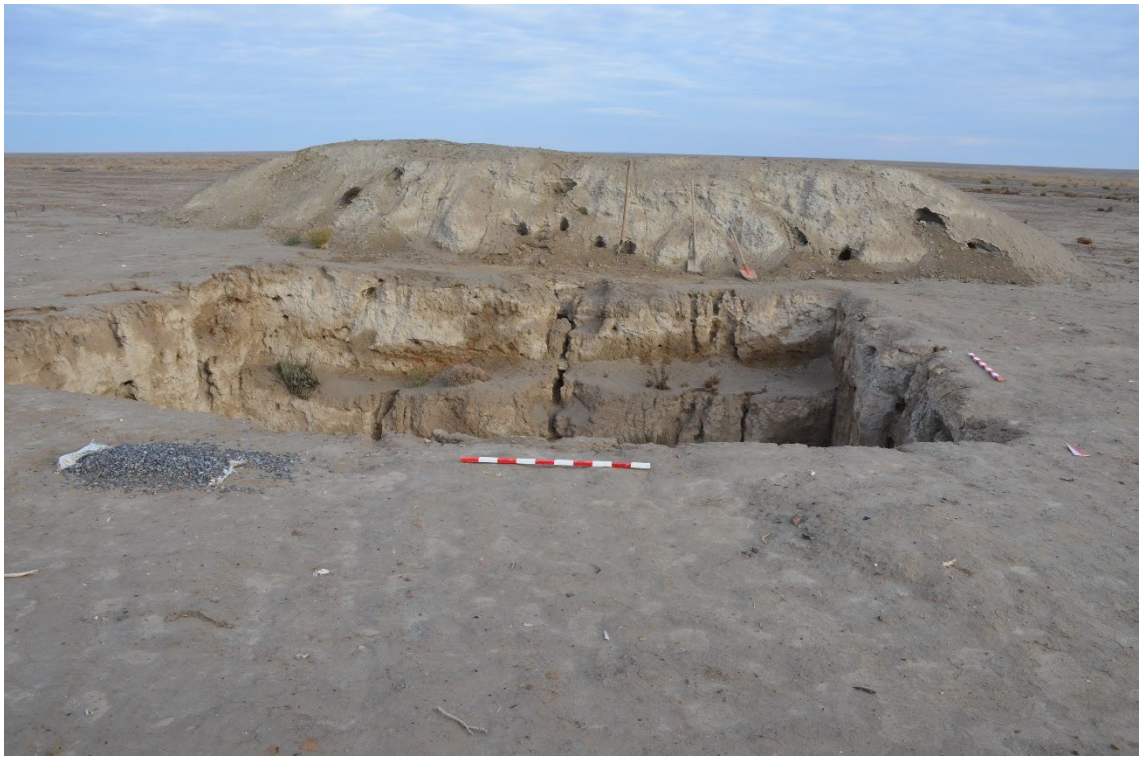

Figure 2 – General view of the excavation prior to the commencement of work. View to the north.

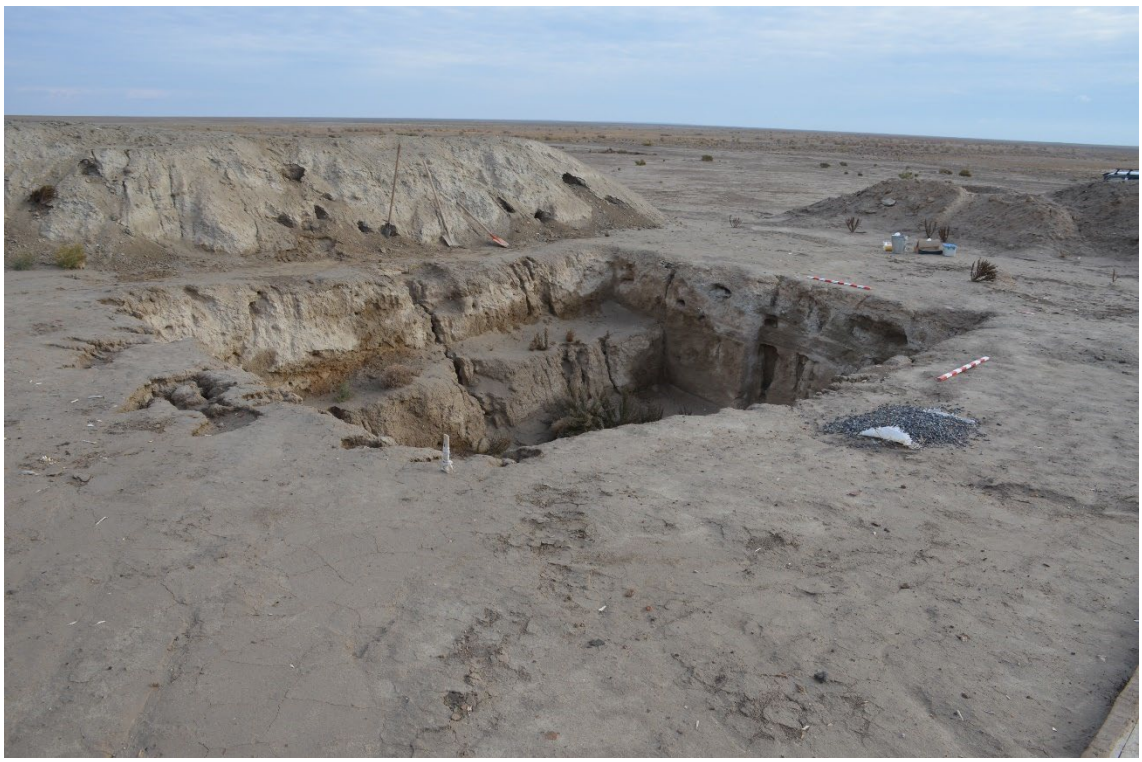

Figure 3 – General view of the excavation prior to the commencement of work. View to the northeast.

Figure 4 – General view of the excavation prior to the commencement of work. View to the east.

Figure 5 – General view of the excavation prior to the commencement of work. View to the southeast.

Figure 6. General view of the excavation prior to the commencement of work. View to the south.

Figure 7. General view of the excavation prior to the commencement of work. View to the southwest.

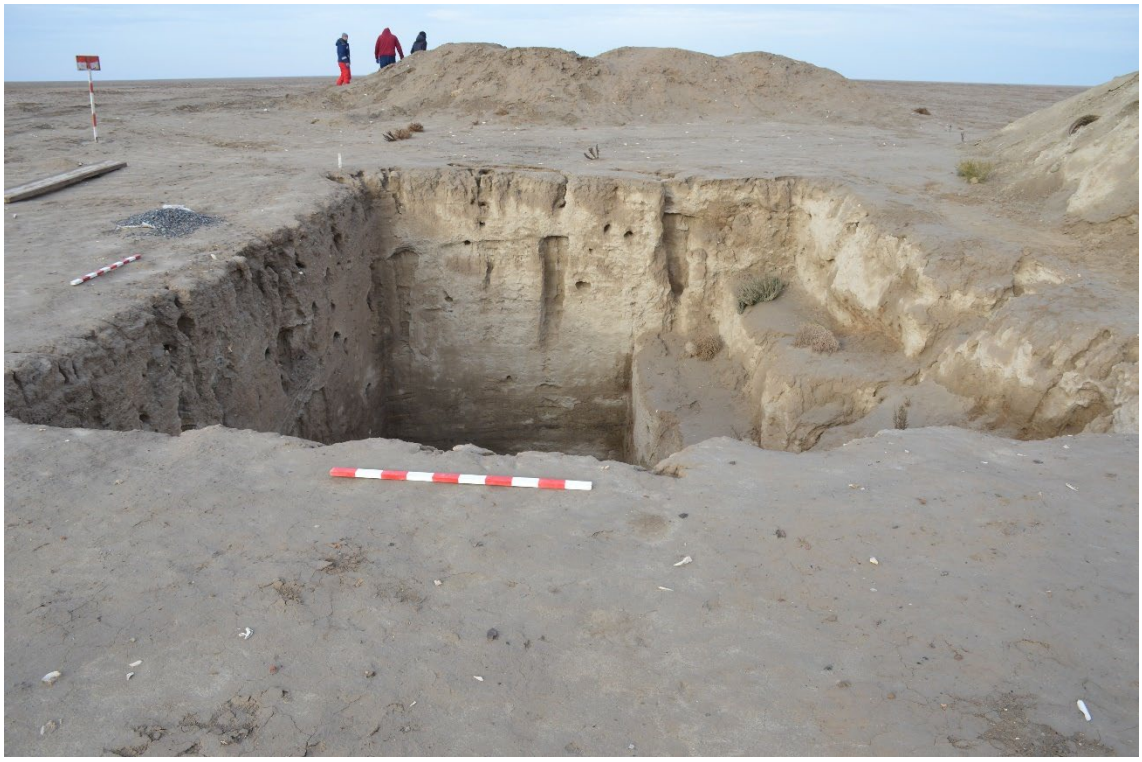

Figure 8. General view of the excavation prior to the commencement of work. View to the west.

Figure 9. Excavation cleaning process. Work in progress.

Figure 10. Excavation cleaning process. Work in progress.

Figure 11. Excavation cleaning process. 2023 level – El. 109. Work in progress.

Figure 12. Excavation cleaning process. 2023 level – El. 109. View to the west.

Figure 13 – Fragment of sand-covered blocks in Layer 11. View to the north.

Figure 14 – Fragment of sand-covered blocks in Layer 11. Documentation in progress.

Figure 15 – Sandy Layer 30 in the southeastern corner of the excavation. After surface cleaning.

Figure 16 – Pit in the sandy Layer 30 in the southeastern corner of the excavation. After cleaning.

Figure 17 – Depression in the lower part of Layer 12, filled with burnt reed and ash. After cleaning.

Figure 18. Depression in the lower part of Layer 12 in section, filled with burnt reed and ash. After cleaning. Below lies natural soil Layer 38.

Figure 19. General view of the excavation after removal of Layer 12. Top of natural soil Layer 38.

Figure 20. Stratigraphic documentation in progress.

Figure 21. Sample 1 for radiocarbon dating: lower level of Layer 12 in the northwest corner of the excavation.

Figure 22. Natural soil layer in the central part of the excavation at the northern edge.

Figure 23. Sample No. 2 for radiocarbon dating: lower level of Layer No. 12 in the eastern profile of the excavation. Located above sand Layer No. 30.

Figure 24. Lower part of the western profile at the level of the natural soil.

Figure 25. Lower part of the eastern profile at the level of the natural soil.

Figure 26. Sampling process for radiocarbon dating.

Figure 27. General view of the excavation. View to the north.

Figure 28. Installation of fencing around the excavation after completion of work.

Appendix – Drawing Documentation

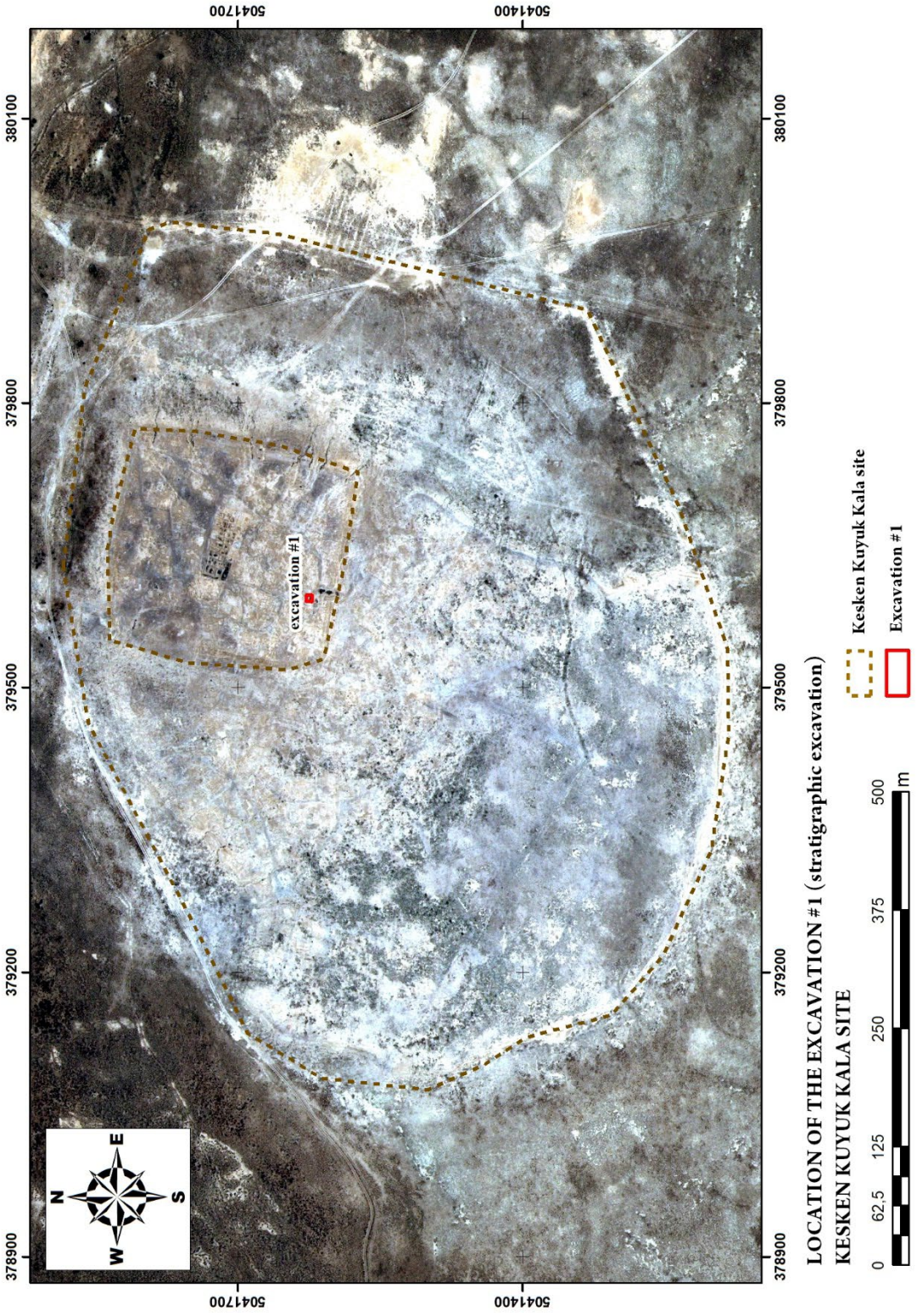

Figure 1 - Scheme of excavation location

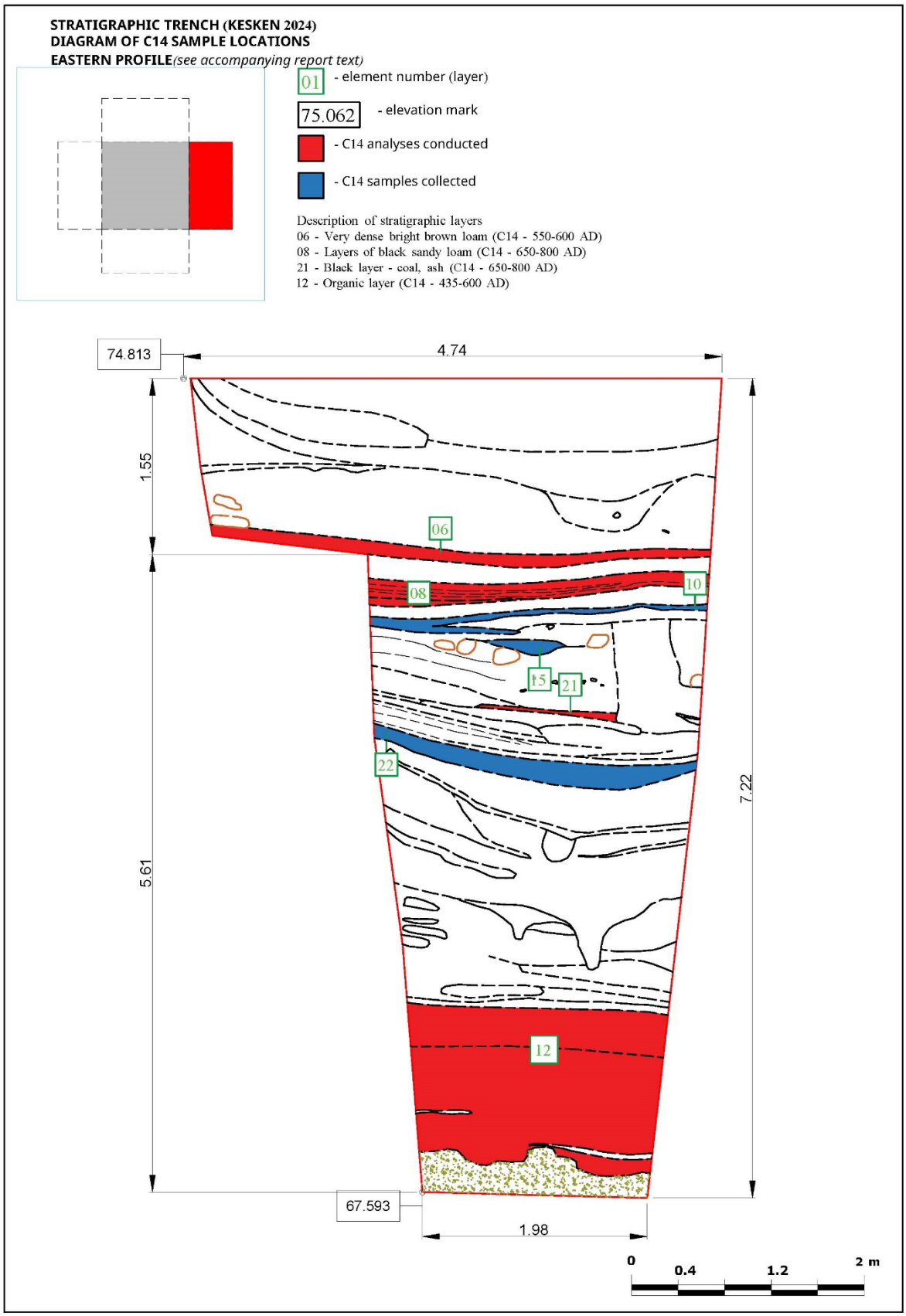

Figure 2 - Eastern profile. Scheme of sample location for radiocarbon dating

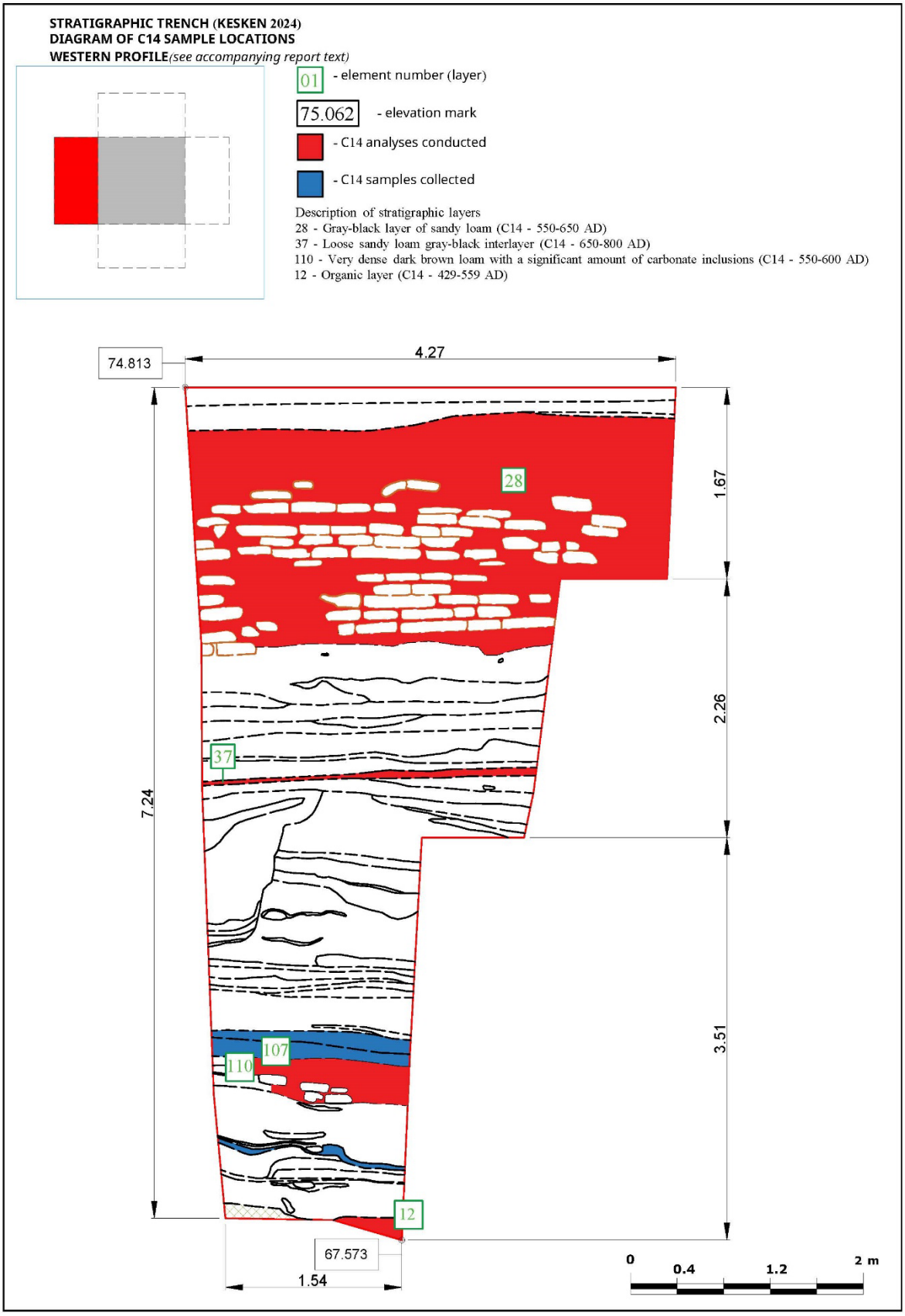

Figure 3 - Western profile. Scheme of sample location for radiocarbon dating

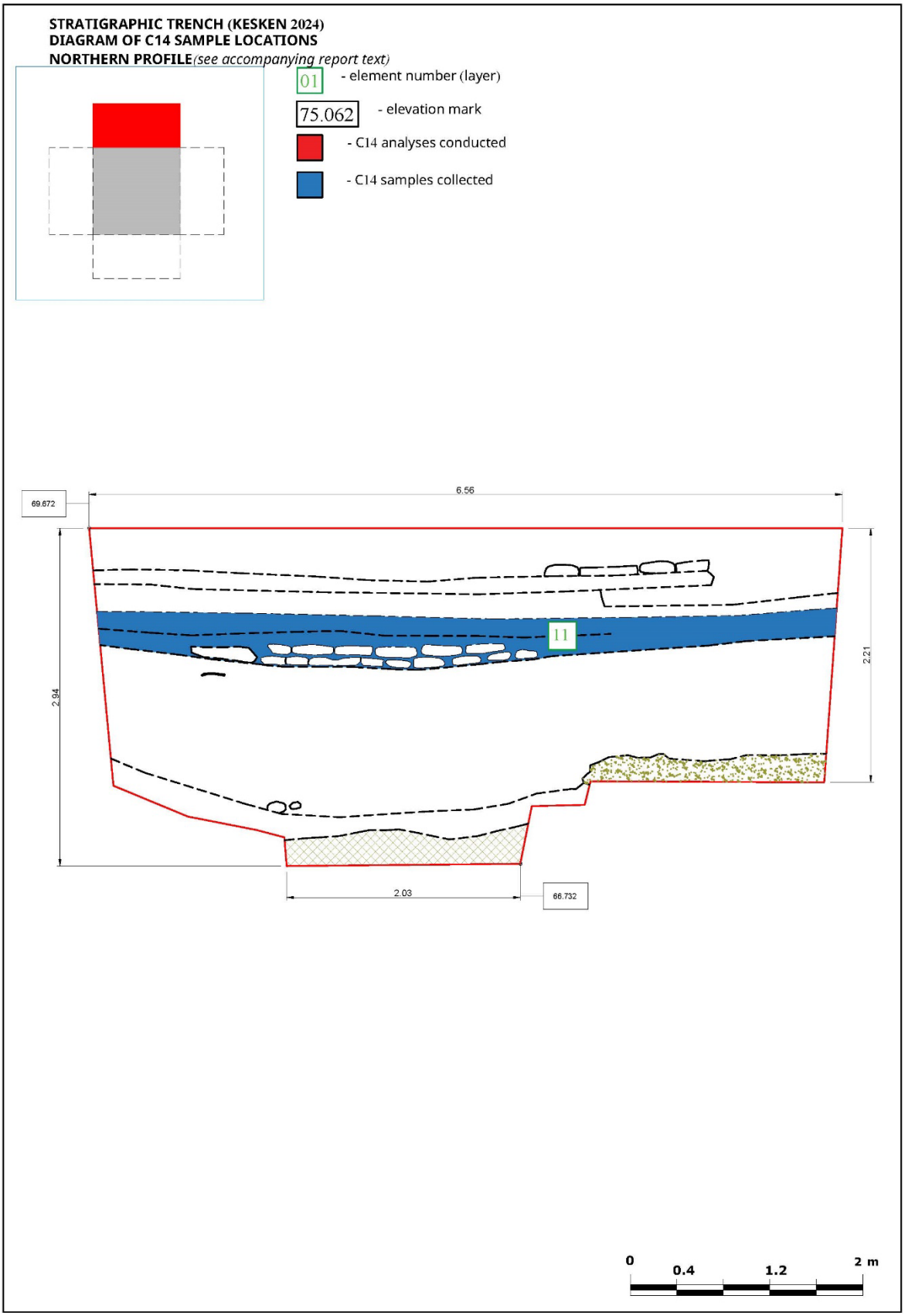

Figure 4 - Northern profile. Scheme of sample location for radiocarbon dating

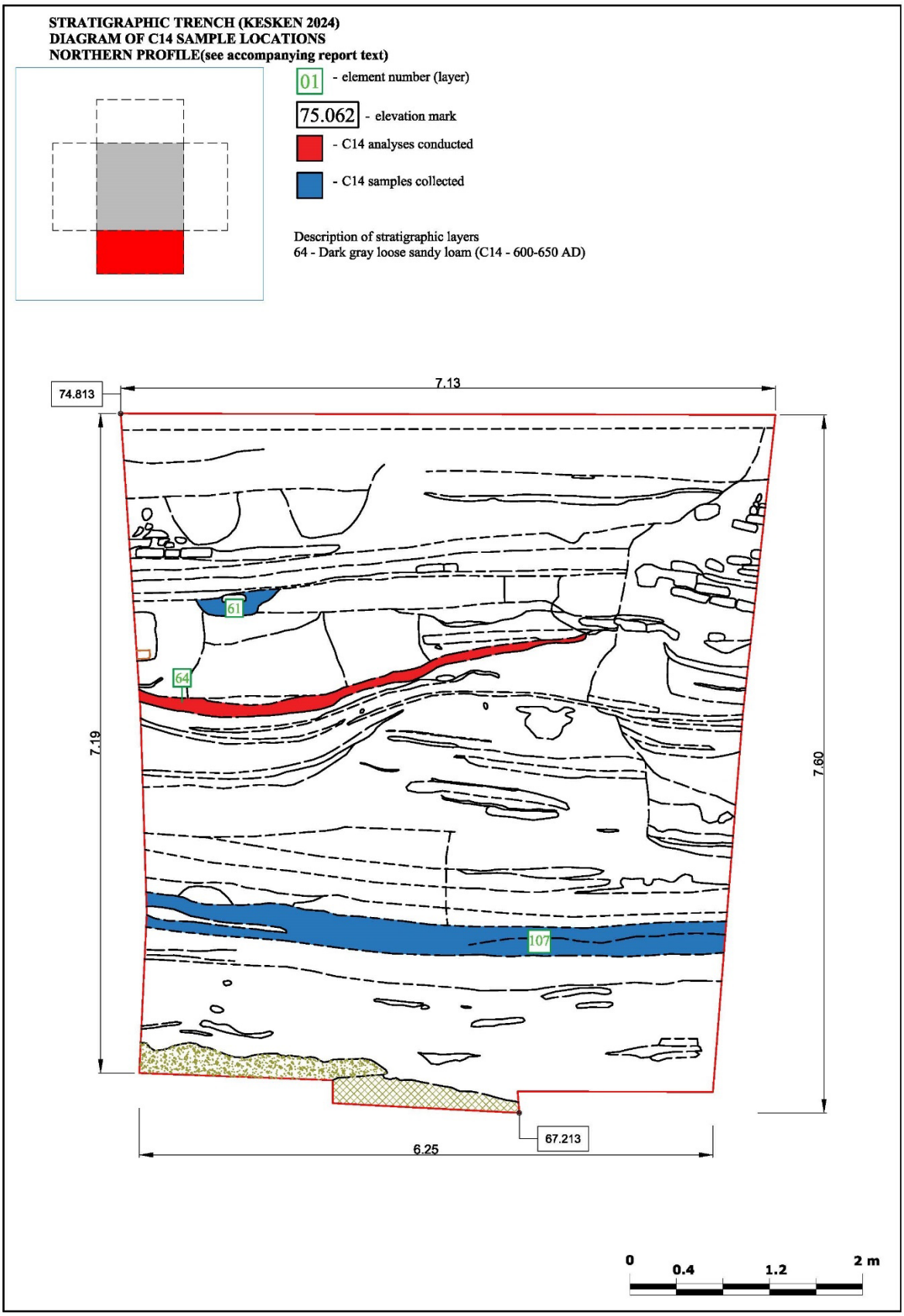

Figure 5 - Southern profile. Scheme of sample location for radiocarbon dating

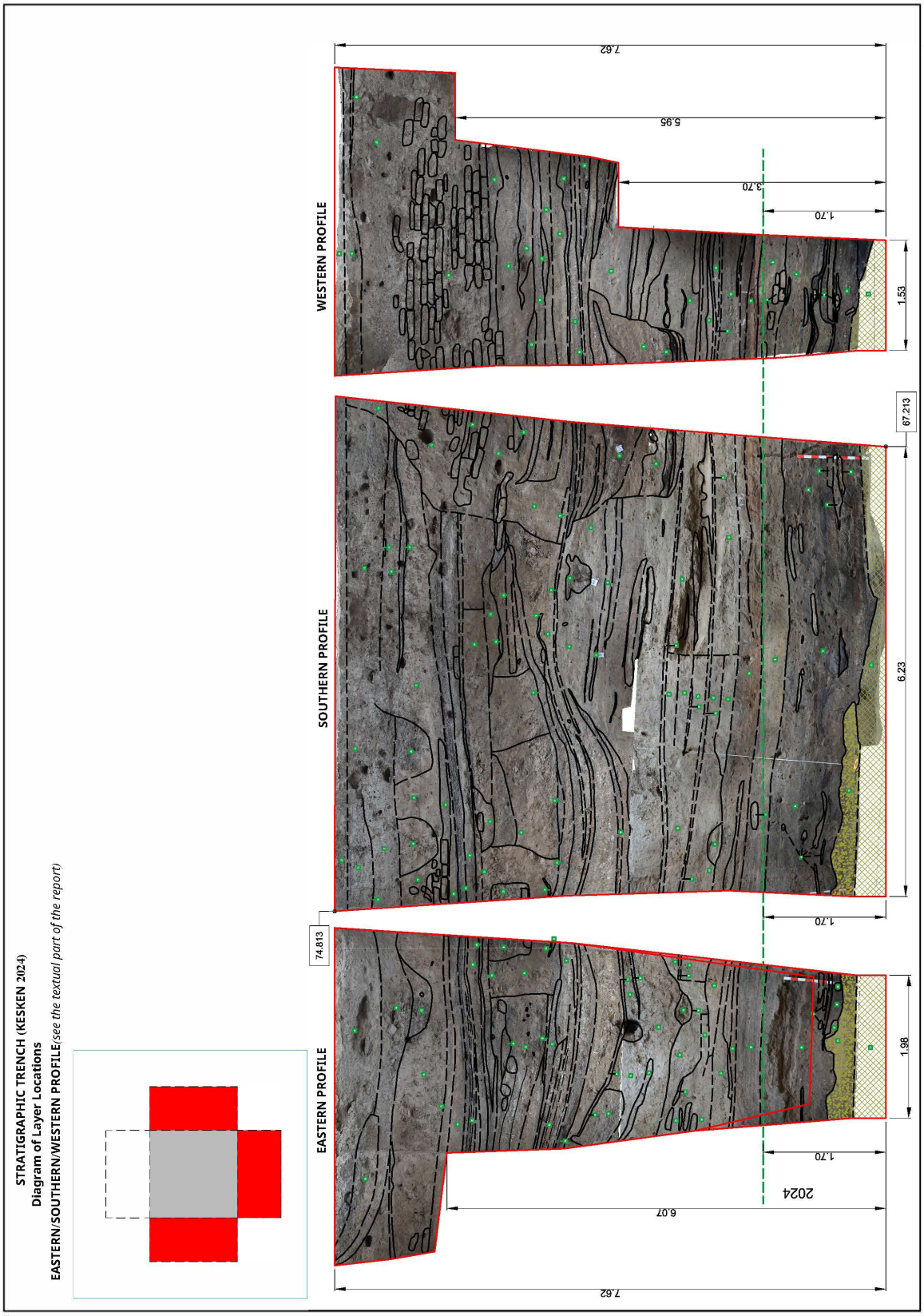

Figure 6 - General scheme of eastern, southern, western profiles

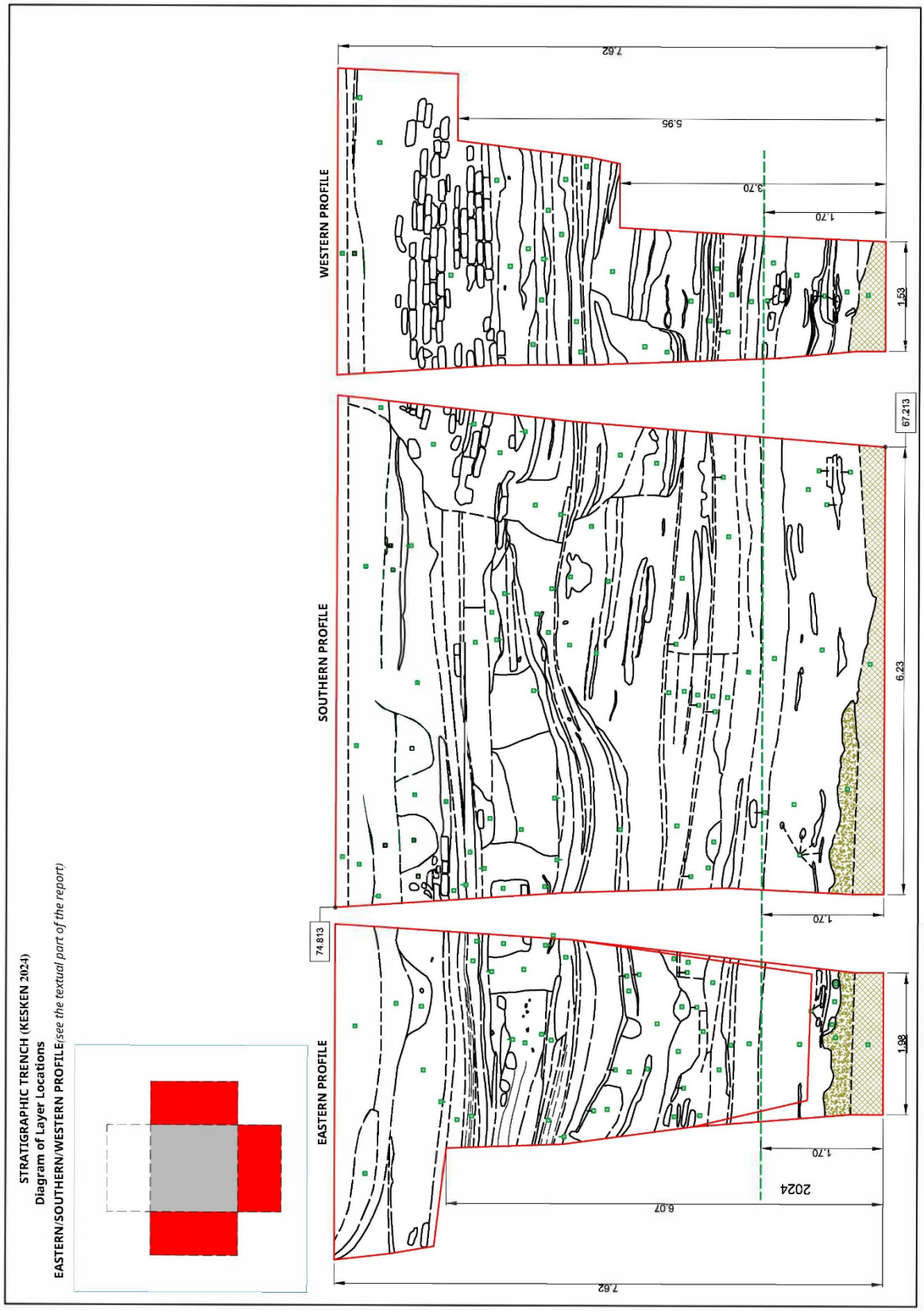

Figure 7 - General scheme of eastern, southern, western profiles

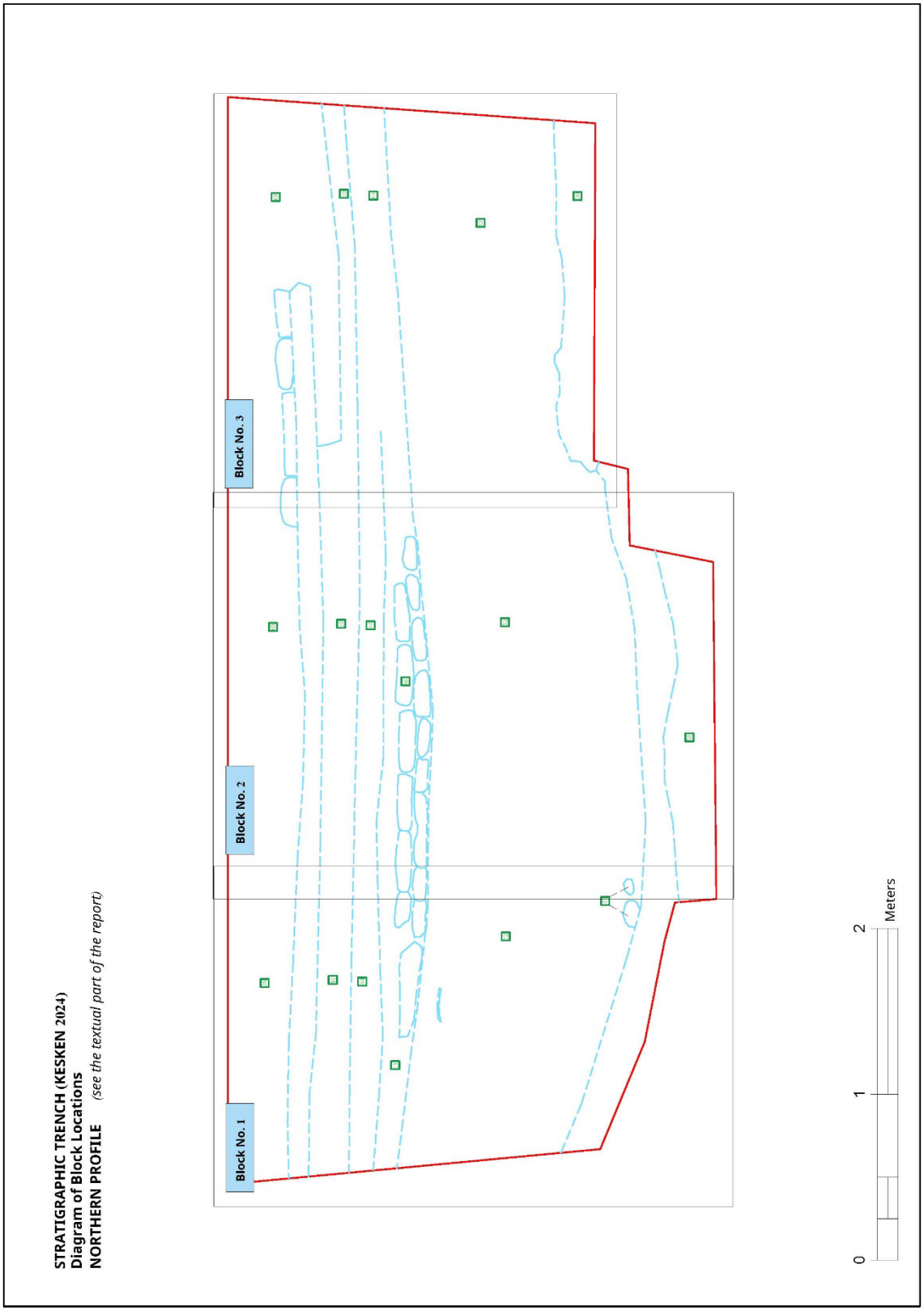

Figure 8 - Northern profile - general scheme

Figure 9 - Northern profile - block No.1

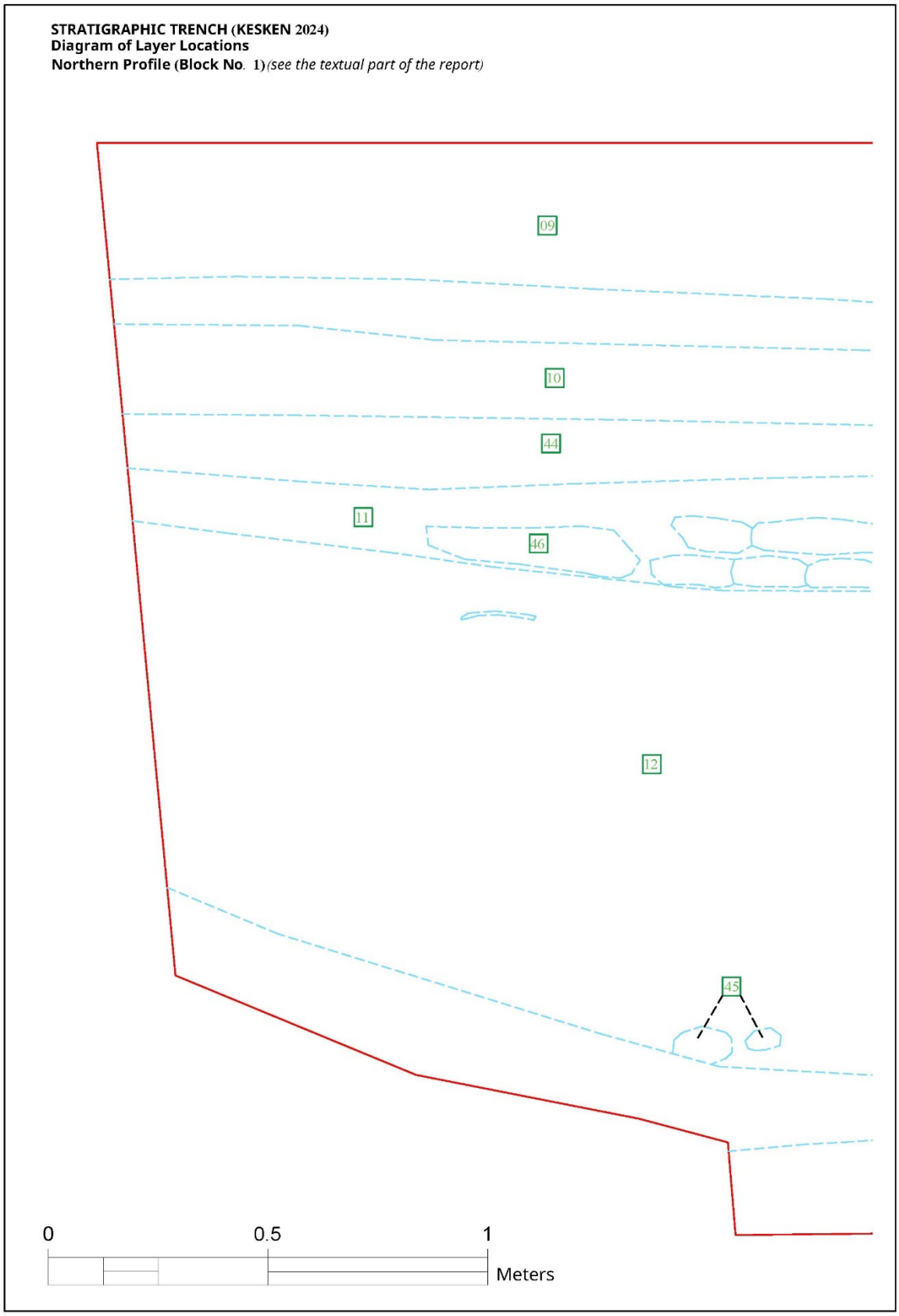

Figure 10 - Northern profile - block No.1

STRATIGRAPHIC TRENCH (KESKEN 2024)
Diagram of Layer Locations
NORTHERN PROFILE (Block No. 2) *(see the textual section of the report)*

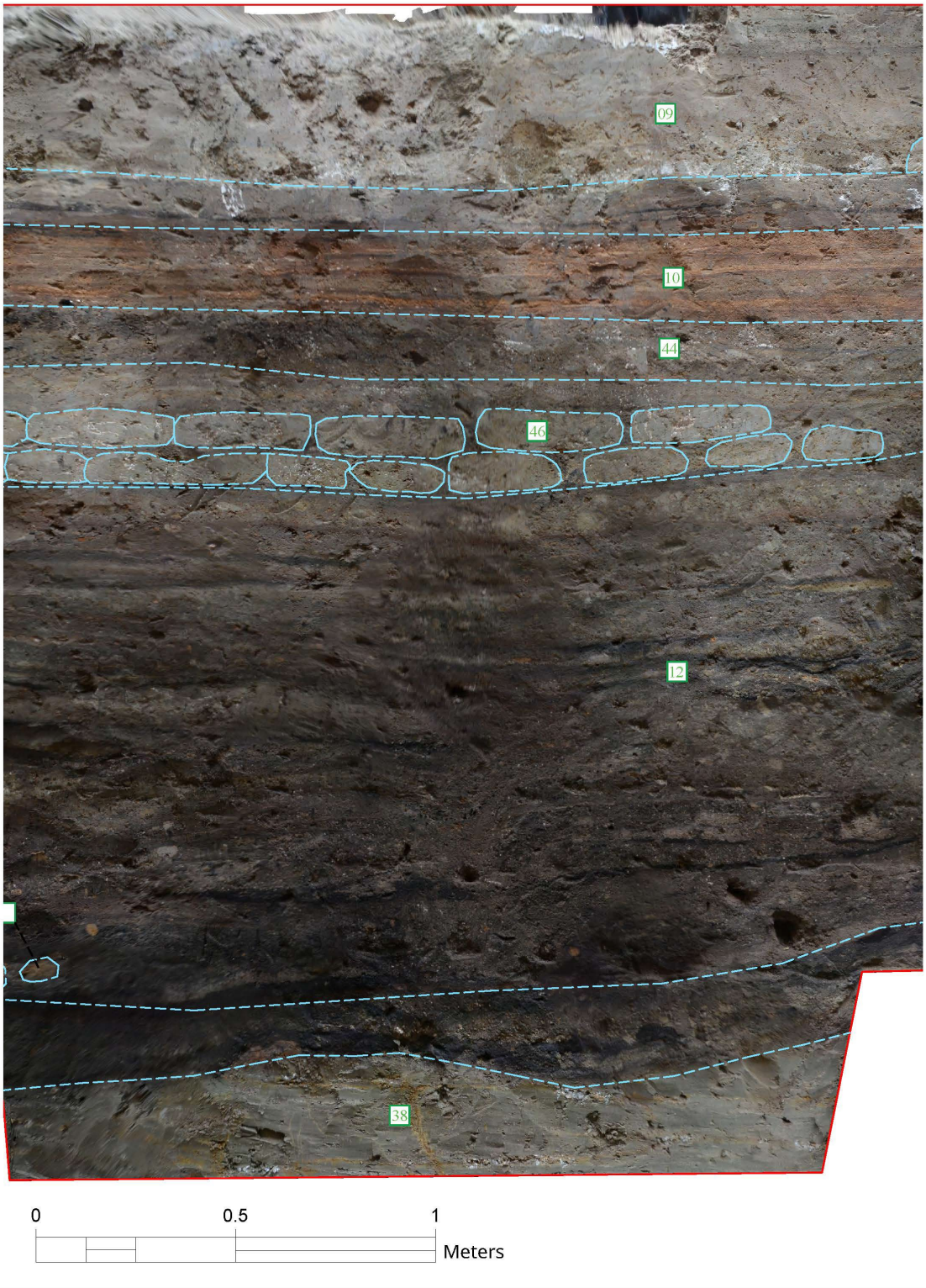

Figure 11 - Northern profile - block No.2

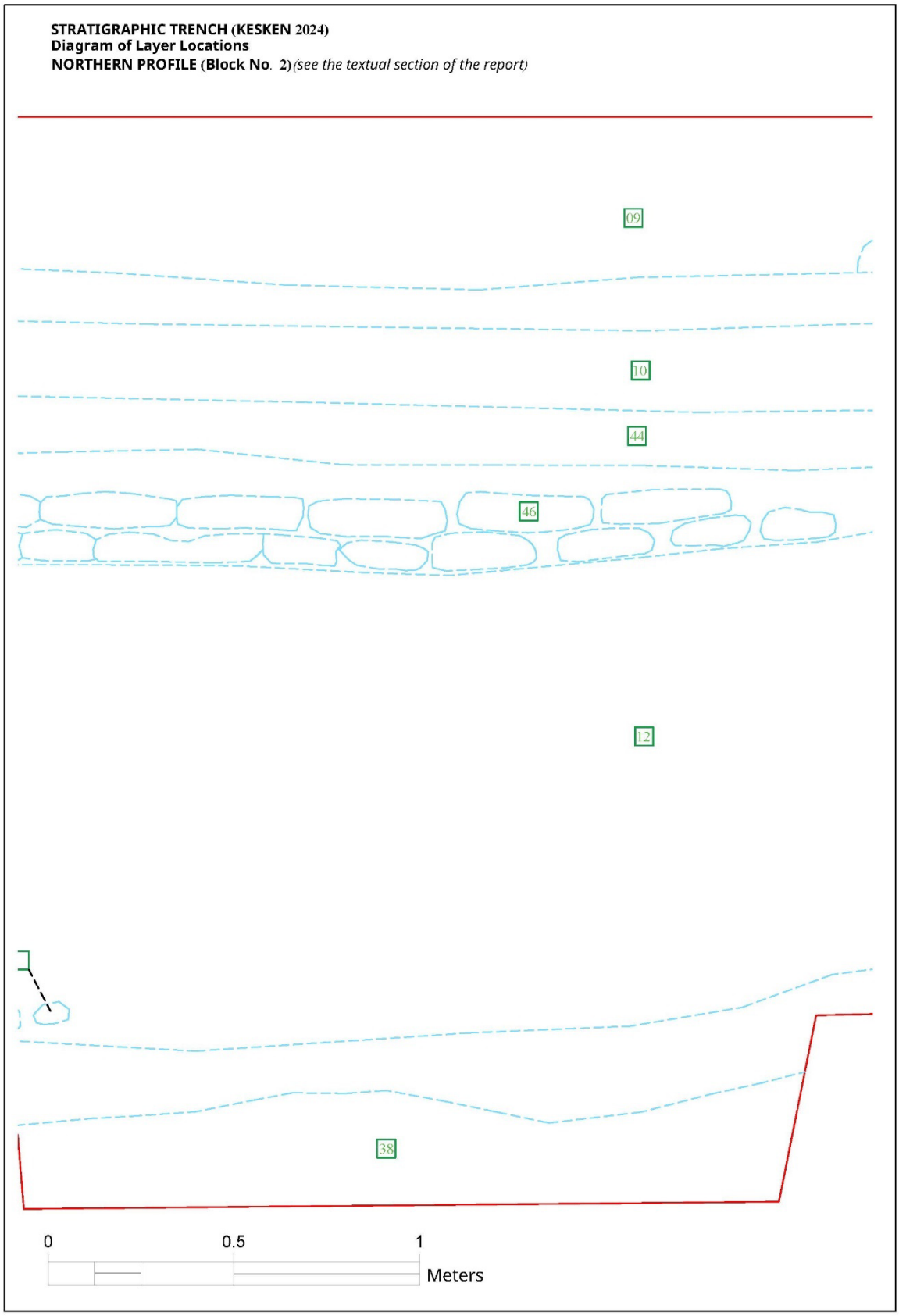

Figure 12 - Northern profile - block No.2

Figure 13 - Northern profile - block No.3

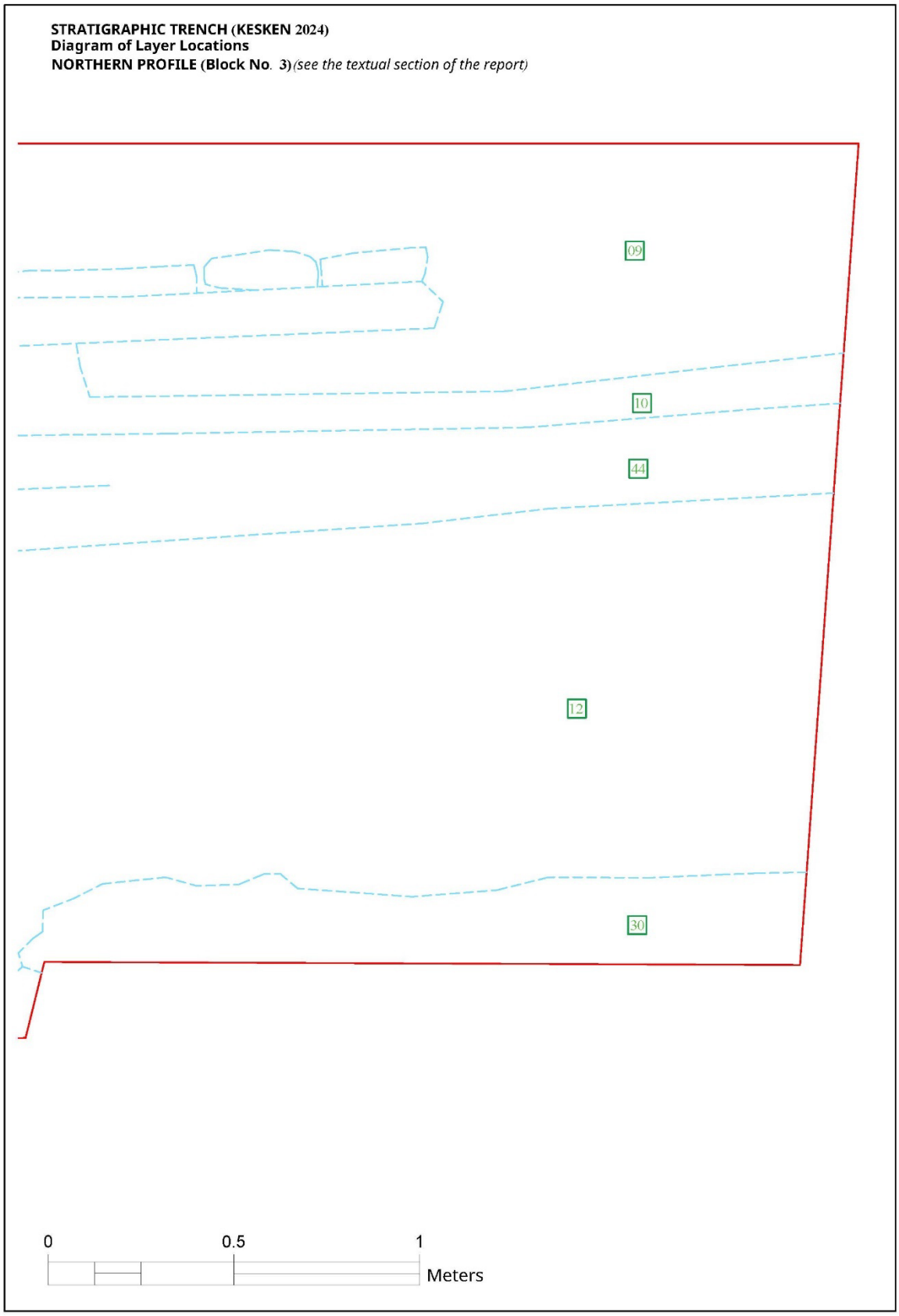

Figure 14 - Northern profile - block No.3

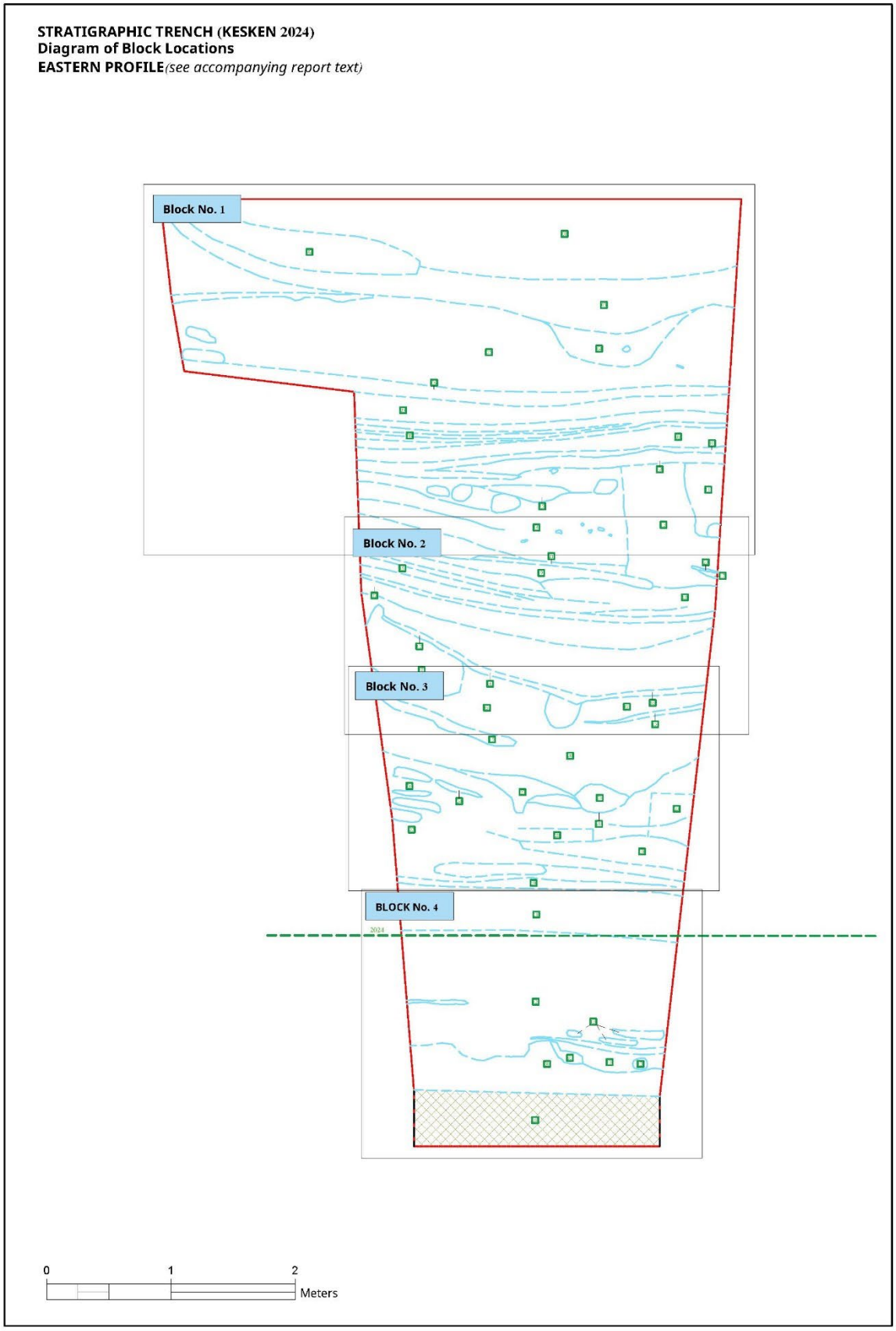

Figure 15 - Eastern profile - general scheme

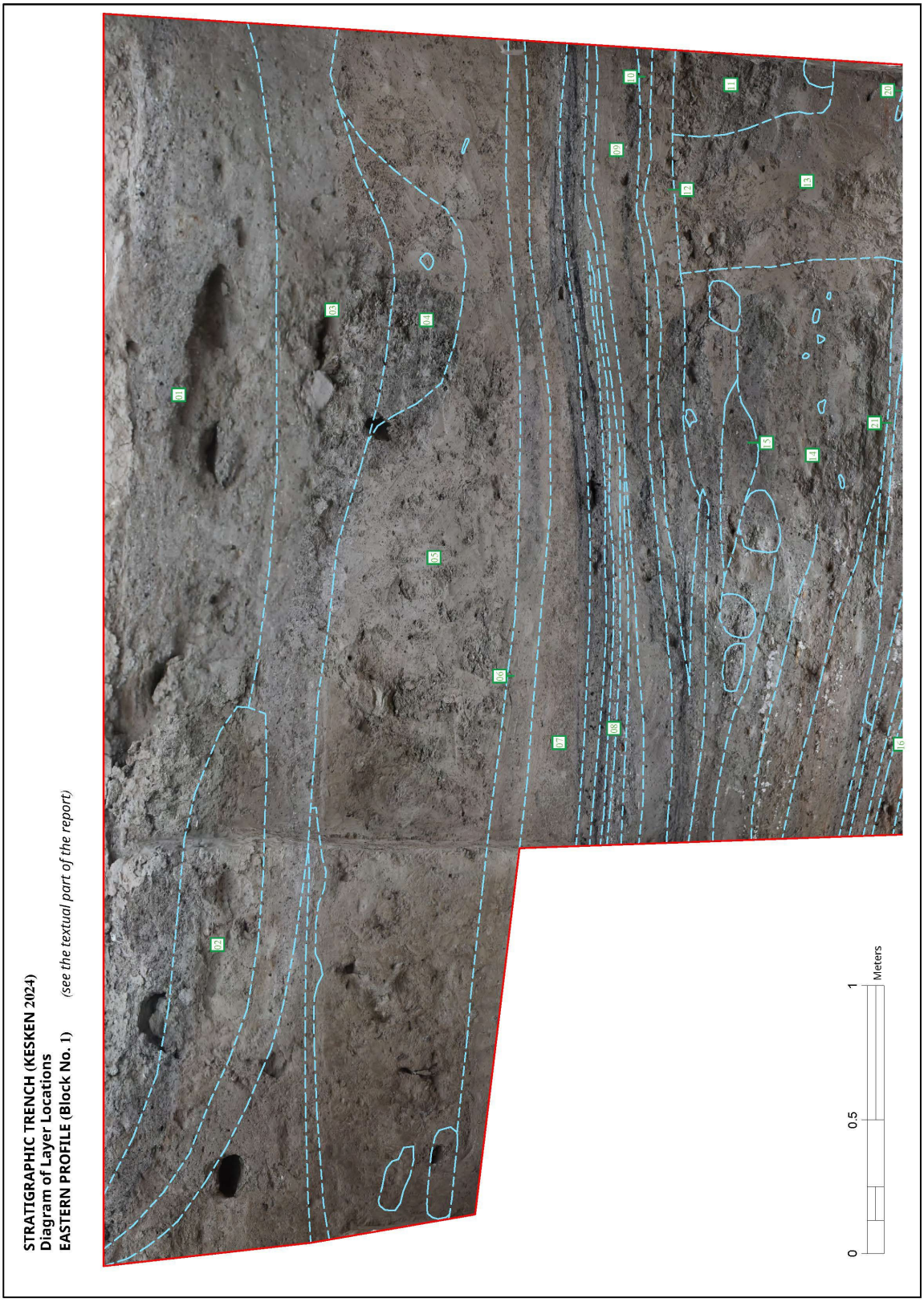

Figure 16 - Eastern profile - block No.1

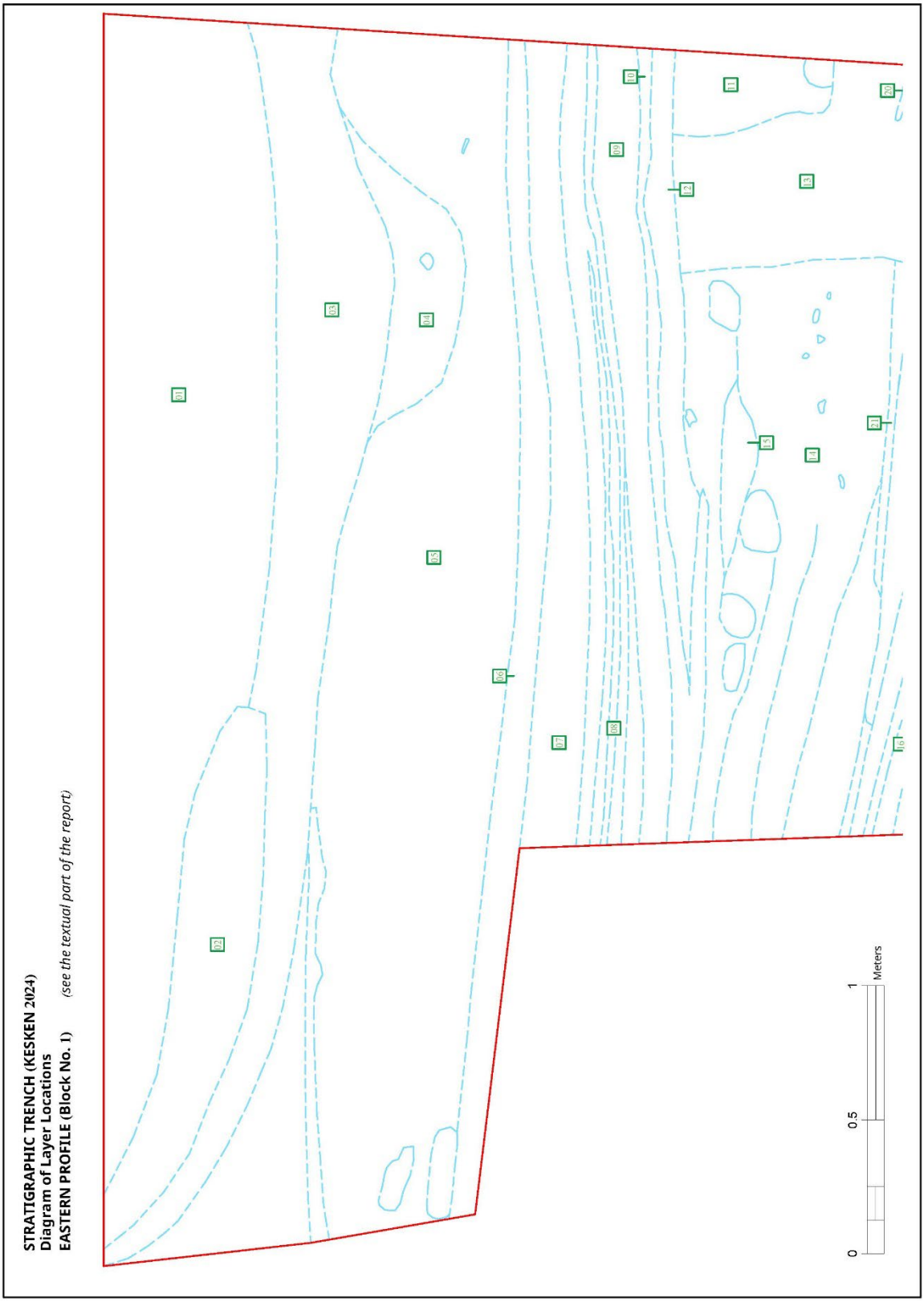

Figure 17 - Eastern profile - block No.1

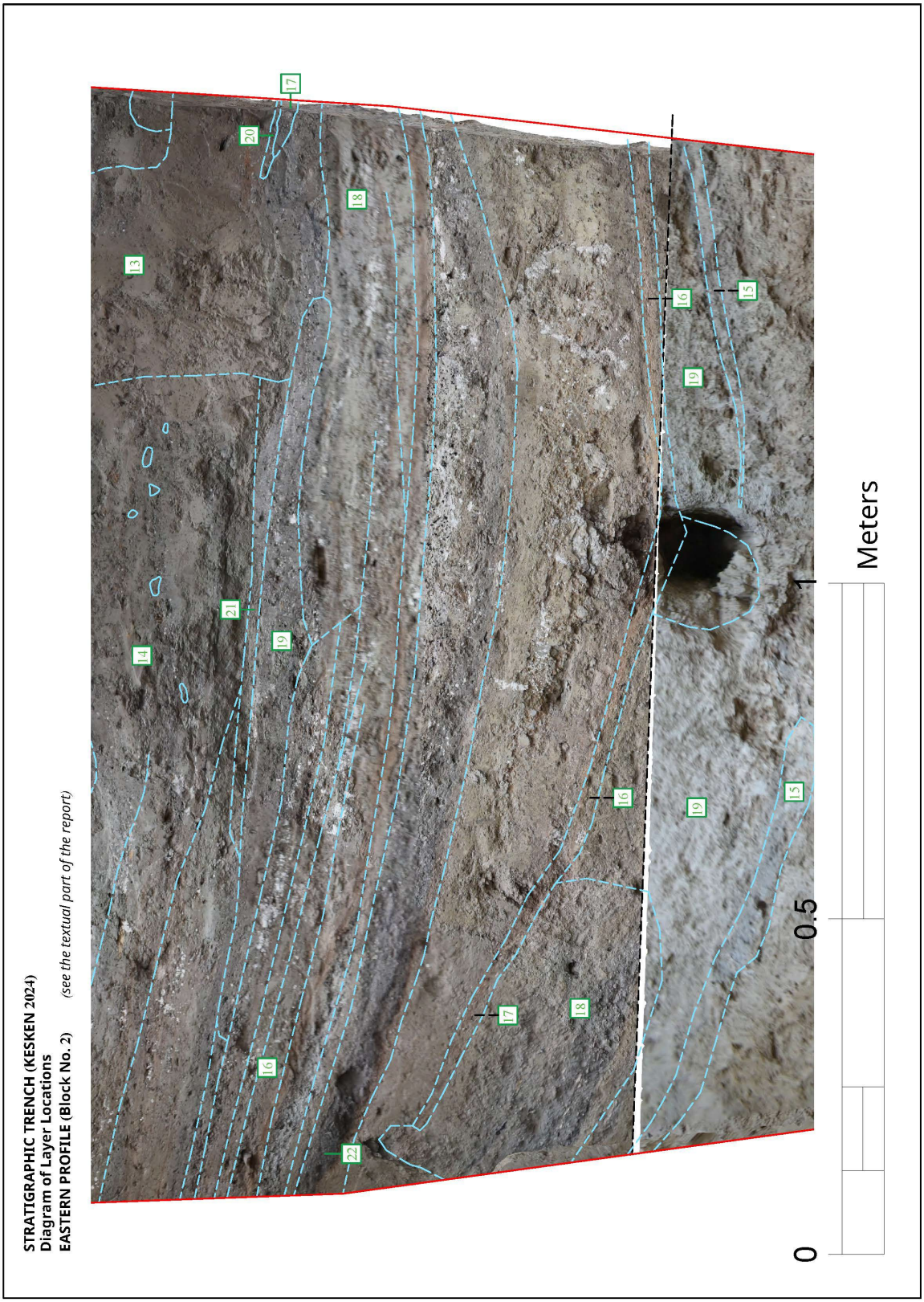

Figure 18 - Eastern profile - block No.2

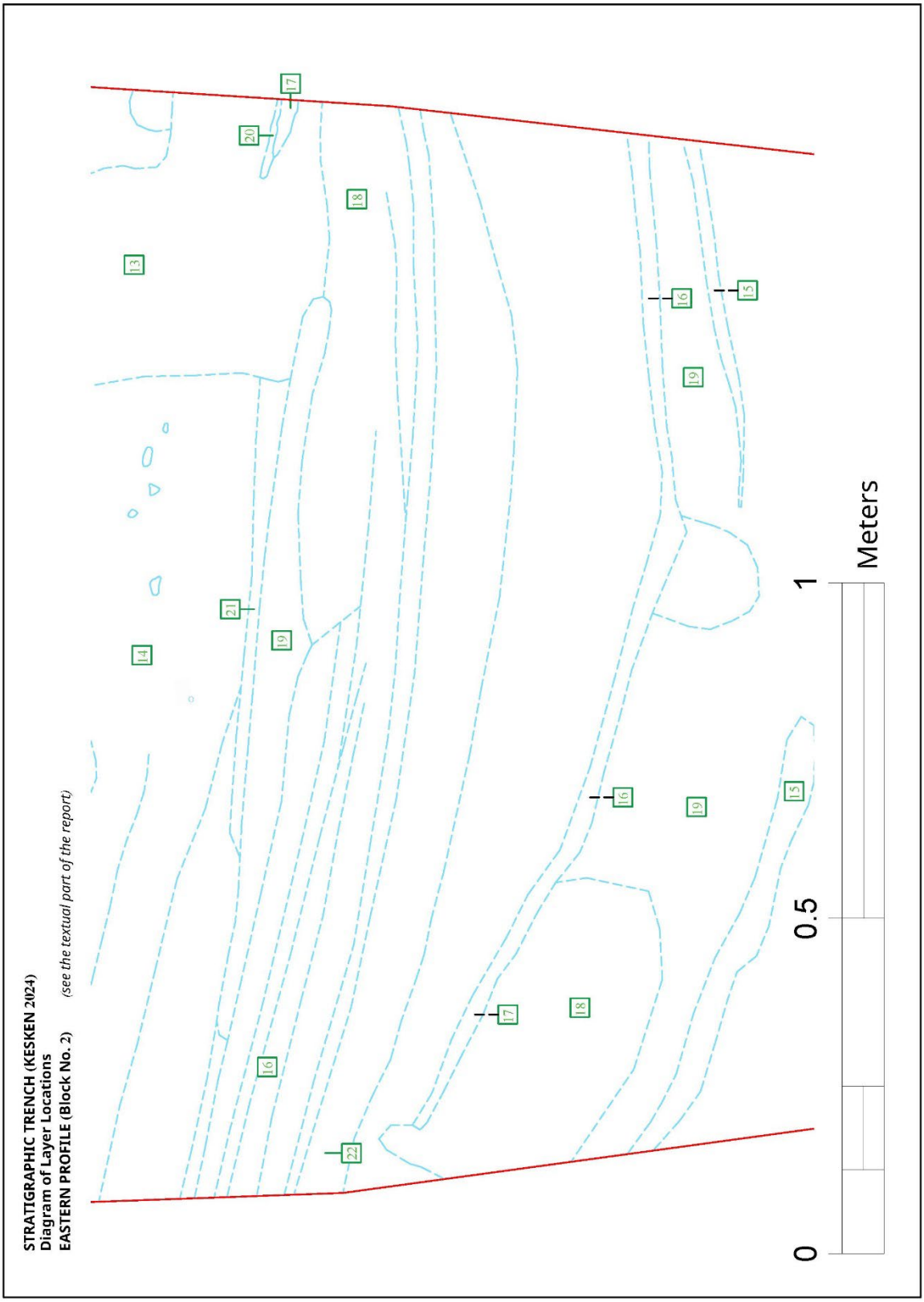

Figure 19 - Eastern profile - block No.2

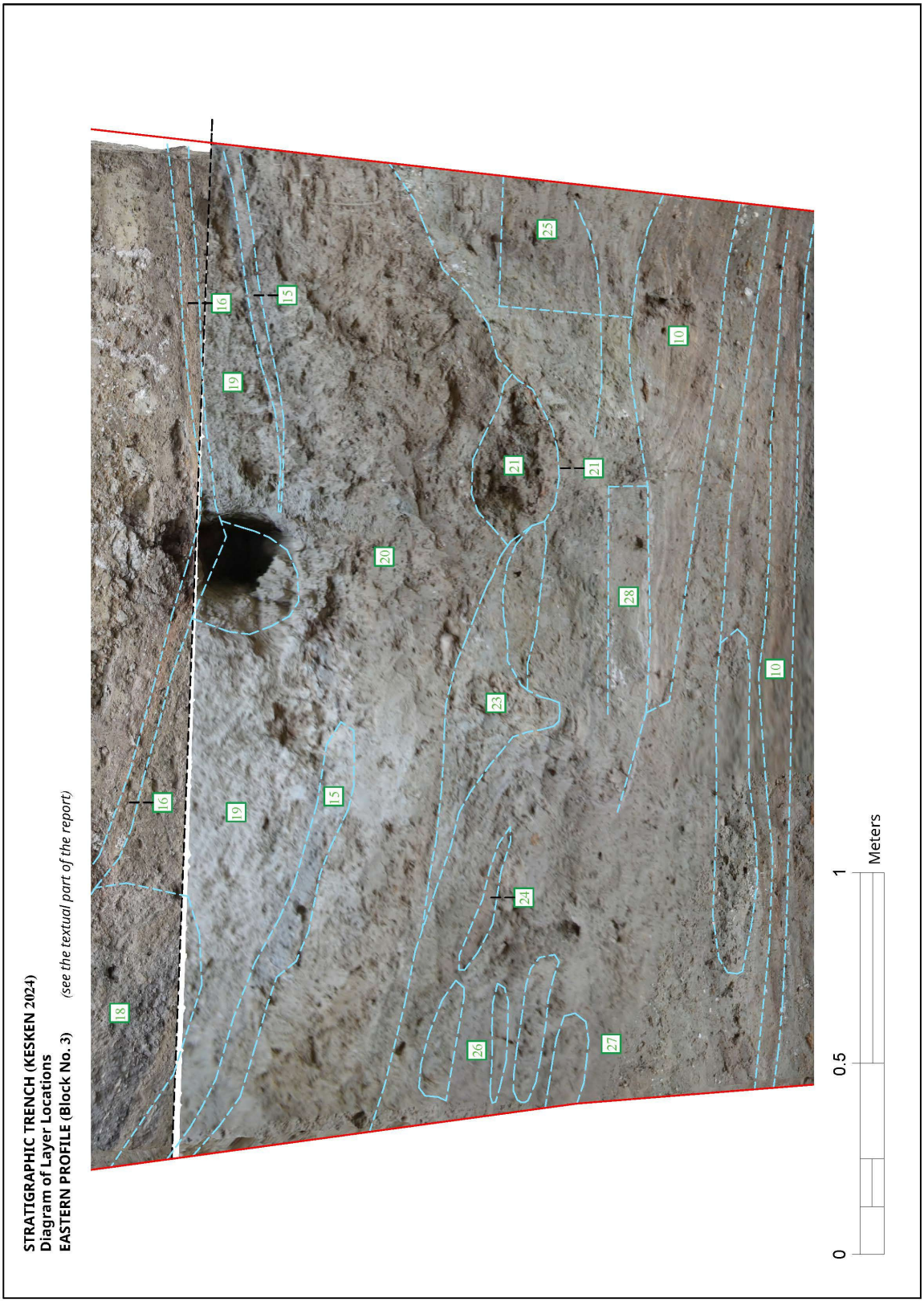

Figure 20 - Eastern profile - block No.3

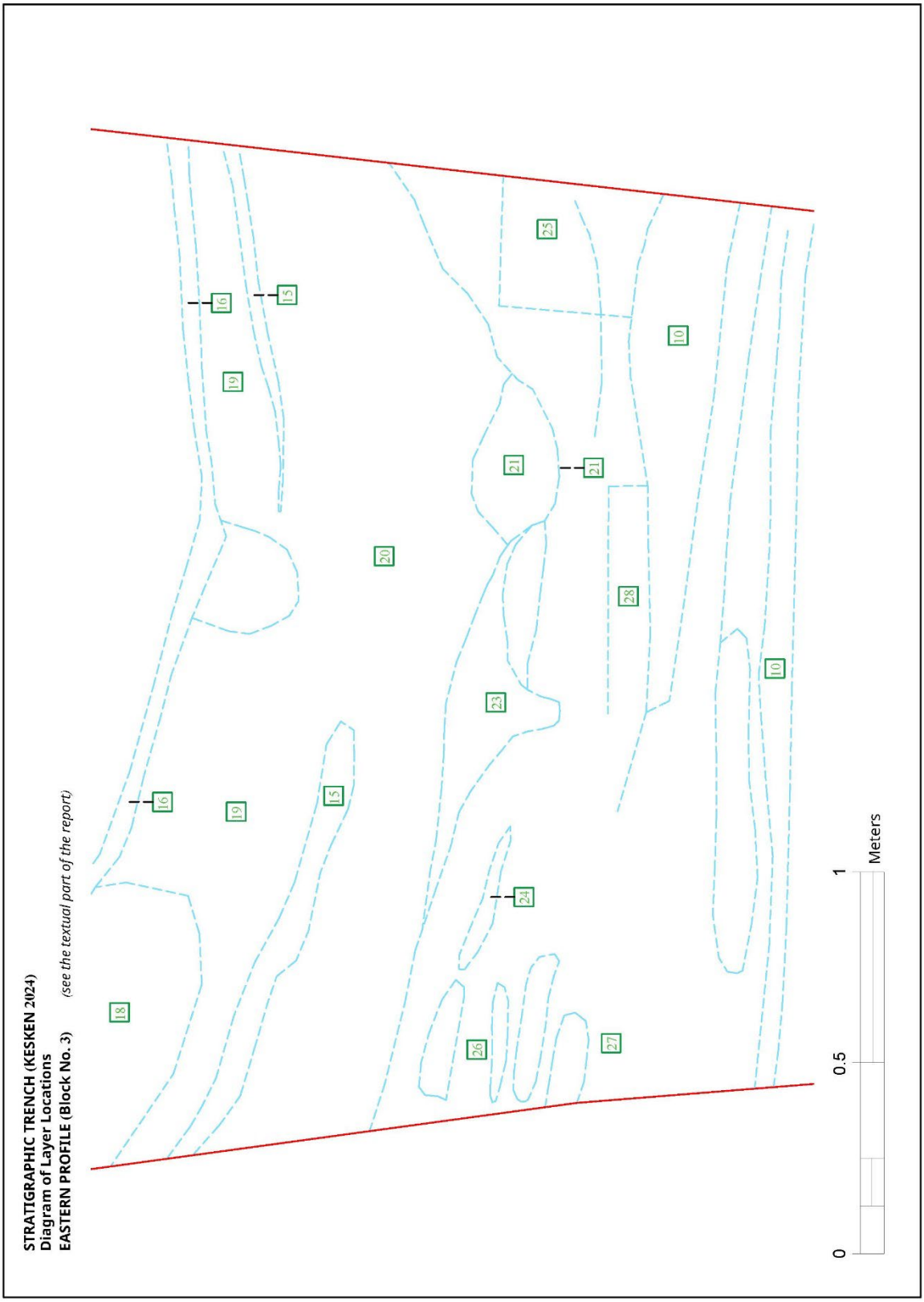

Figure 21 - Eastern profile - block No.3

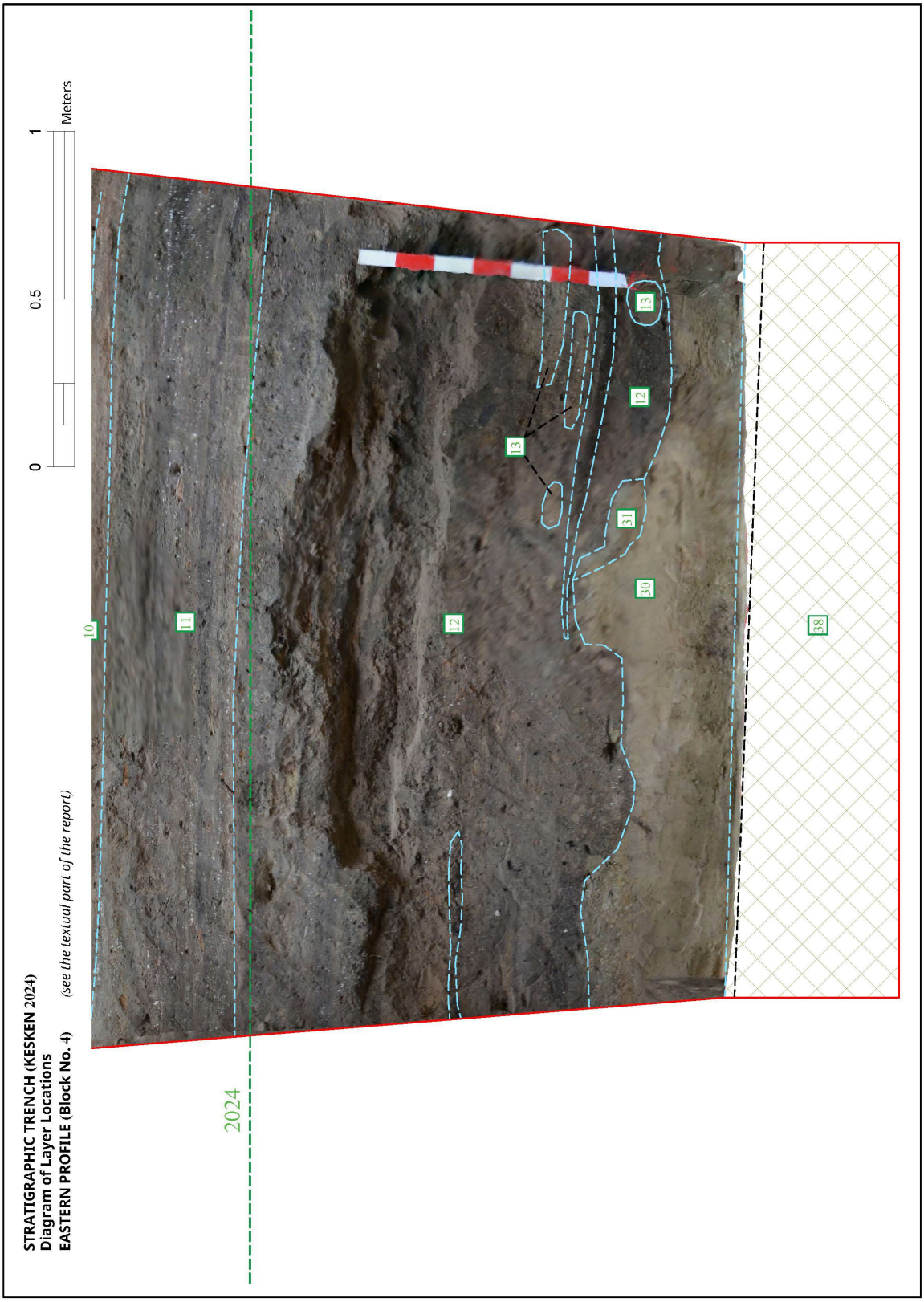

Figure 22 - Eastern profile - block No.4

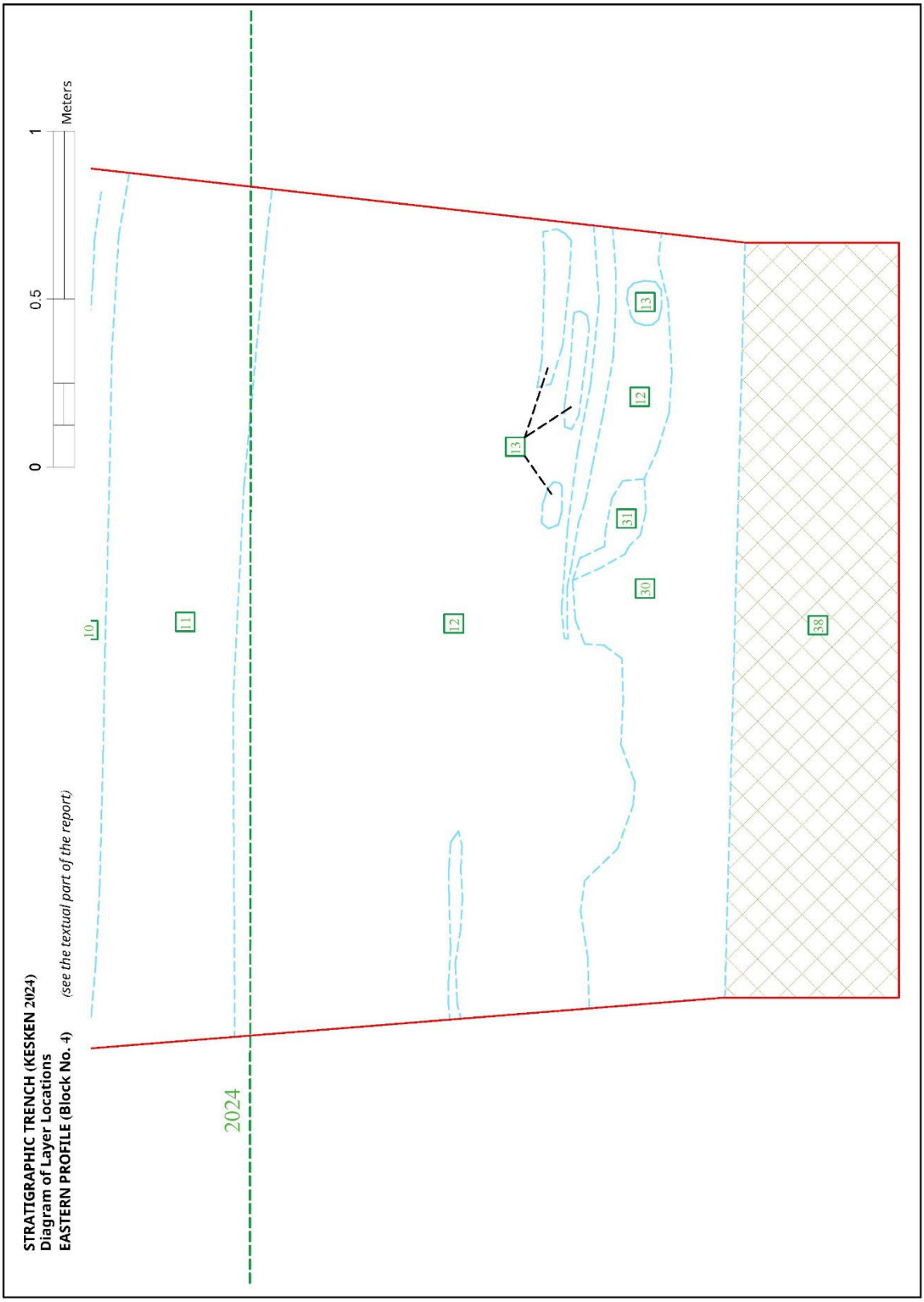

Figure 23 - Eastern profile - block No.4

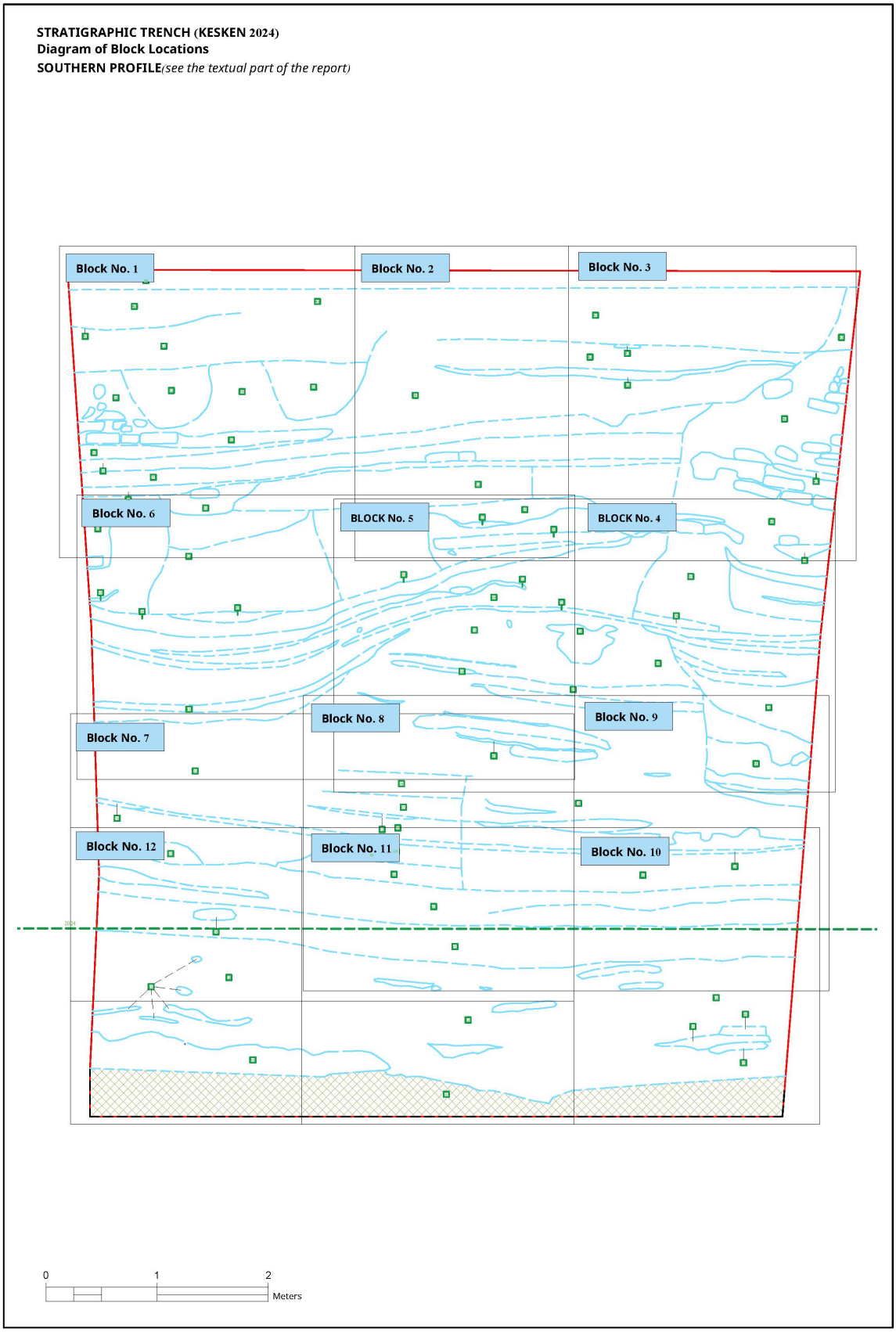

Figure 24 - Southern profile - general scheme

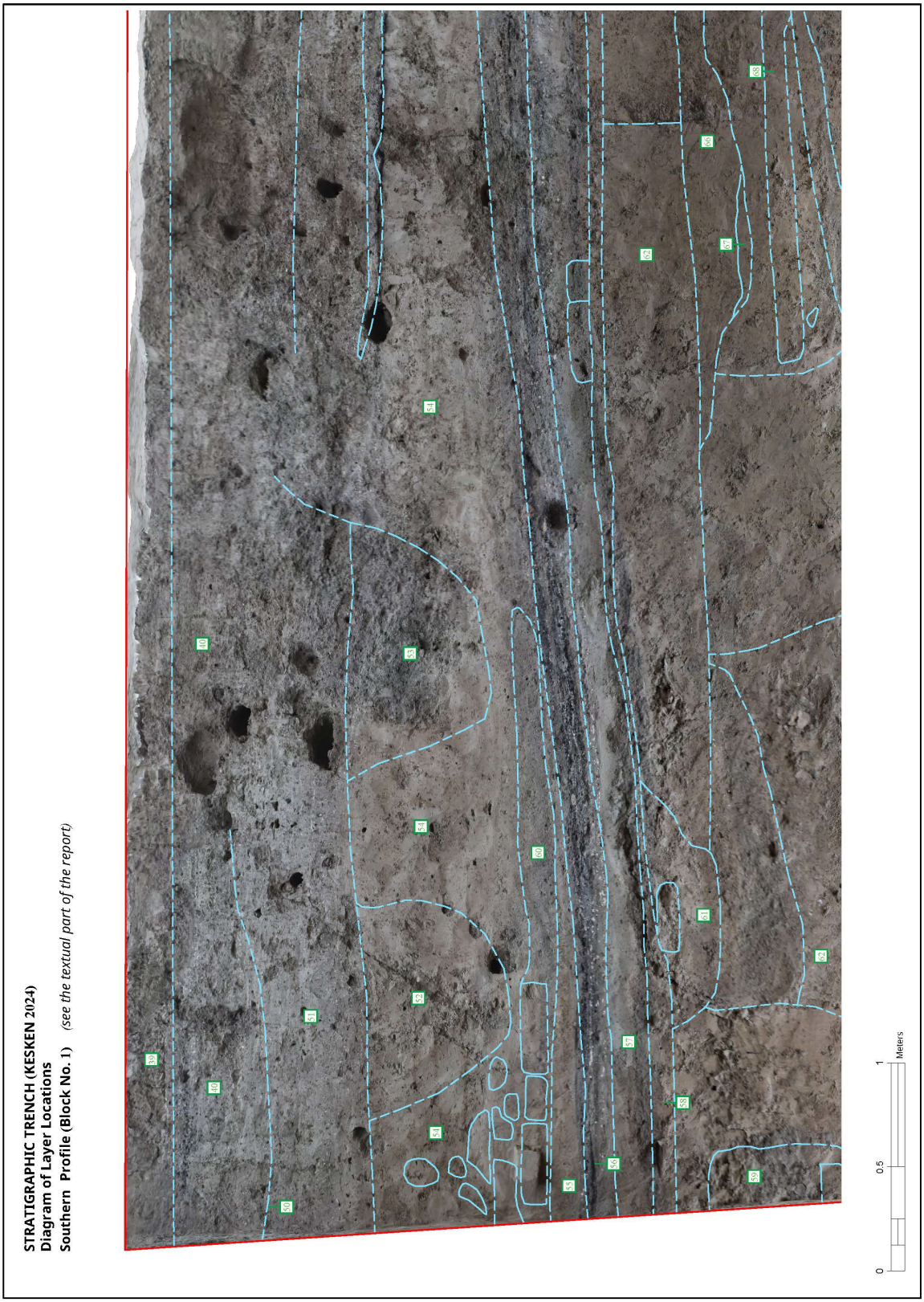

Figure 25 - Southern profile - block No.1

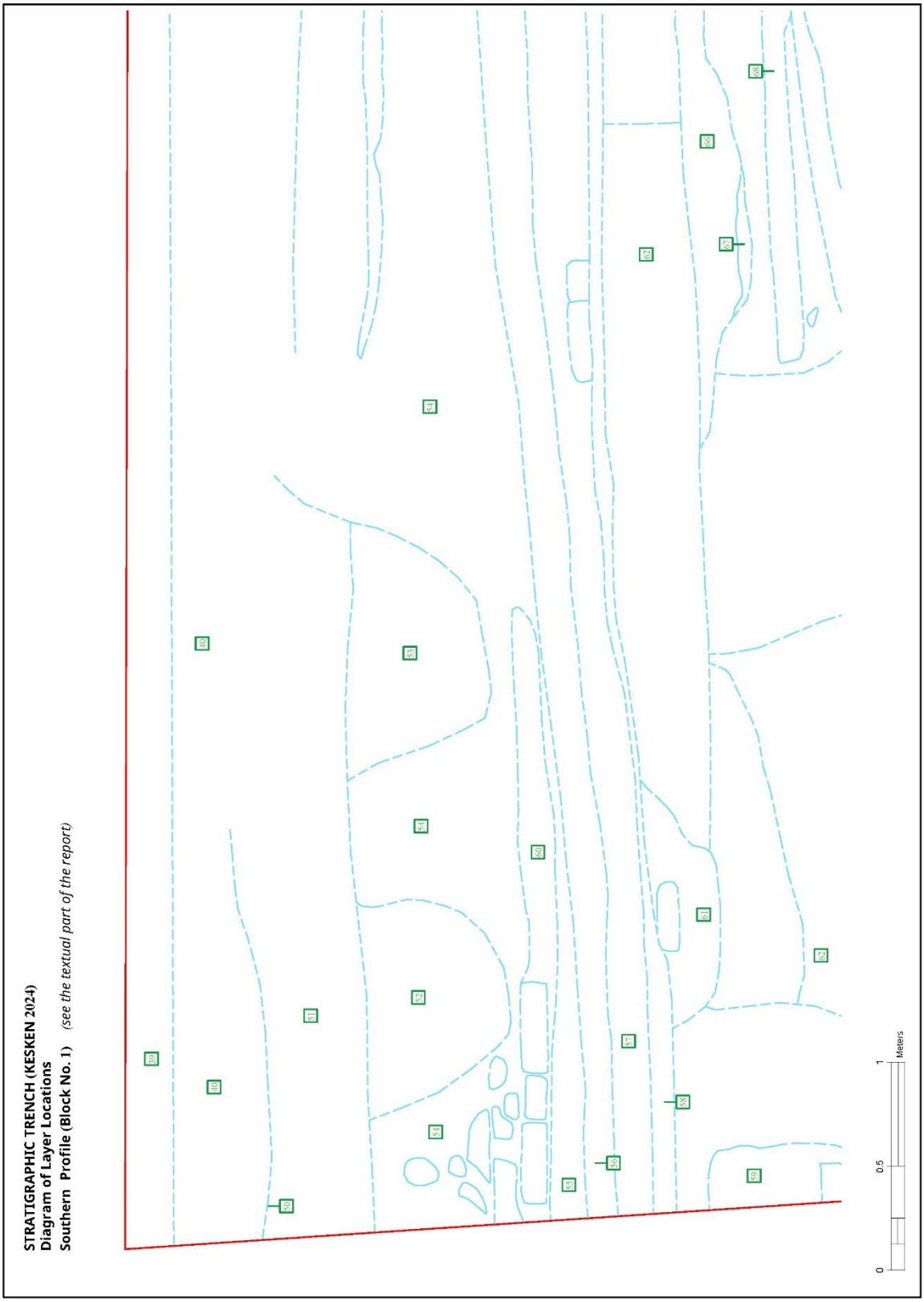

Figure 26 - Southern profile - block No.1

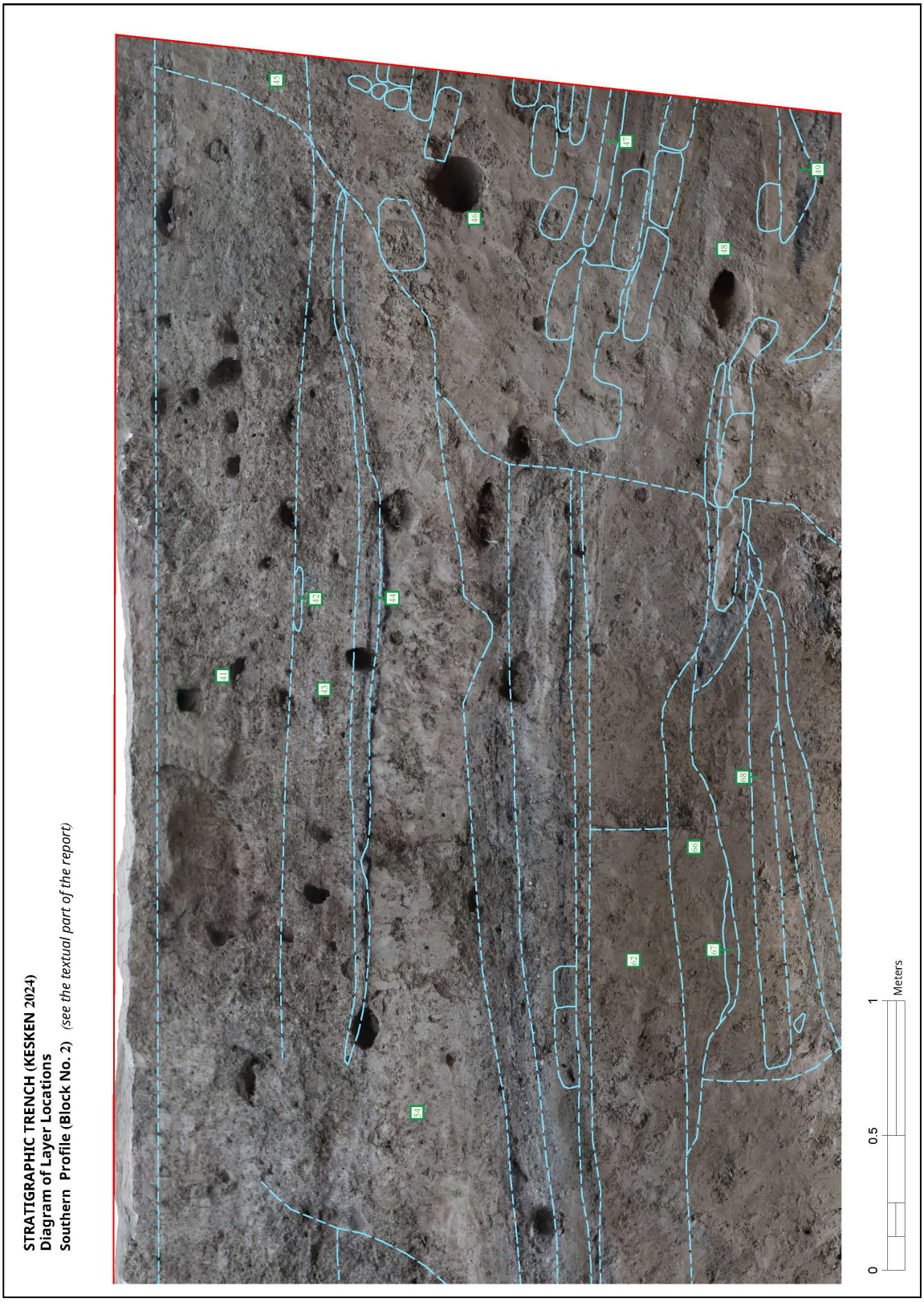

Figure 27 - Southern profile - block No.2

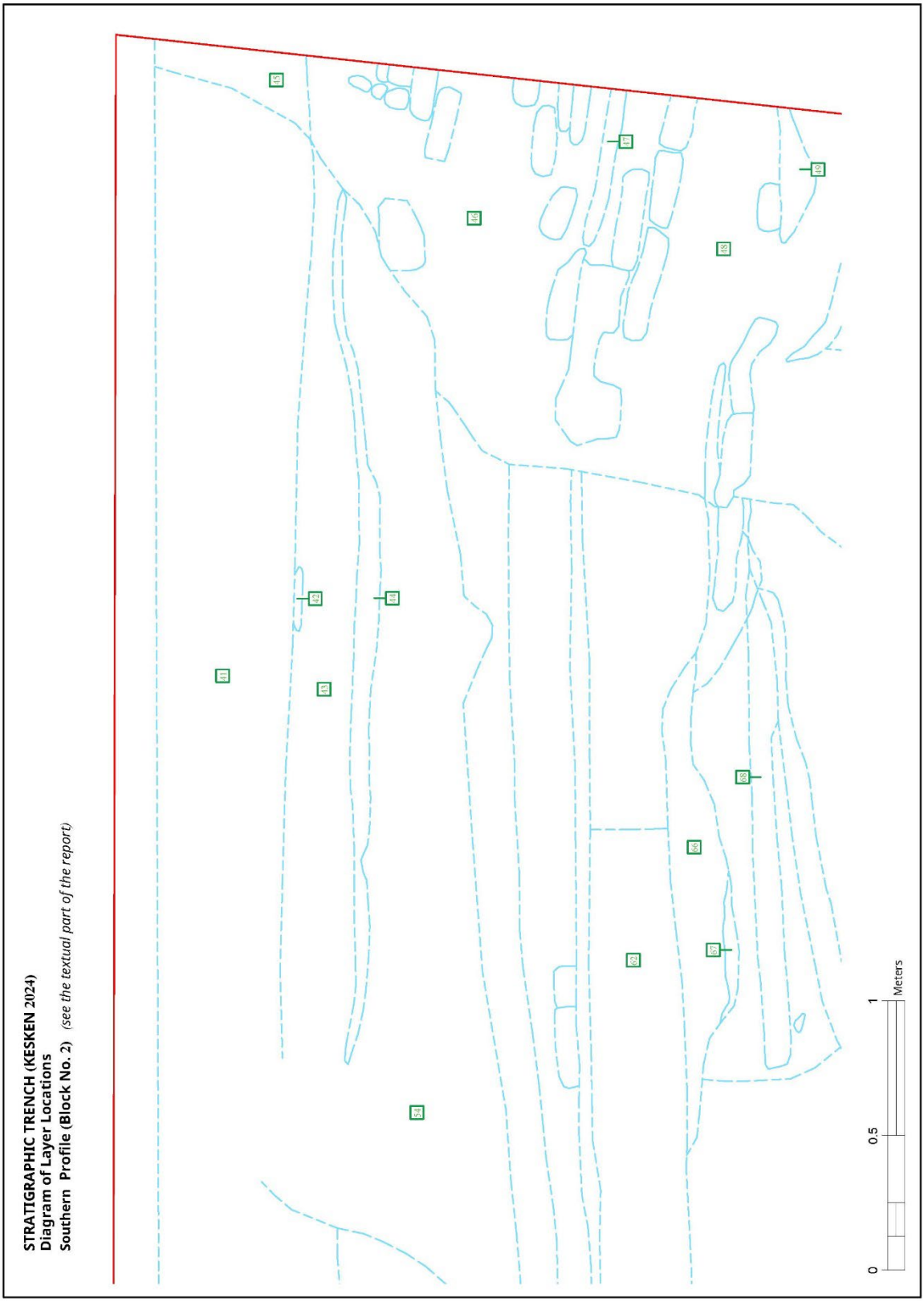

Figure 28 - Southern profile - block No.2

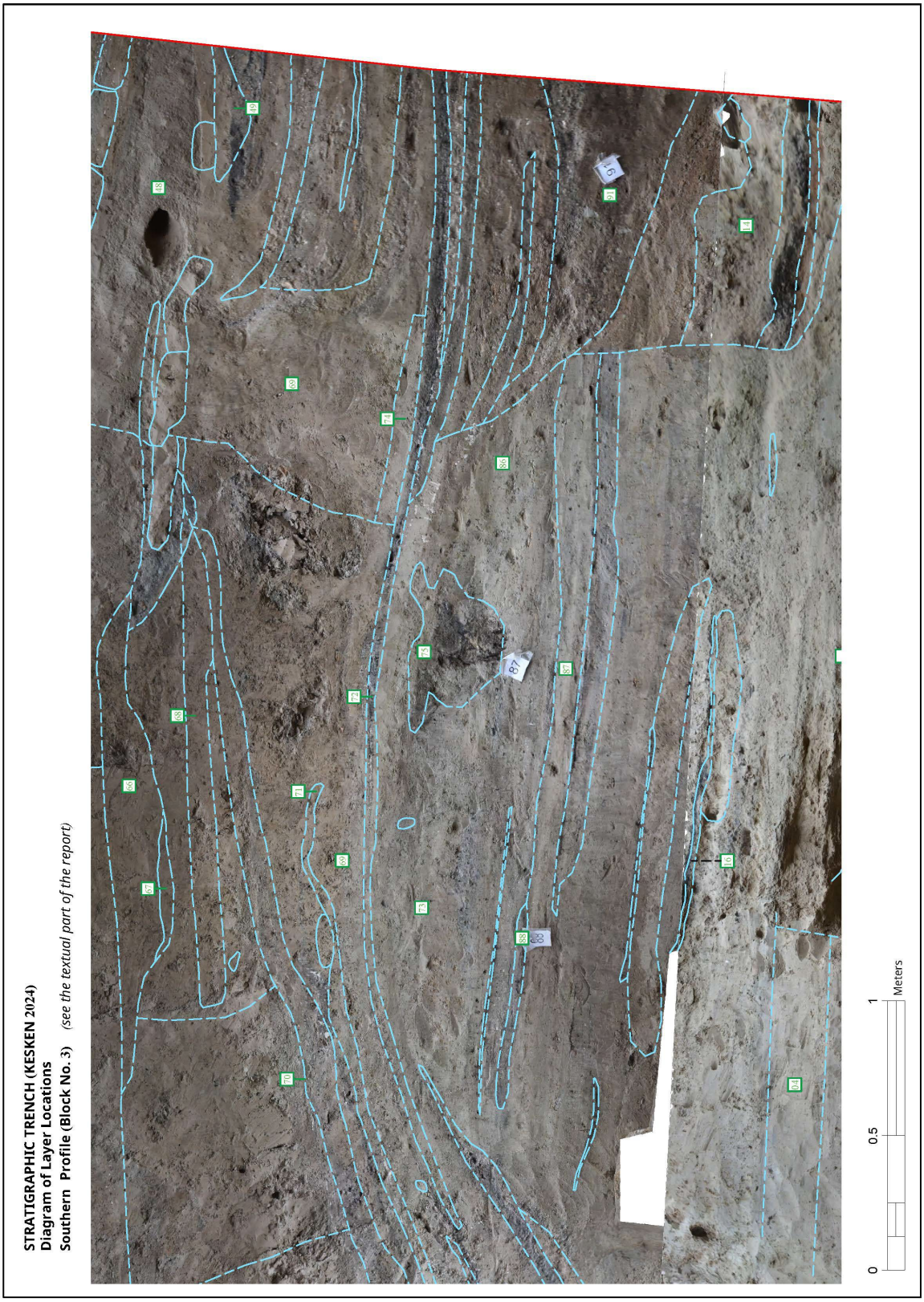

Figure 29 - Southern profile - block No.3

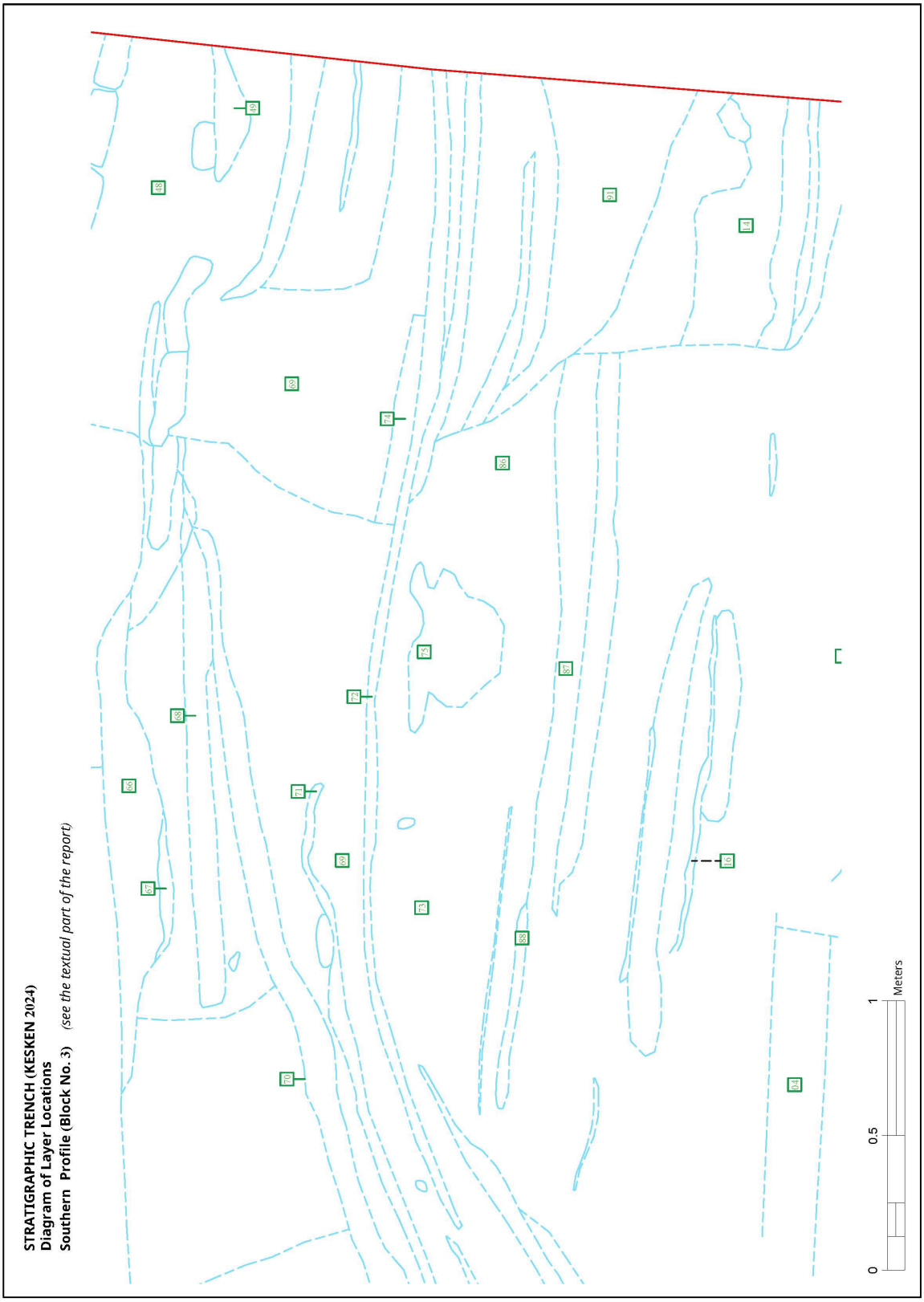

Figure 30 - Southern profile - block No.3

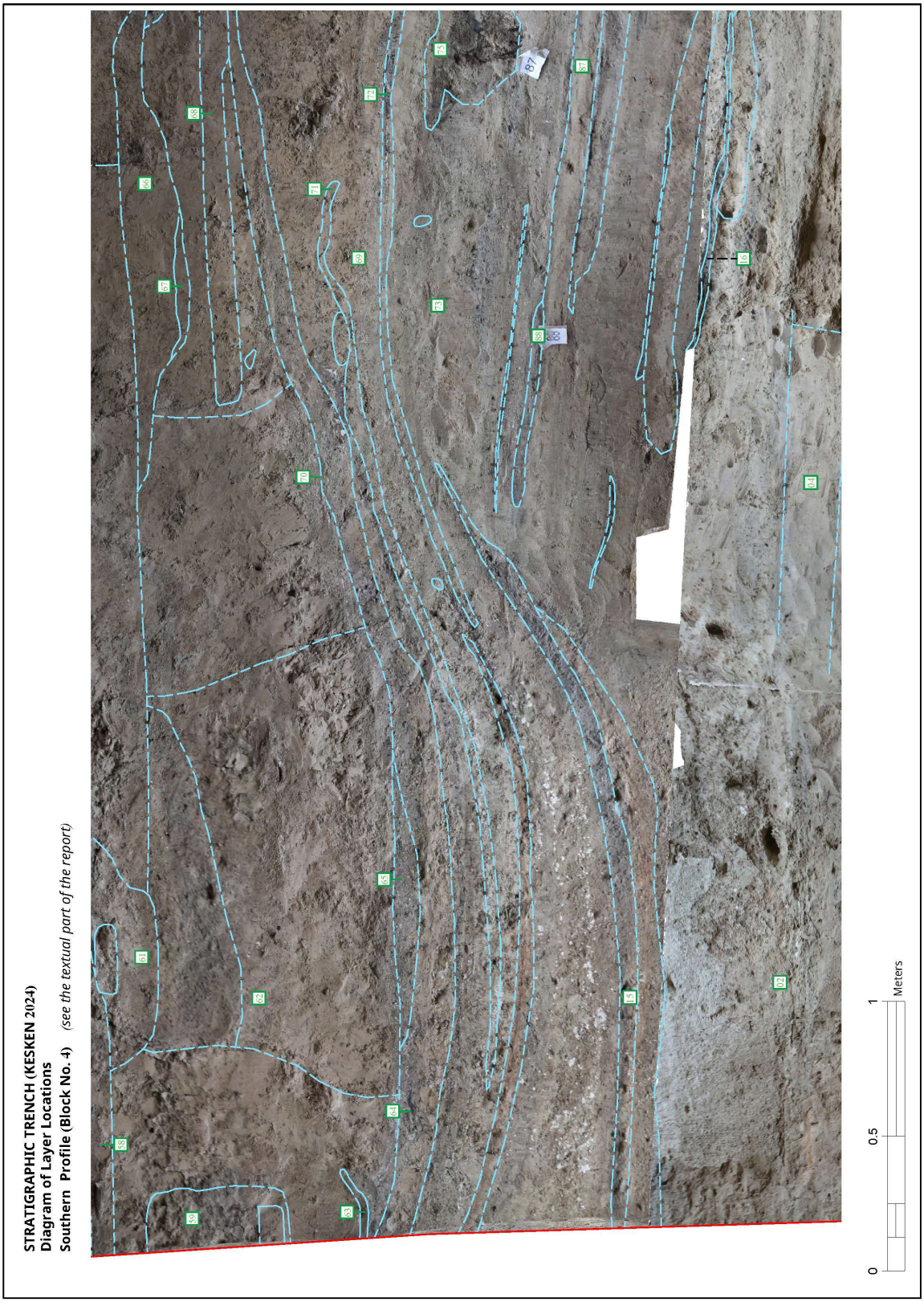

Figure 31 - Southern profile - block No.4

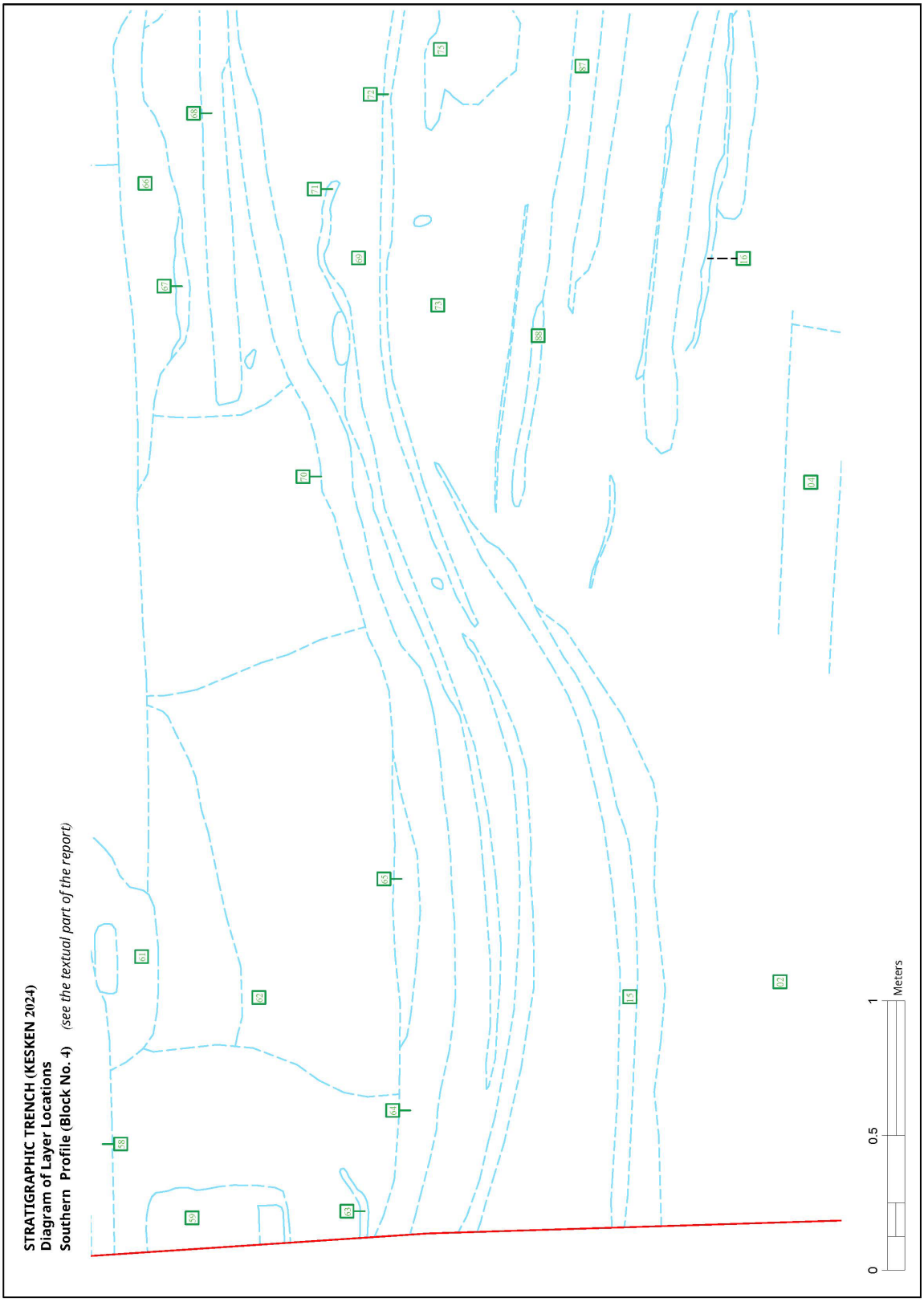

Figure 32 - Southern profile - block No.4

Figure 33 - Southern profile - block No.5

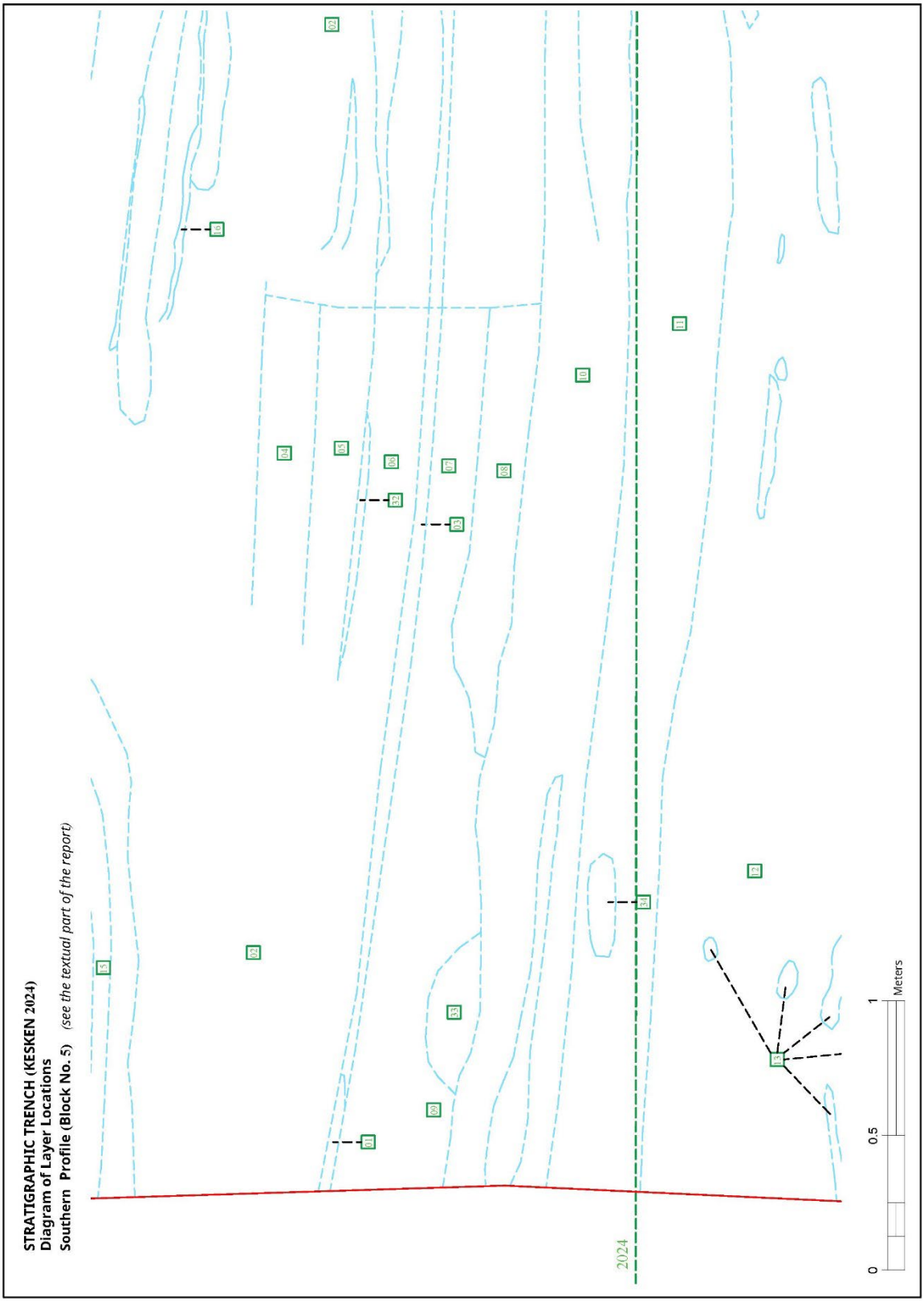

Figure 34 - Southern profile - block No.5

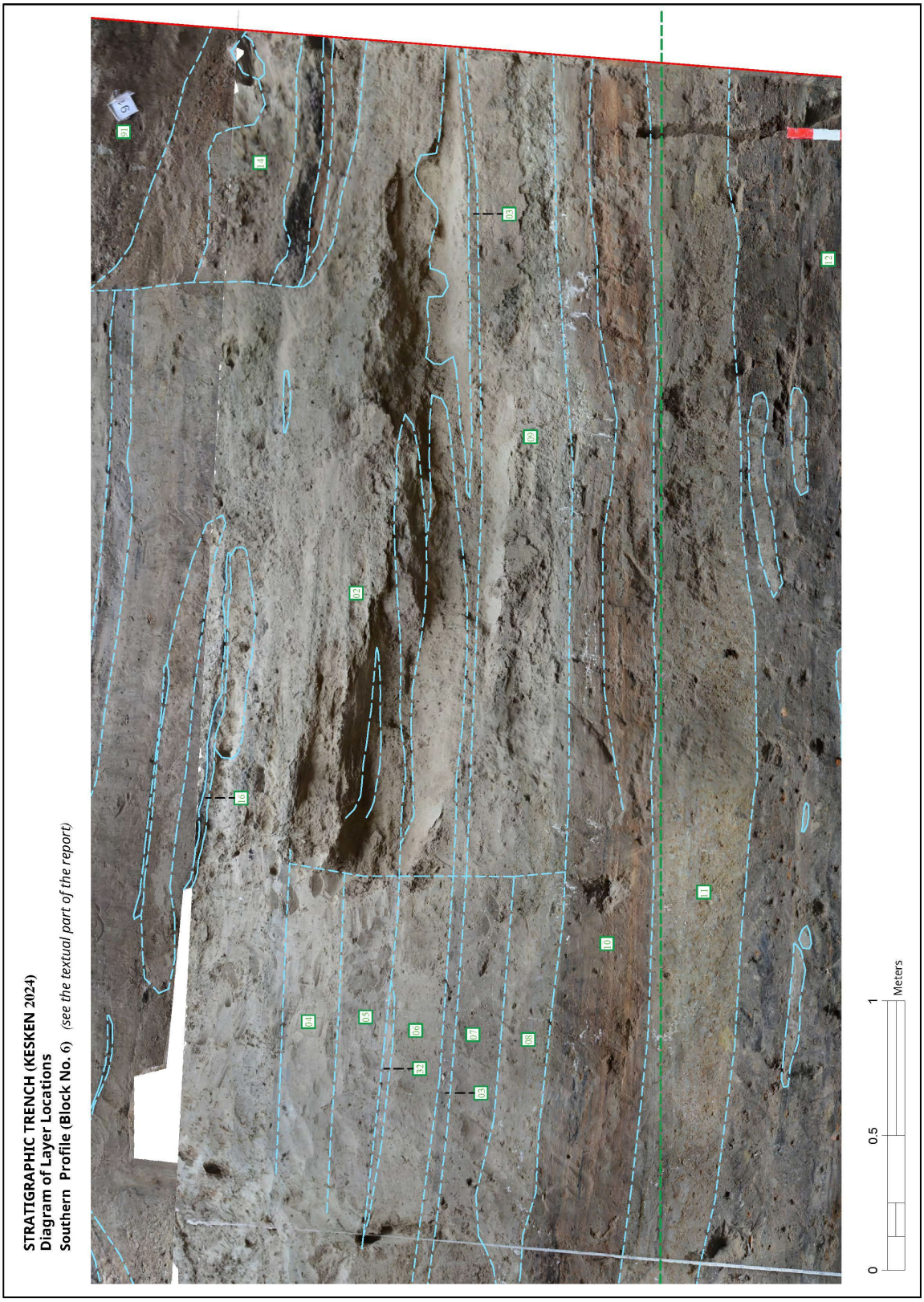

Figure 35 - Southern profile - block No.6

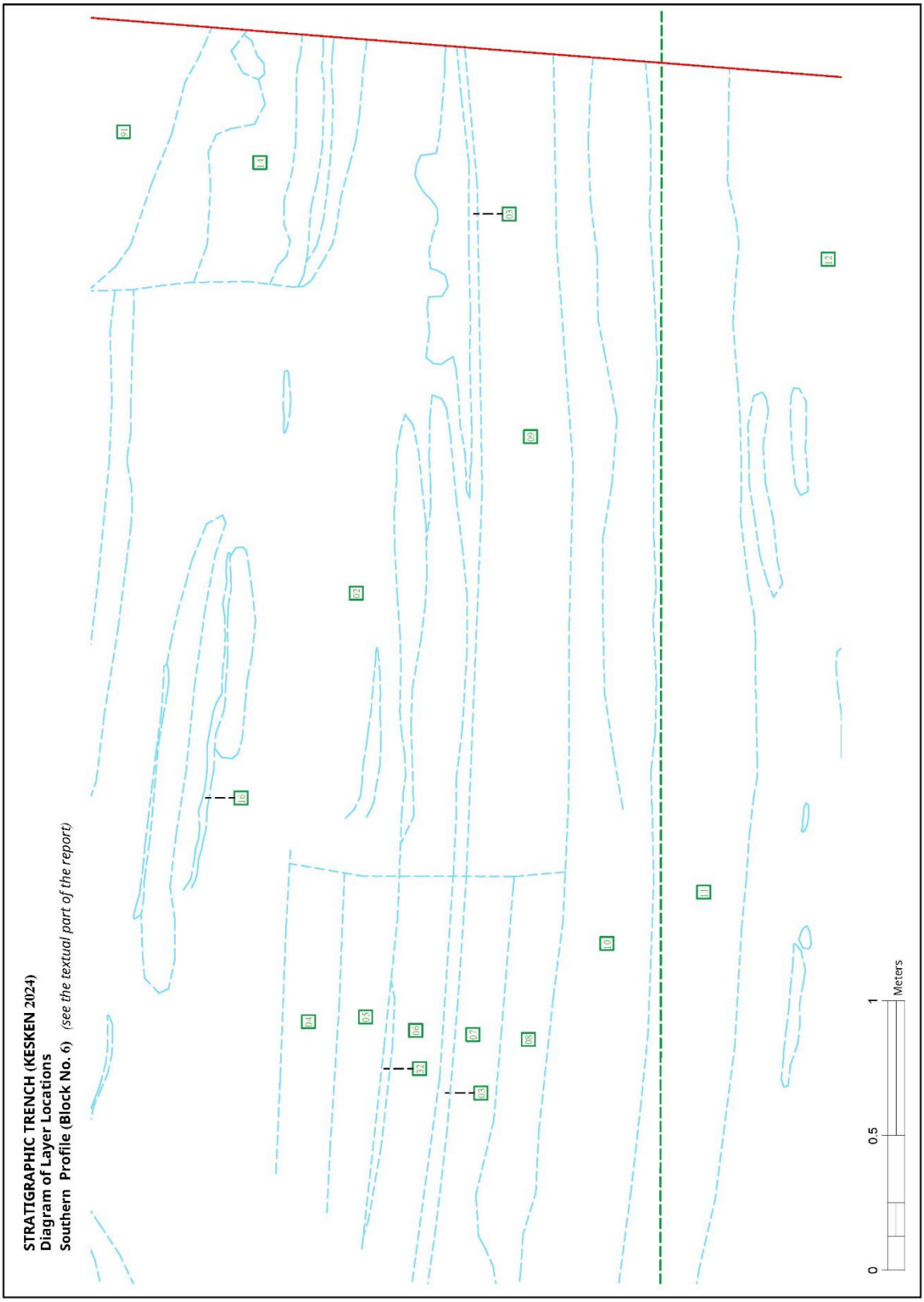

Figure 36 - Southern profile - block No.6

Figure 37 - Southern profile - block No.7

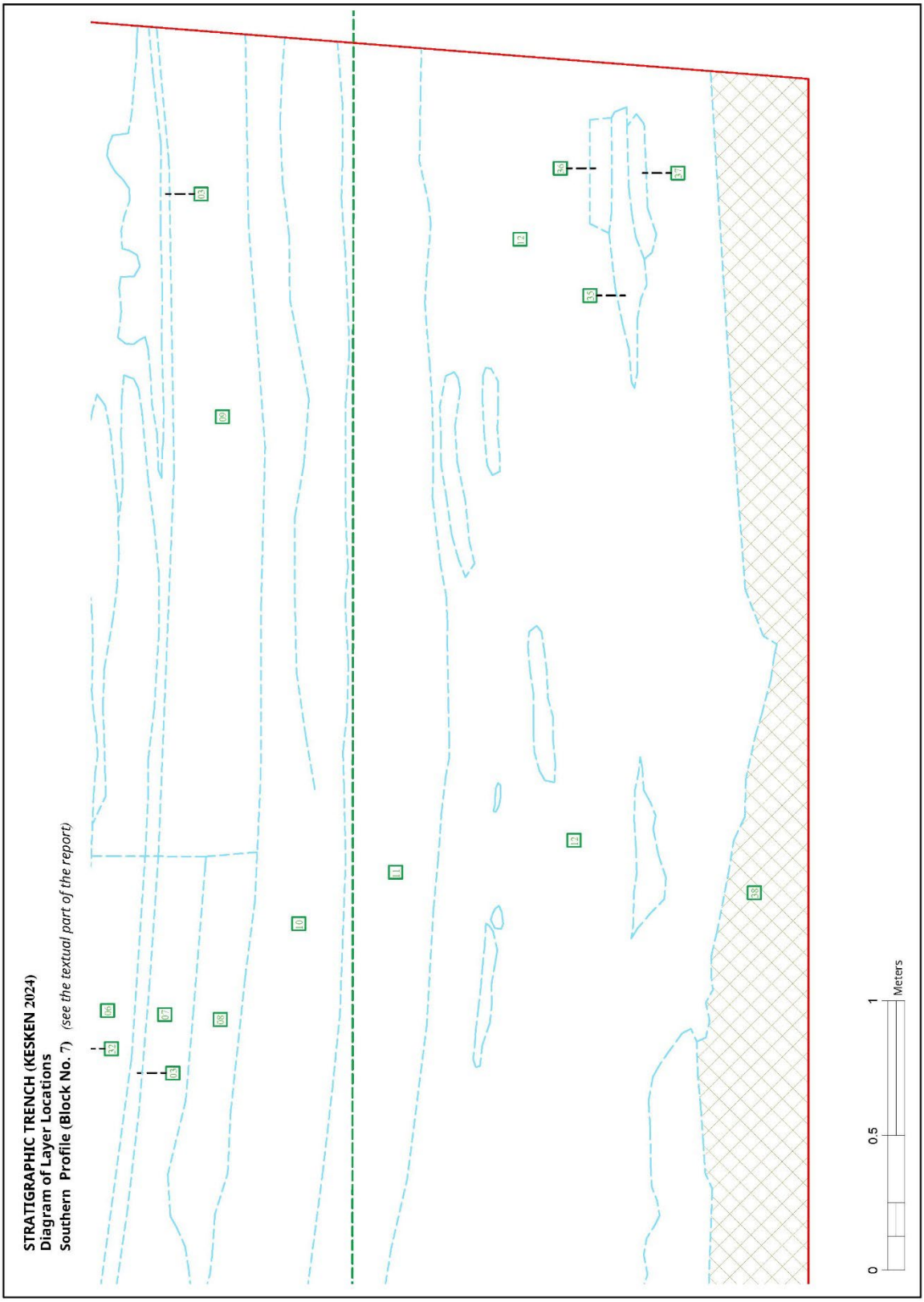

Figure 38 - Southern profile - block No.7

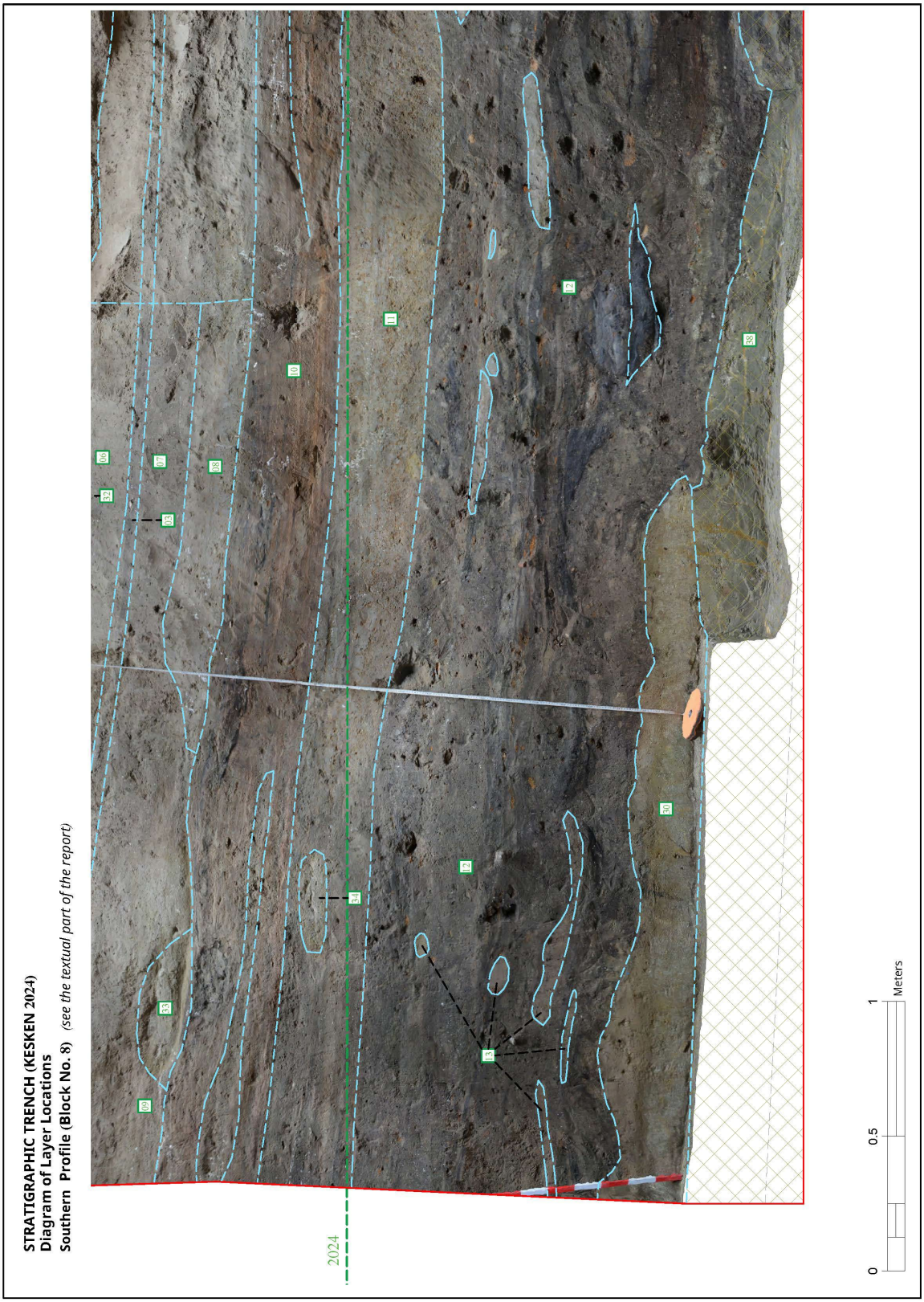

Figure 39 - Southern profile - block No.8

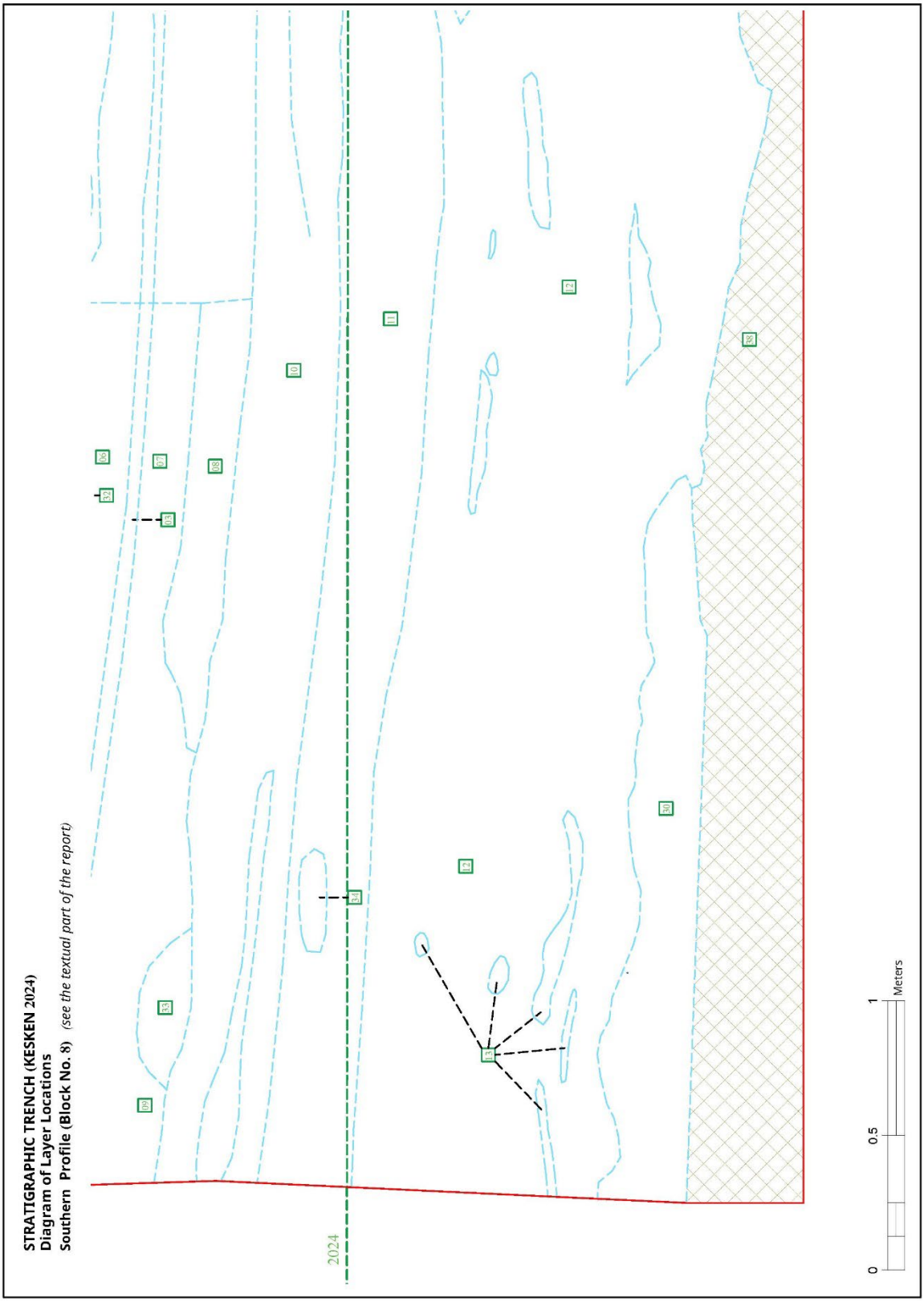

Figure 40 - Southern profile - block No.8

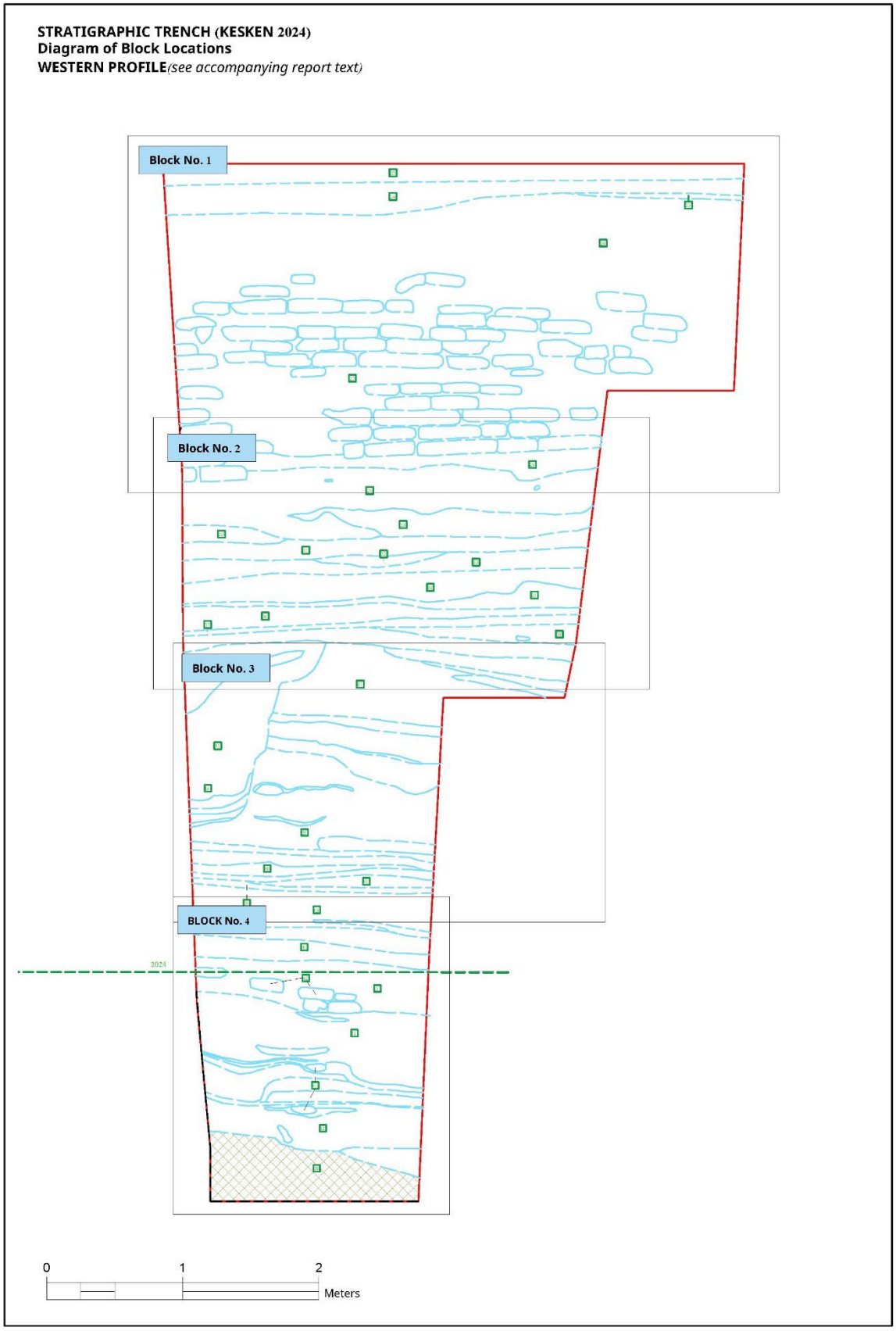

Figure 41 - Western profile - general scheme

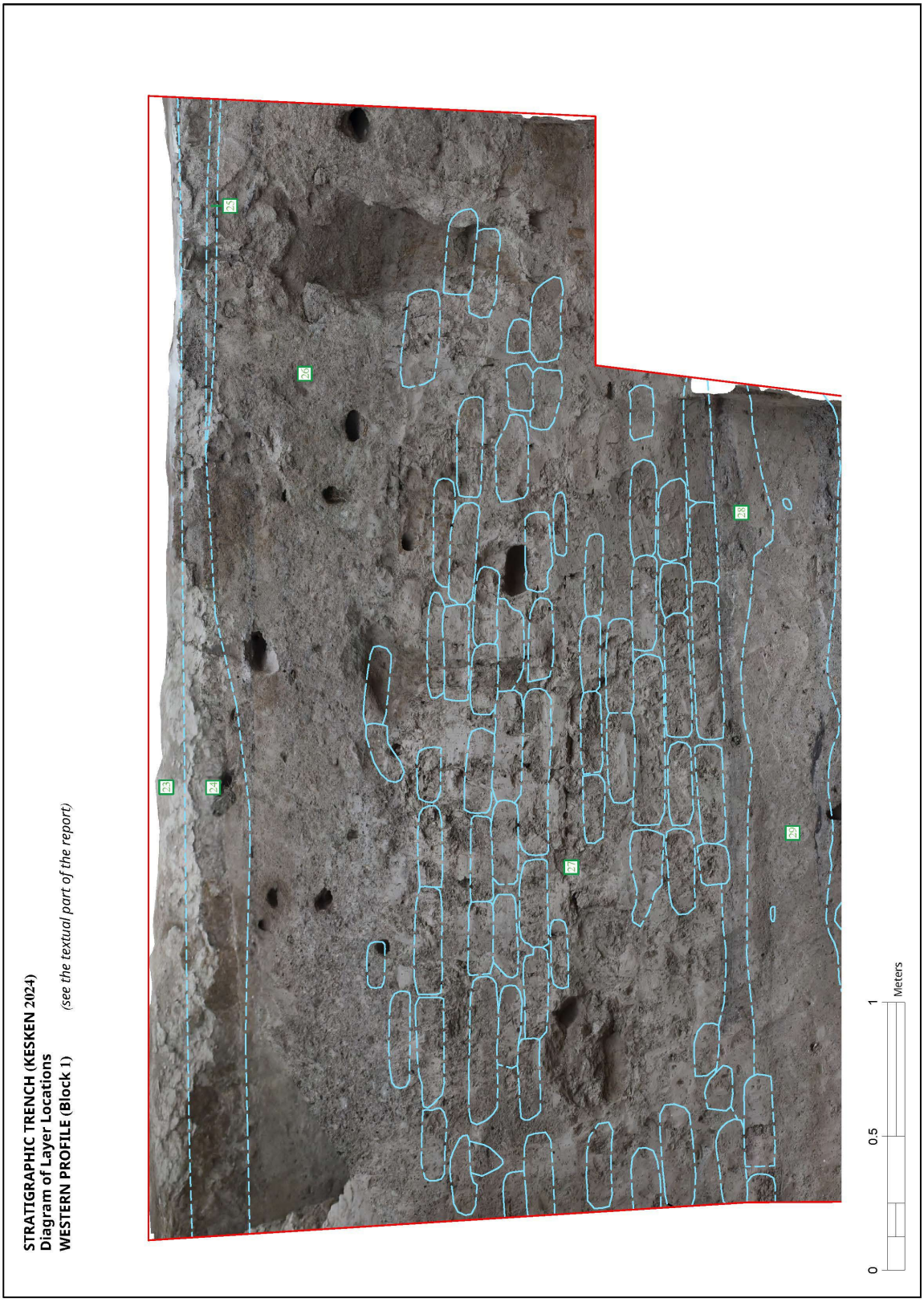

Figure 42 - Western profile - Block No.1

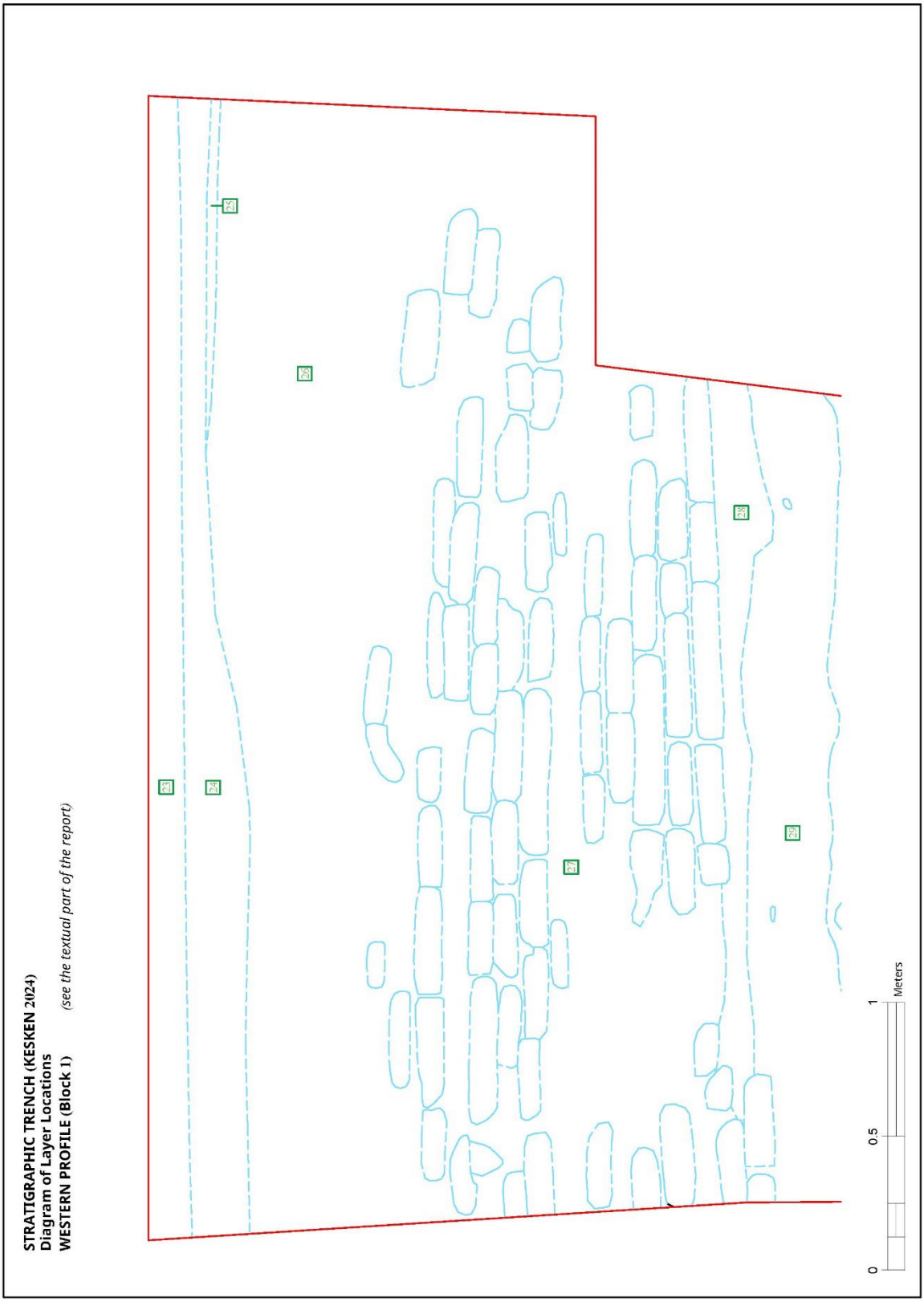

Figure 43 - Western profile - Block No.1

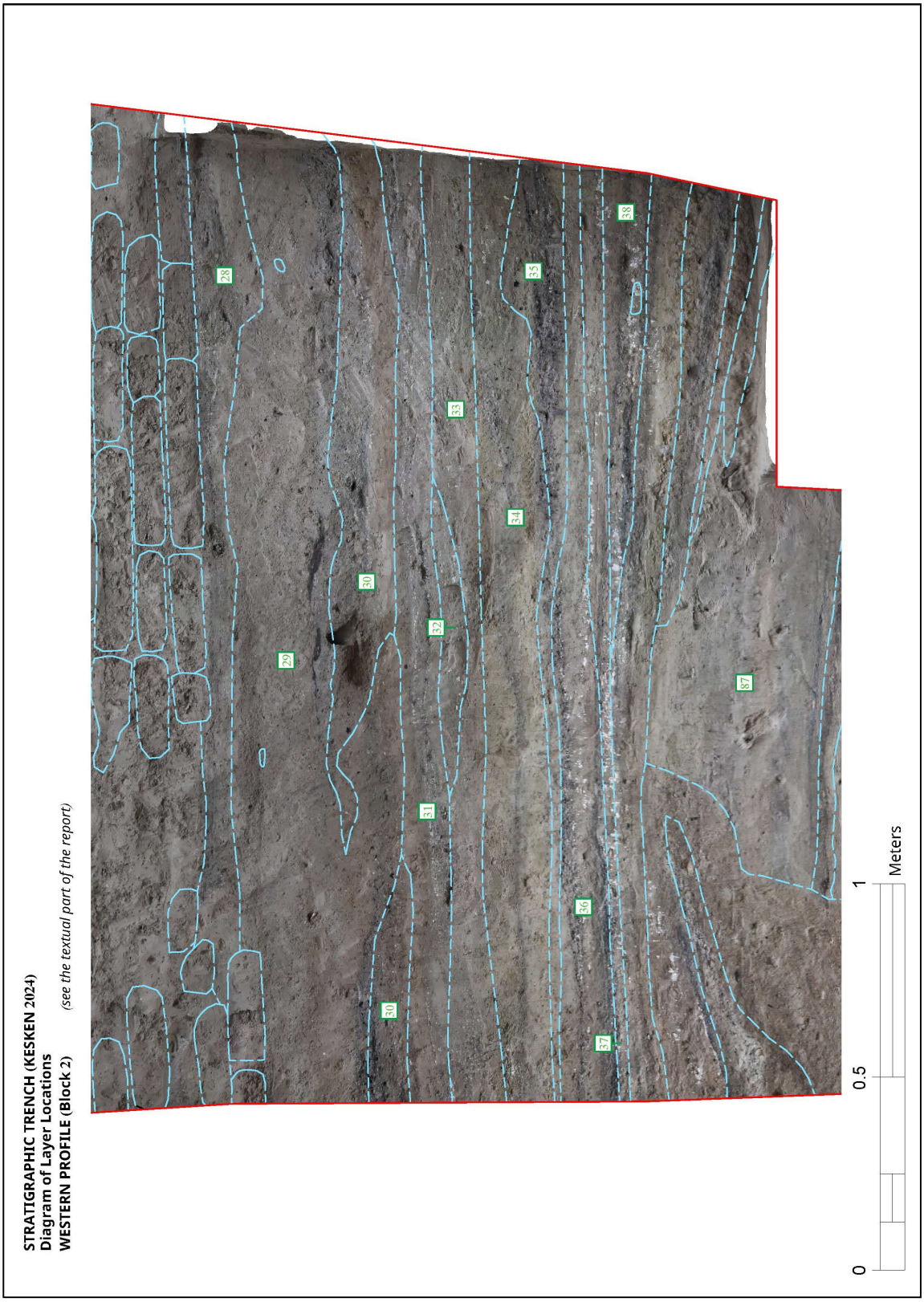

Figure 44 - Western profile - Block No.2

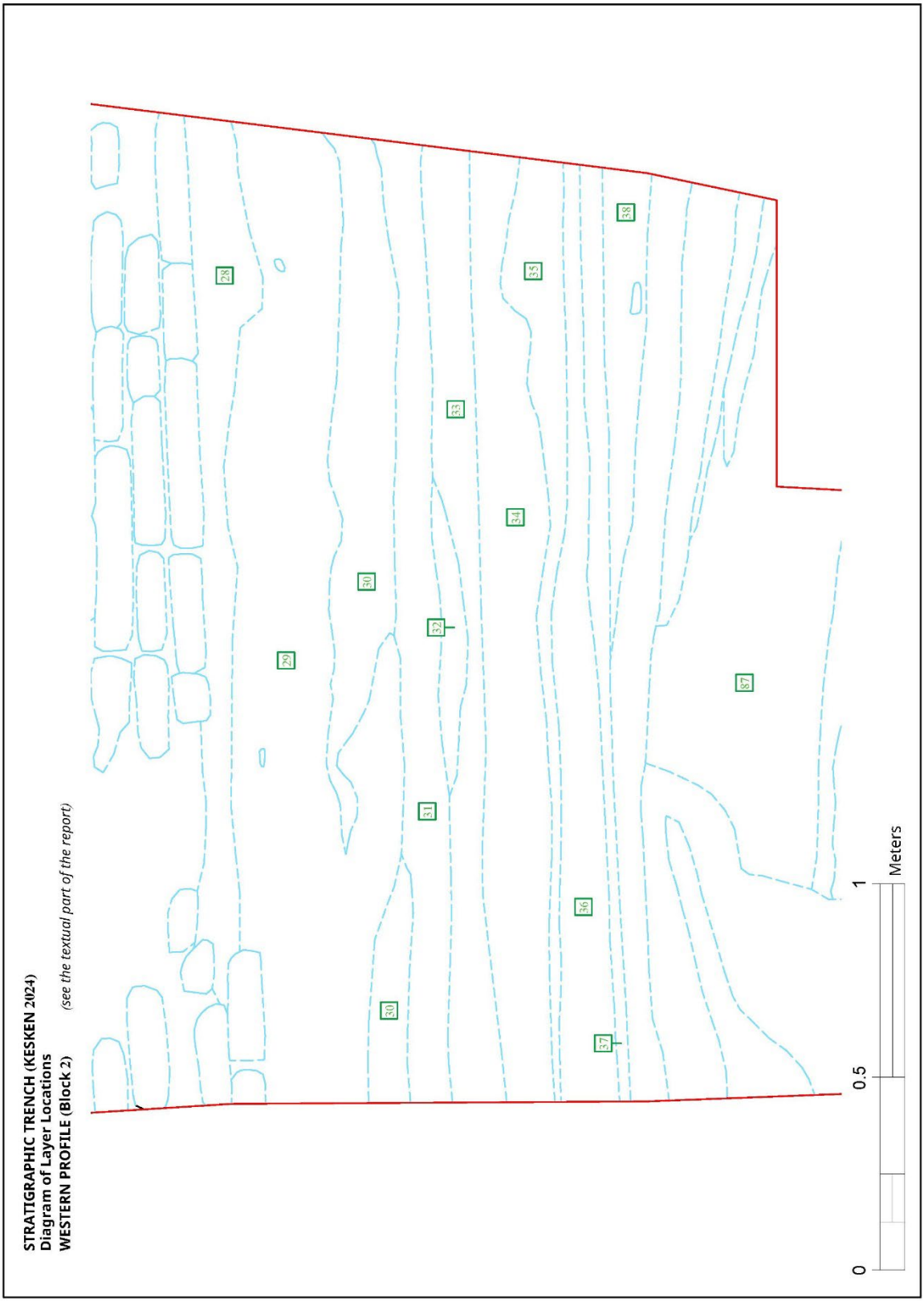

Figure 45 - Western profile - Block No.2

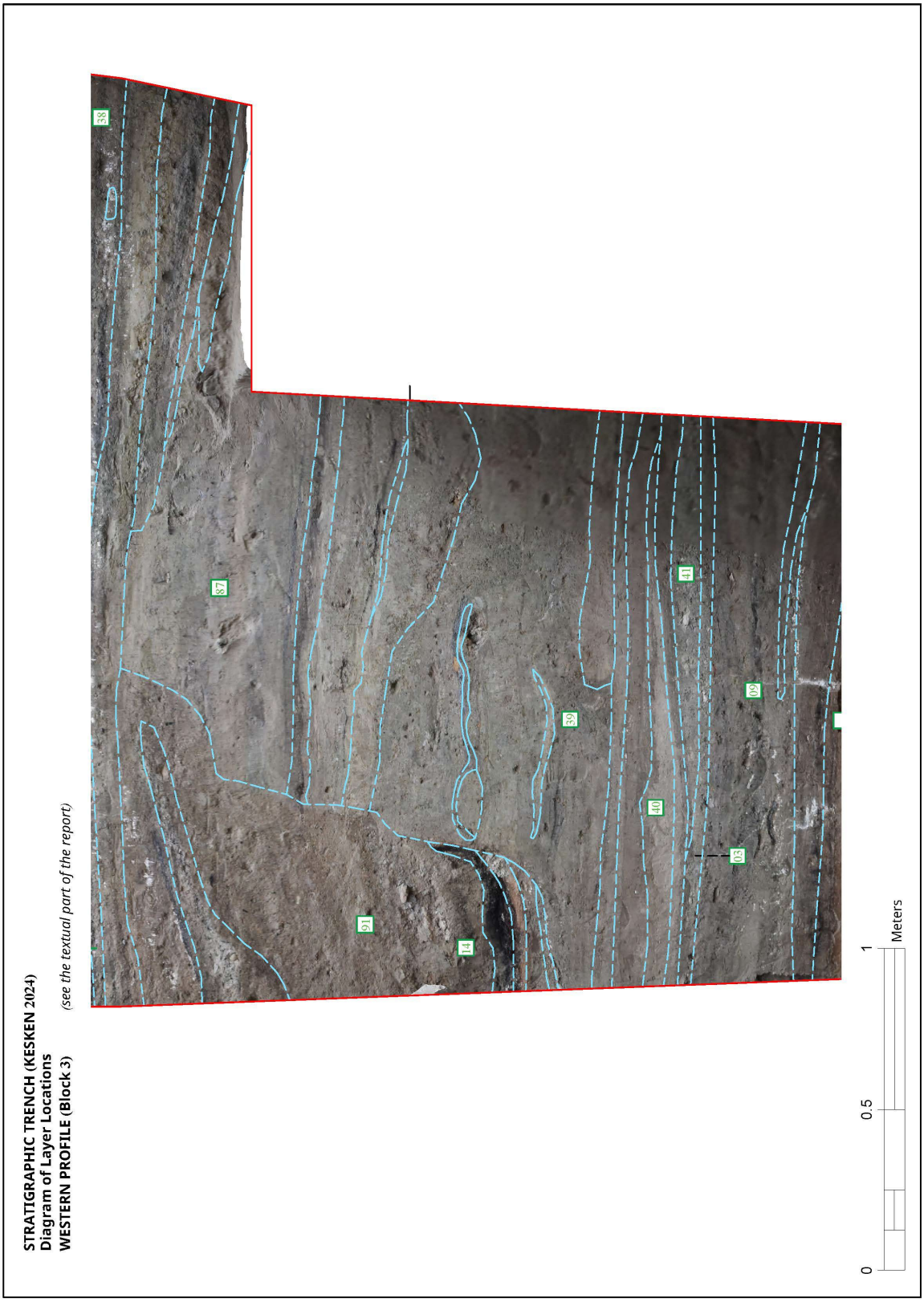

Figure 46 - Western profile - Block No.3

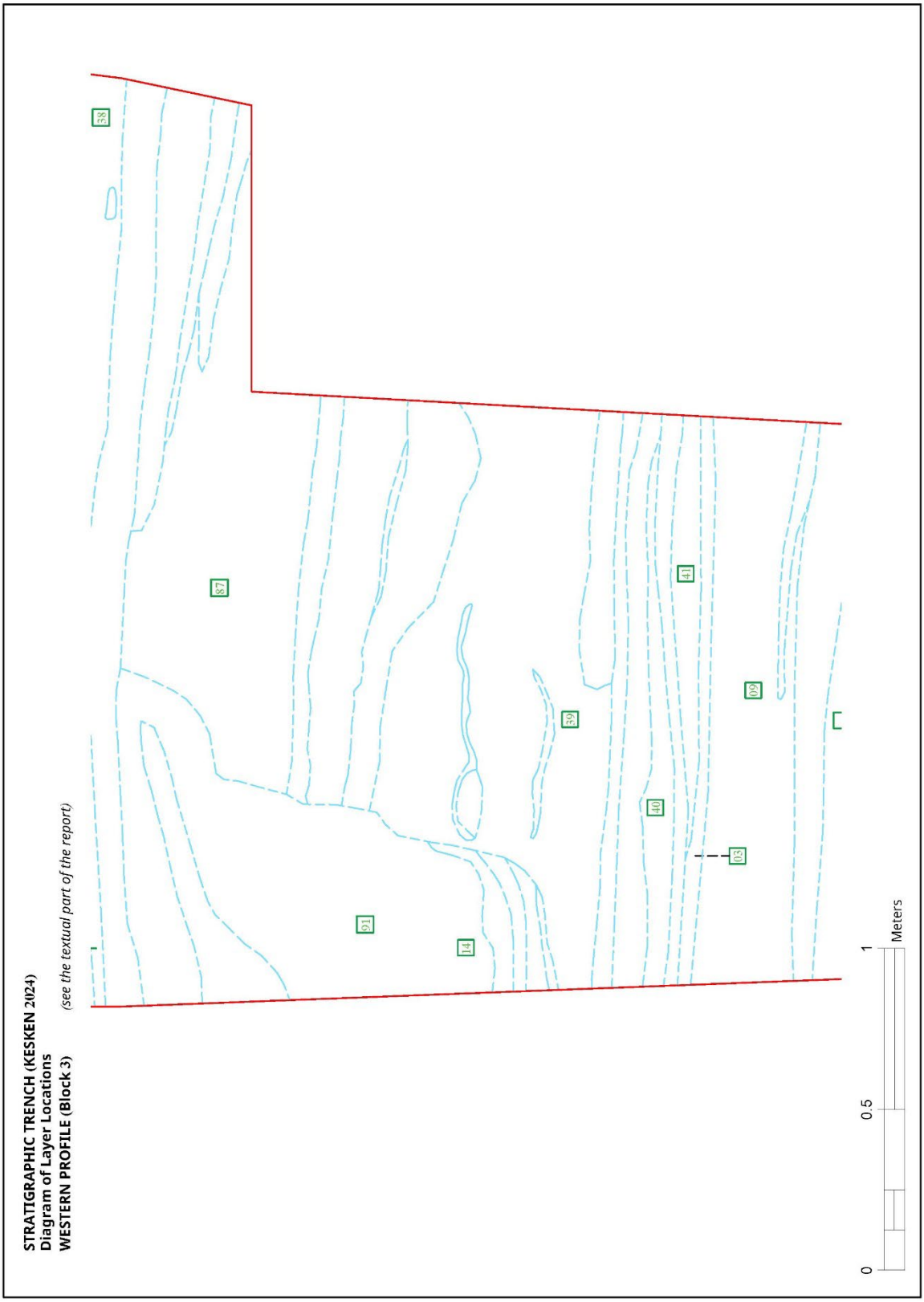

Figure 47 - Western profile - Block No.3

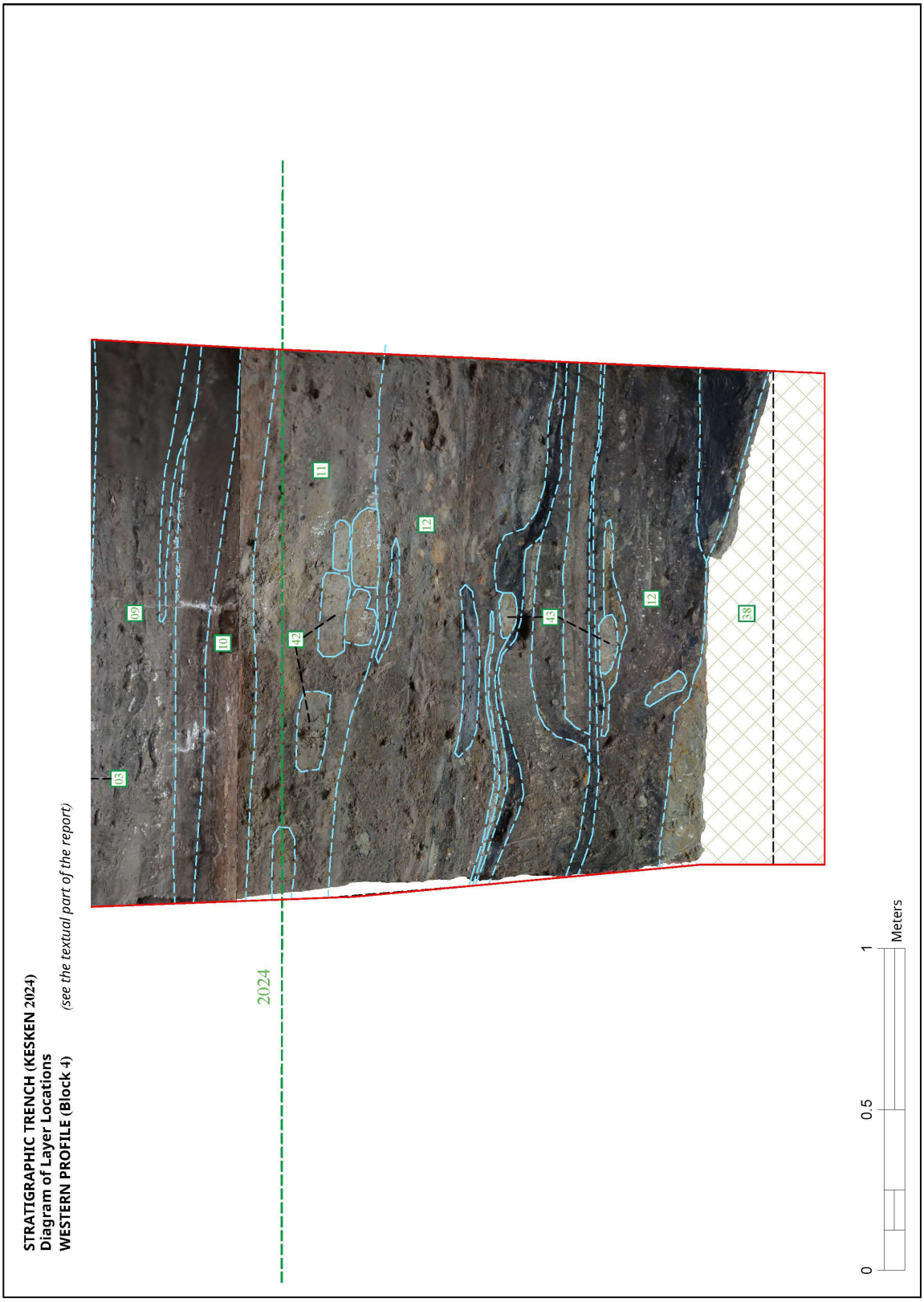

Figure 48 - Western profile - Block No.4

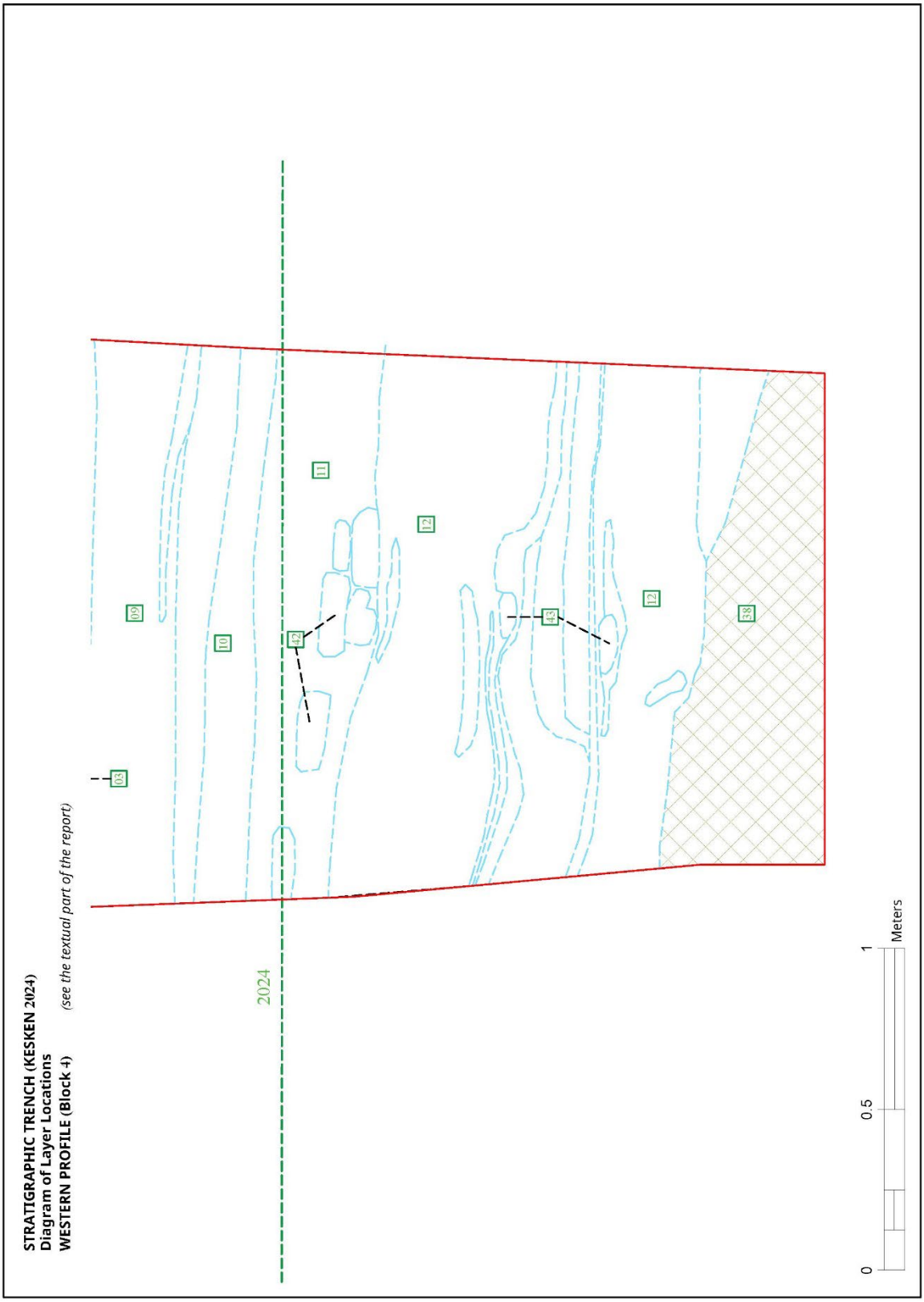

Figure 49 - Western profile - Block No.4

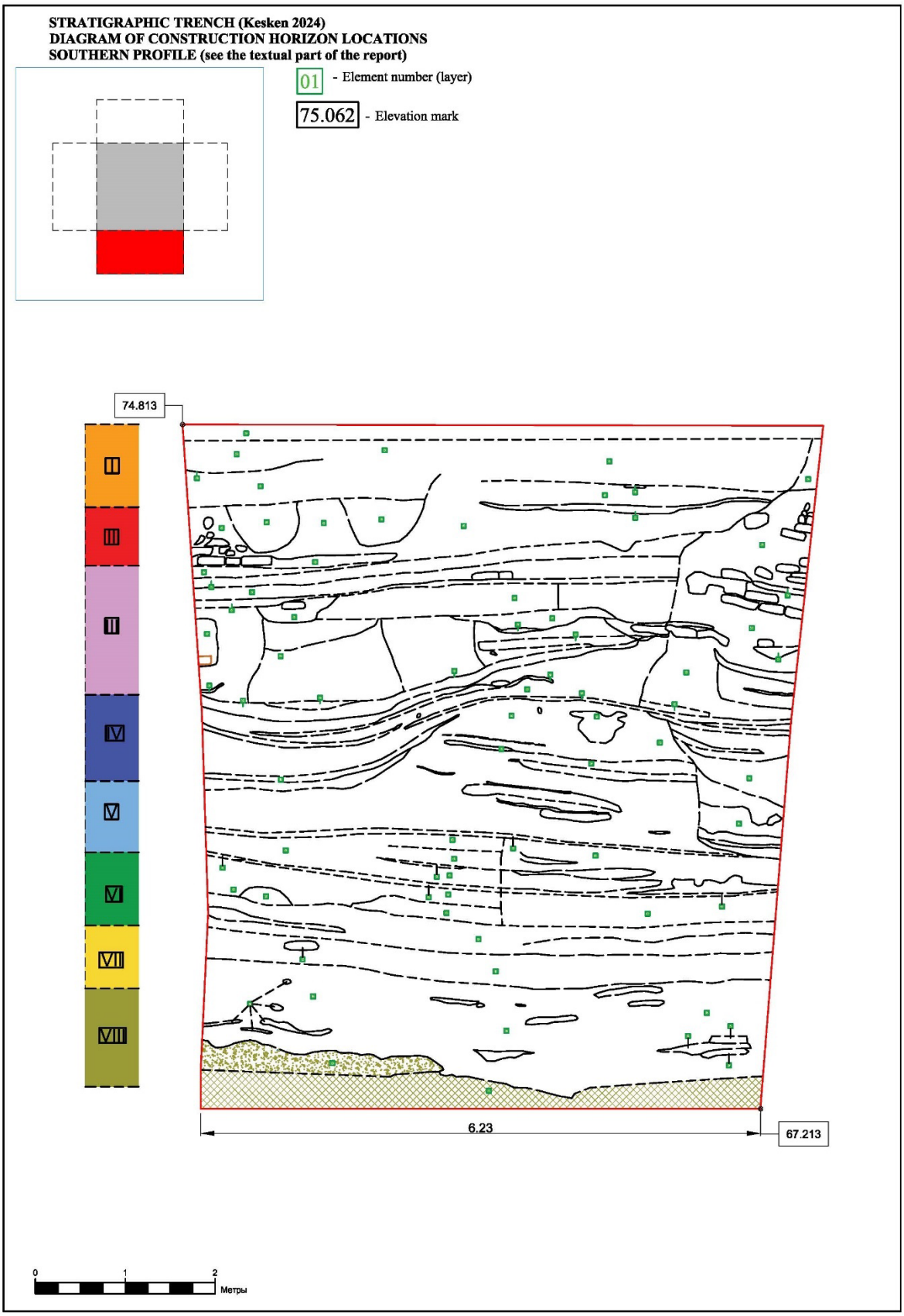

Figure 50 - Southern Profile. Scheme of construction horizons.