International Conference Marine Research and Education: MARESEDU 2022

Underwater archaeological research of **the fortress Sarkel**, flooded in the Tsimlyansk reservoir

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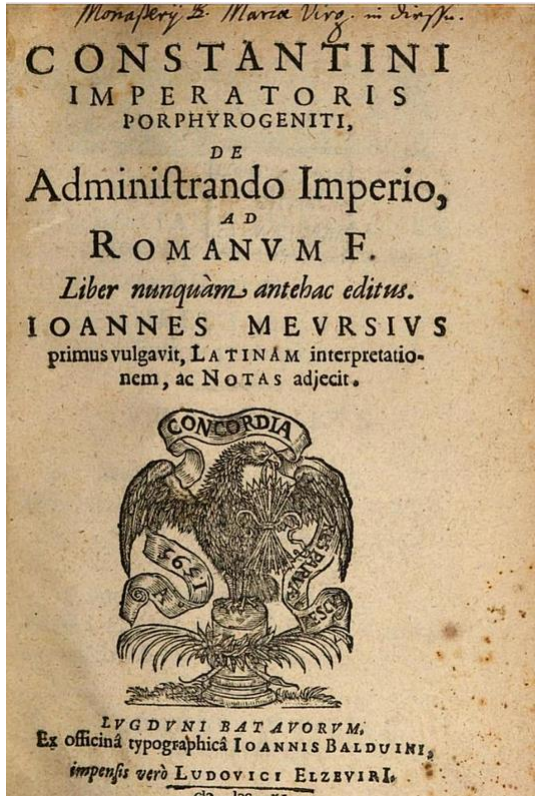
Briefly about the history of Sarkel


CONSTANTINI
IMPERATORIS
PORPHYROGENITI,
DE
Administrando Imperio,
AD
ROMANVM F.
Liber nunquàm antehac editus.
IOANNES MEVRSIVS
primus vulgavit, LATINÁM interpretationem, ac NOTAS adjecit.
CONCORDIA
LVGDVNI BATAVORVM,
Ex officinâ typographicâ IOANNIS BALDUINI,
impensis verò LUDOVICI ELZEVIRI.

Written sources about building of the fortress Sarkel
De Administrando Imperio
10th-century Eastern Roman Emperor Constantine VII

The Sarkel - Khazar fortress was built around 840 AD by Byzantine engineers at the request of the Khazar Khaganate. They asked the Byzantine Emperor Theophilus for help in the construction.

A written mention of this is contained in ***De Administrando Imperio*** ("On the Governance of the Empire"), which was written by another Byzantine emperor Constantine VII Porphyrogenitus about 100 years after this event.

He described this event in detail. An official named Petronas Kamateros was sent for construction. Frist of all he went from Constantinople to Chersonesos. And then from there to Tanais (Don), where the fortress was built.

About the fact that the fortress was built of bricks Constantine writes the following: *"Since there were no stones suitable for the construction of the fortress on the spot, having built furnaces and burned bricks in them, he made a fortress building out of them, making lime from small river shells."*

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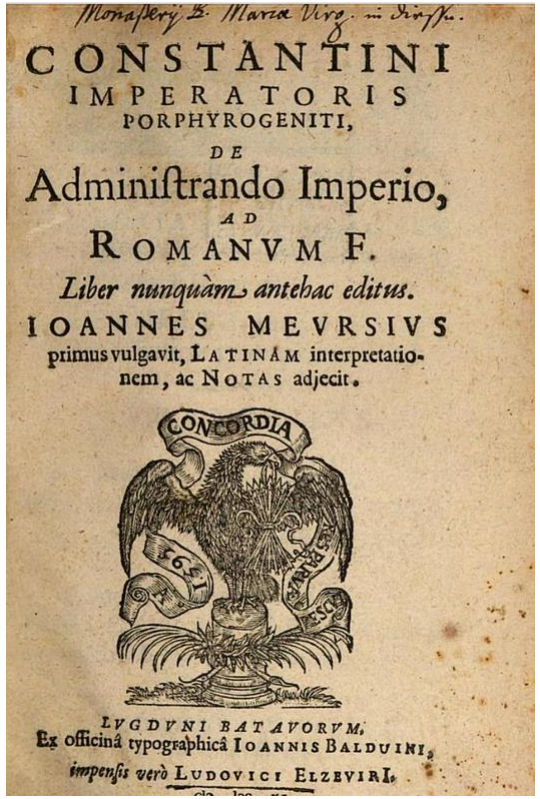

Monastery B. Mariæ Virg. in Sirsa.

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Excavations before 1953

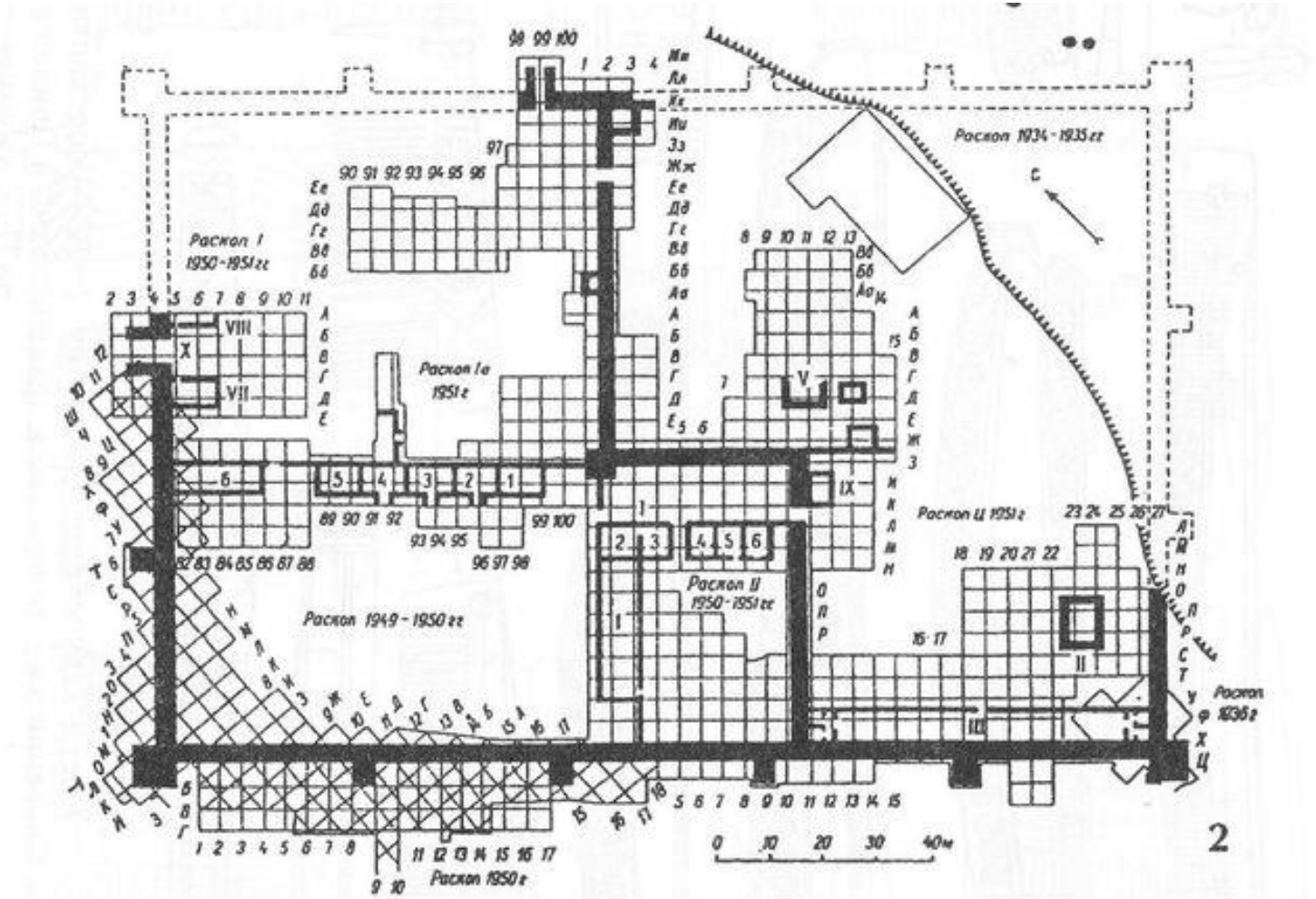
At the end of the XIX century, Khariton Popov argumentatively proved that the Left-bank Tsimlyansk settlement in the Tsimlyansky district is the fortress of Sarkel, about which Constantine VII Porphyrogenitus wrote.

Excavations of the fortress were carried out in the XIX century, but the largest excavations were carried out in the middle of the XX century under the leadership of Mikhail Artamonov (director of the Hermitage Museum).

A significant part of the archaeological site has been excavated, reports, excavation plans, and aerial photography have been preserved. The archaeological materials of the excavations are stored in the Hermitage Museum (St. Petersburg).

In 1953, during the filling of the Tsimlyansk reservoir, the archaeological site was flooded. However, a significant part remained unexplored, and the geographical coordinates were not preserved.

Excavations before 1953



Sarkel excavation plan before flooding (MIA) No. 75 Vol. II., 1959

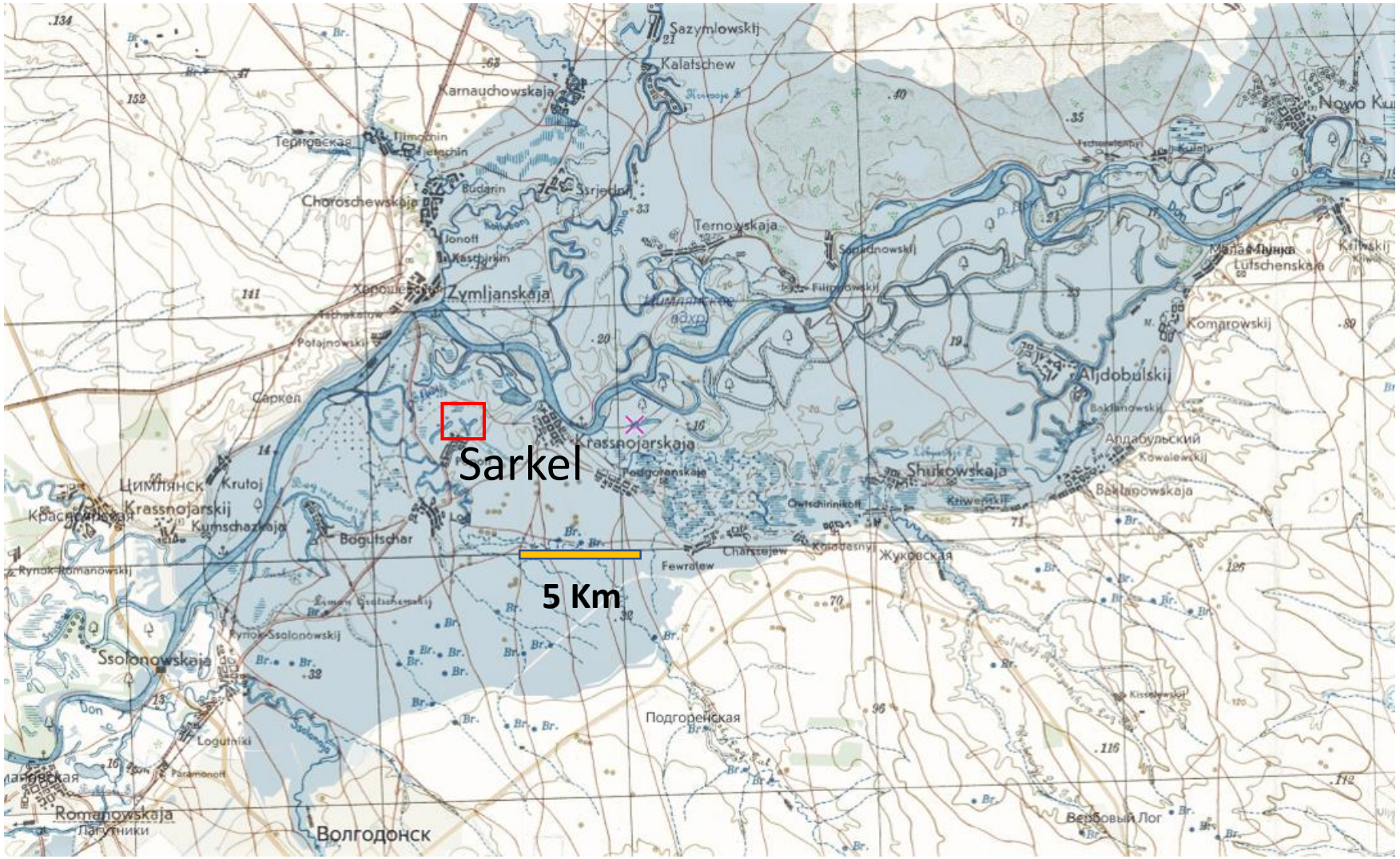
Localization of the archaeological site in the Tsimlyansk reservoir

- In 2019, the archaeological site Sarkel was localized at the bottom of the Tsimlyansk reservoir, we have already reported on this expedition earlier on MaresEDU.

- In 2022, the expedition conducted the first studies of Sarkel since its flooding.

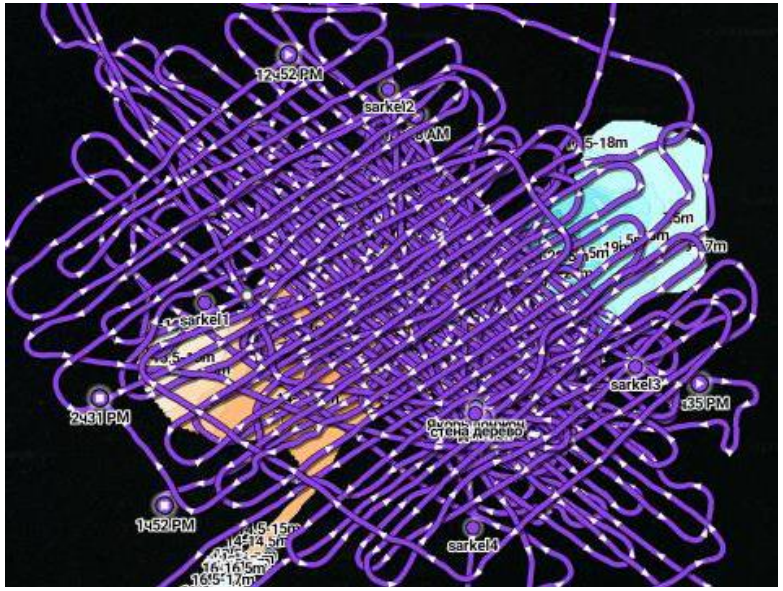
The goals of the 2022 expedition:

- confirmation of the localization of the archaeological site,
- the study with remote archaeological methods,
- assessment of the current state of the archaeological site.



This map shows both the old riverbed of the Don and the modern contours of the Tsimlyansk reservoir. The archaeological site is located at a depth of 15 meters, 5 kilometers from the shore.

Bathymetry map 2022



All GPS-tracks of investigation 2022

The expedition conducted remote archaeological research using various hydrophysical equipment: **Side Scan Sonar, Magnetometer, Acoustic profiler.**
A bathymetric map of the bottom was constructed using echo sounders. On the bathymetric map, the undiscovered high areas are displayed in brown, and the lowlands in blue.

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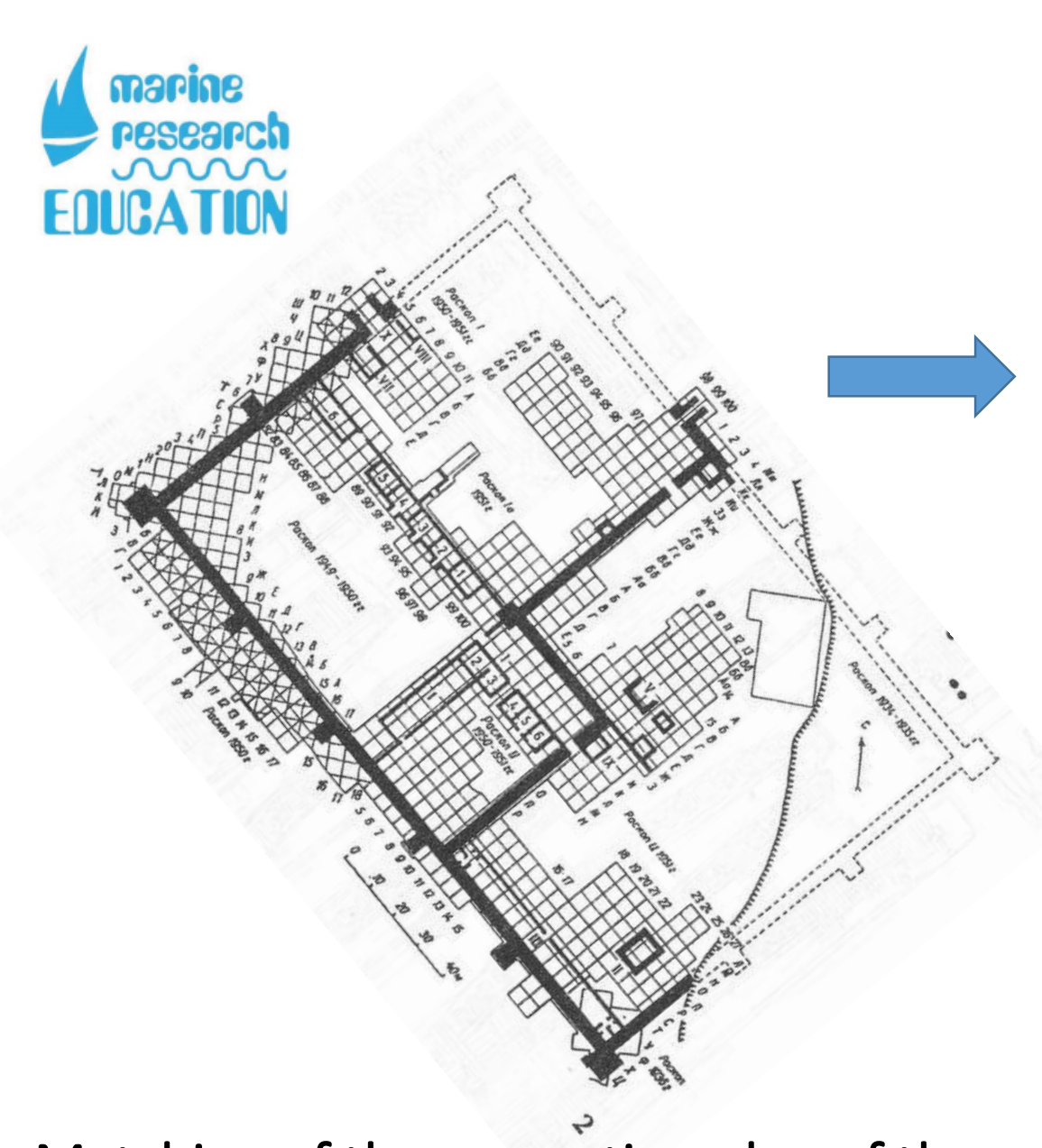
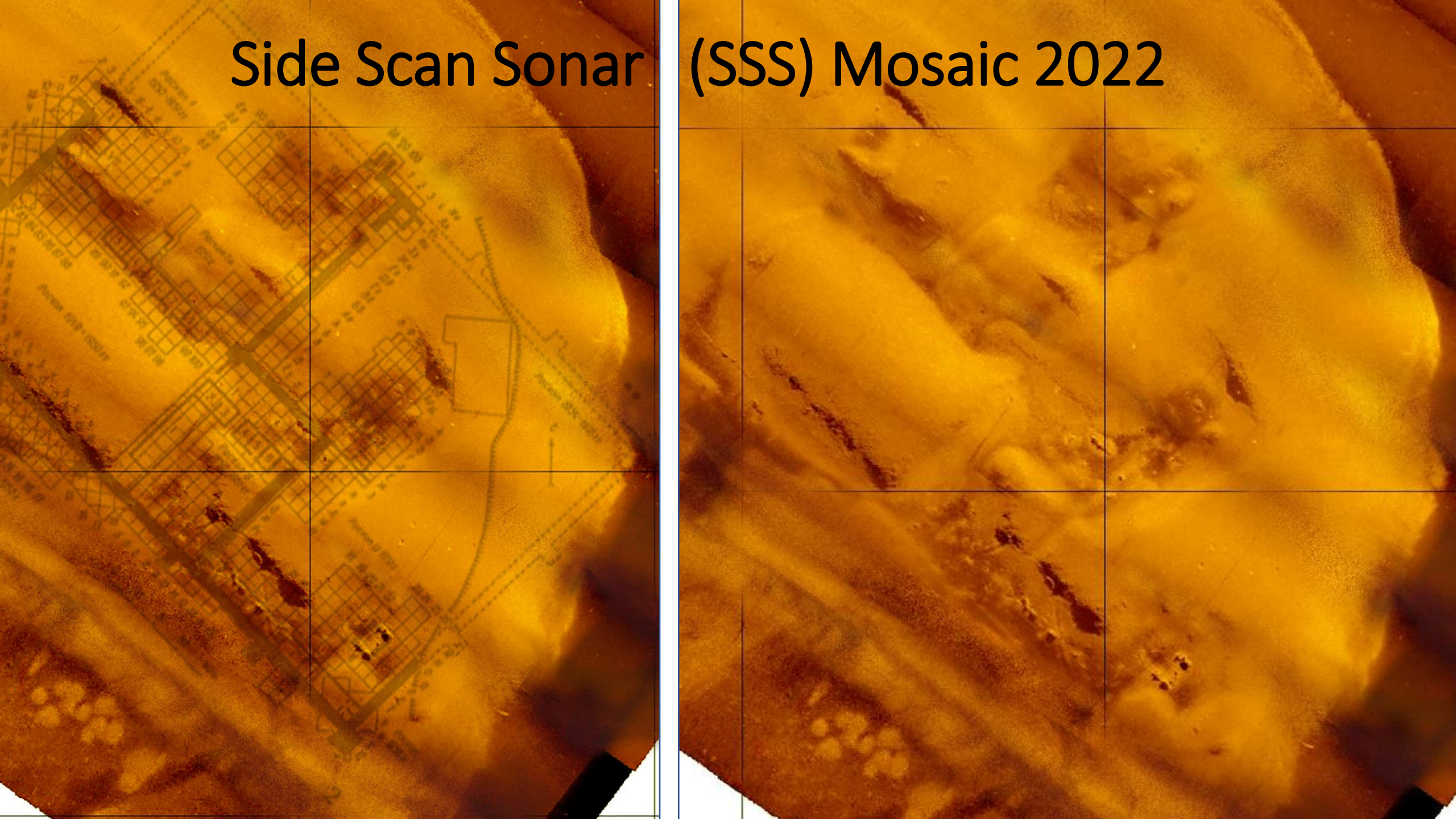


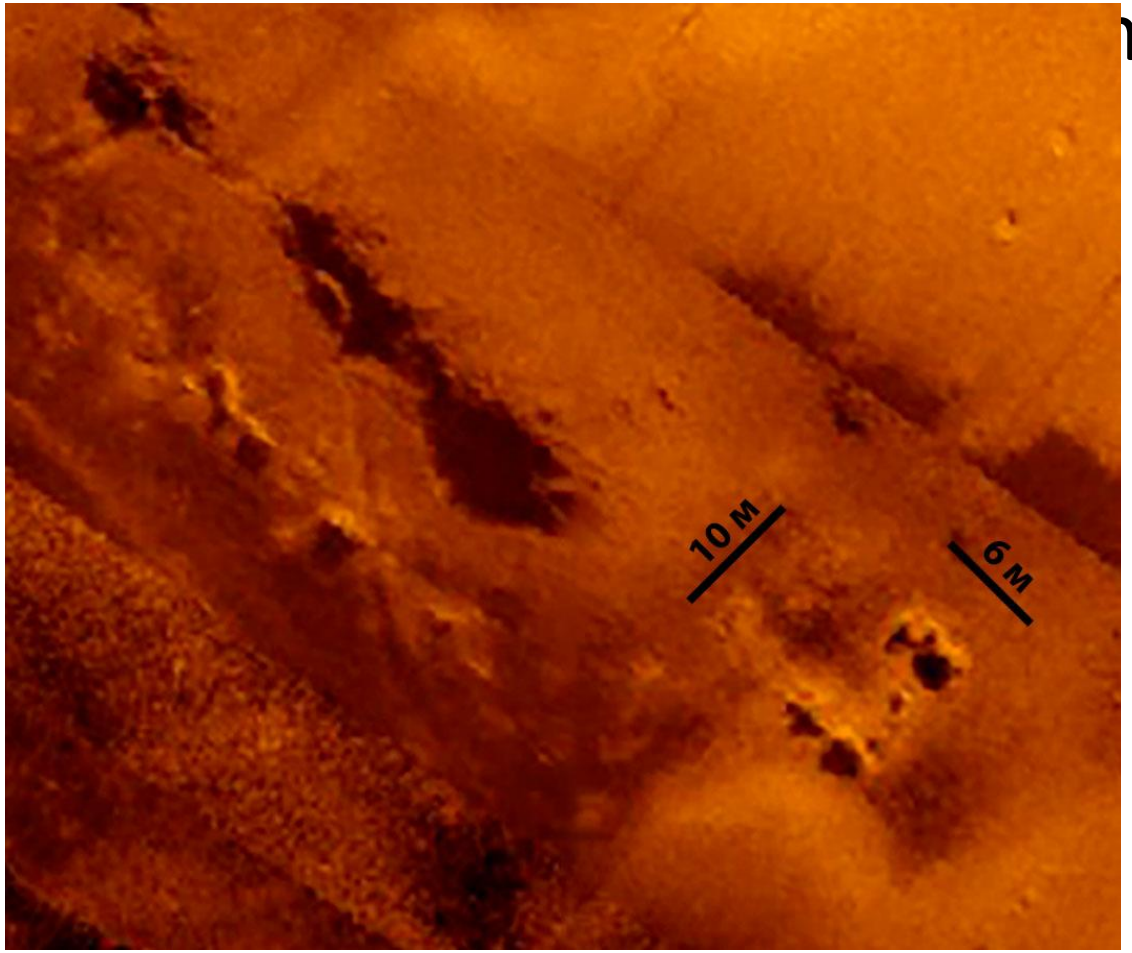
Matching of the excavation plan of the 1950s to the 2022 bathymetric map

Side Scan Sonar (SSS) Mosaic 2022

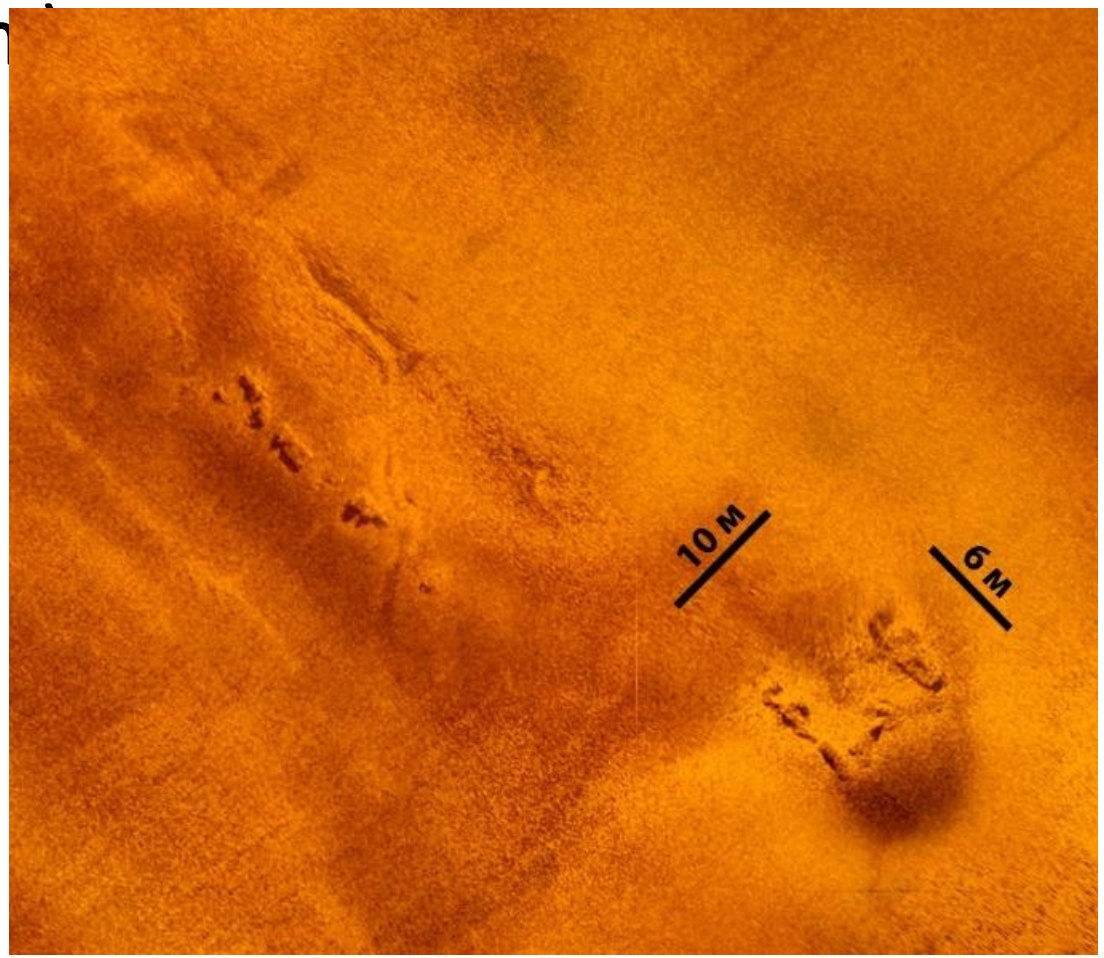


Comparison of two Side Scan Sonars

on the example of the site of the building II area (depth 12)

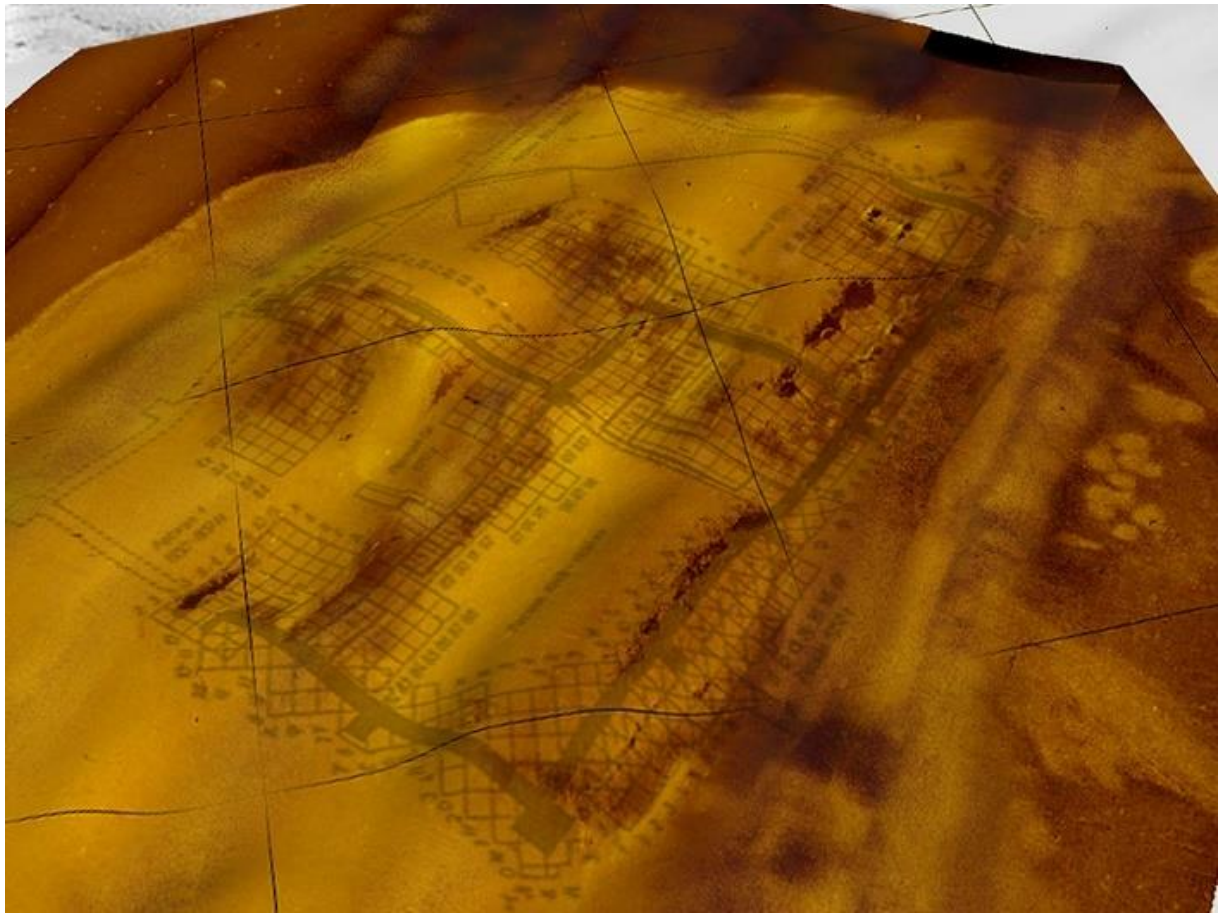


NELAKS 250 kHz



Humminbird 1050 kHz

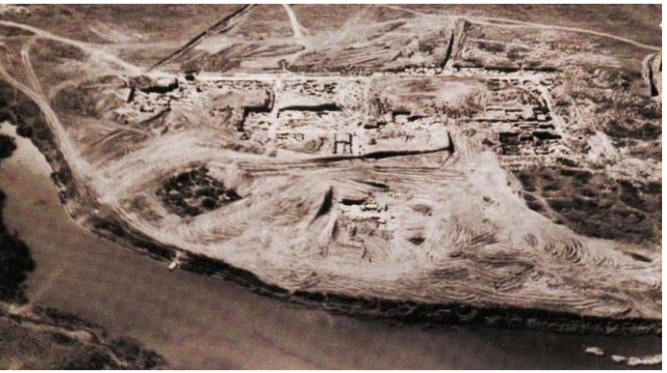
Comparison of aerial photography in 1951 with a 3D model made on the basis of bathymetry and SSS mosaic

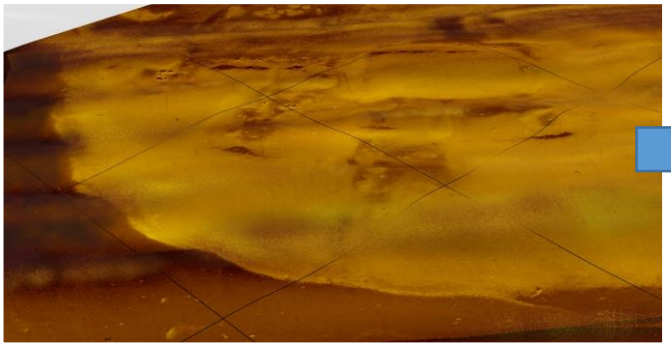


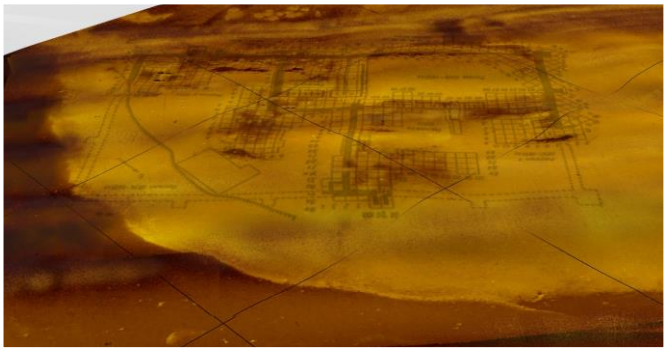
A 3D model was built based on the SSS mosaic and a bathymetric map. By turning it at the same angle and finding the position from which the aerial photography of the 1950s was carried out, it was possible to analyze quite accurately how the archeological site looks under water now.

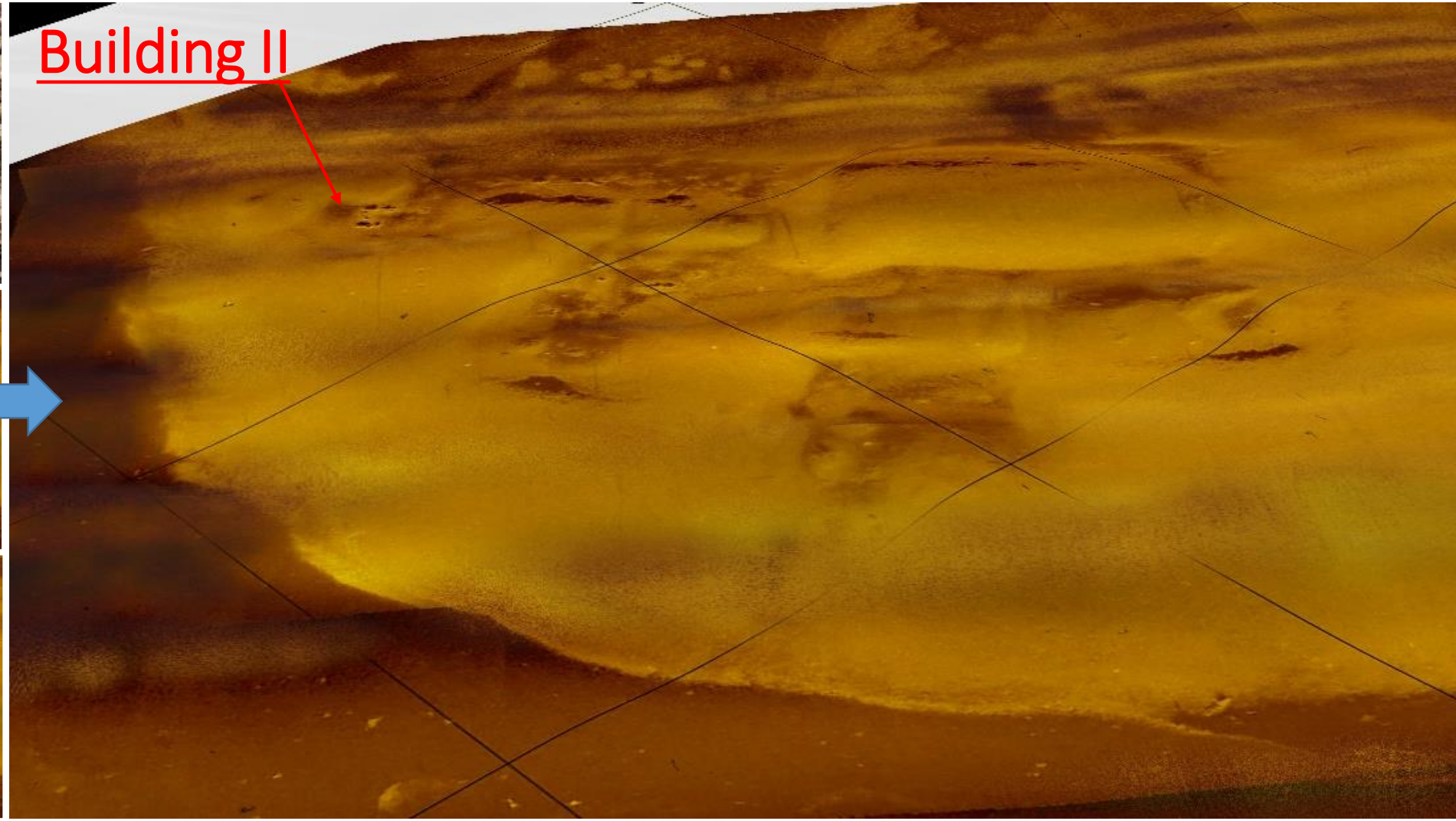
Comparison of aerial photography in 1951 with a 3D model made on the basis of bathymetry and SSS mosaic

Comparison of aerial photography in 1951 with a 3D model made on the basis of bathymetry and SSS mosaic

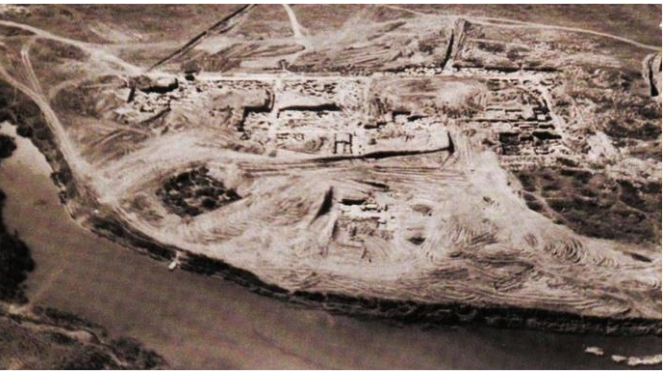


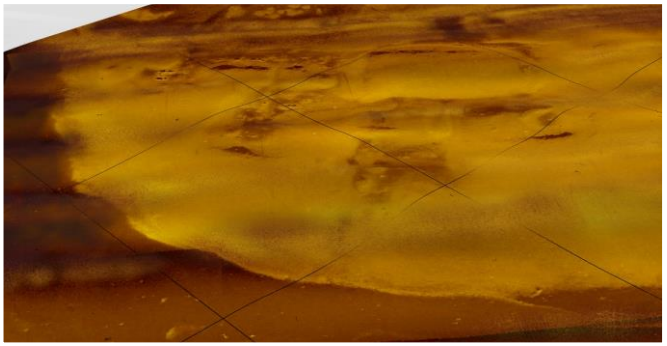


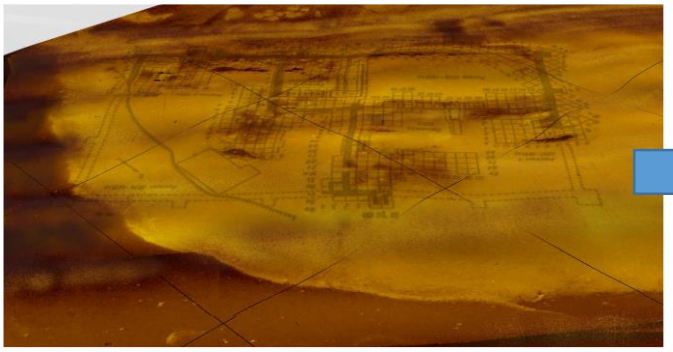


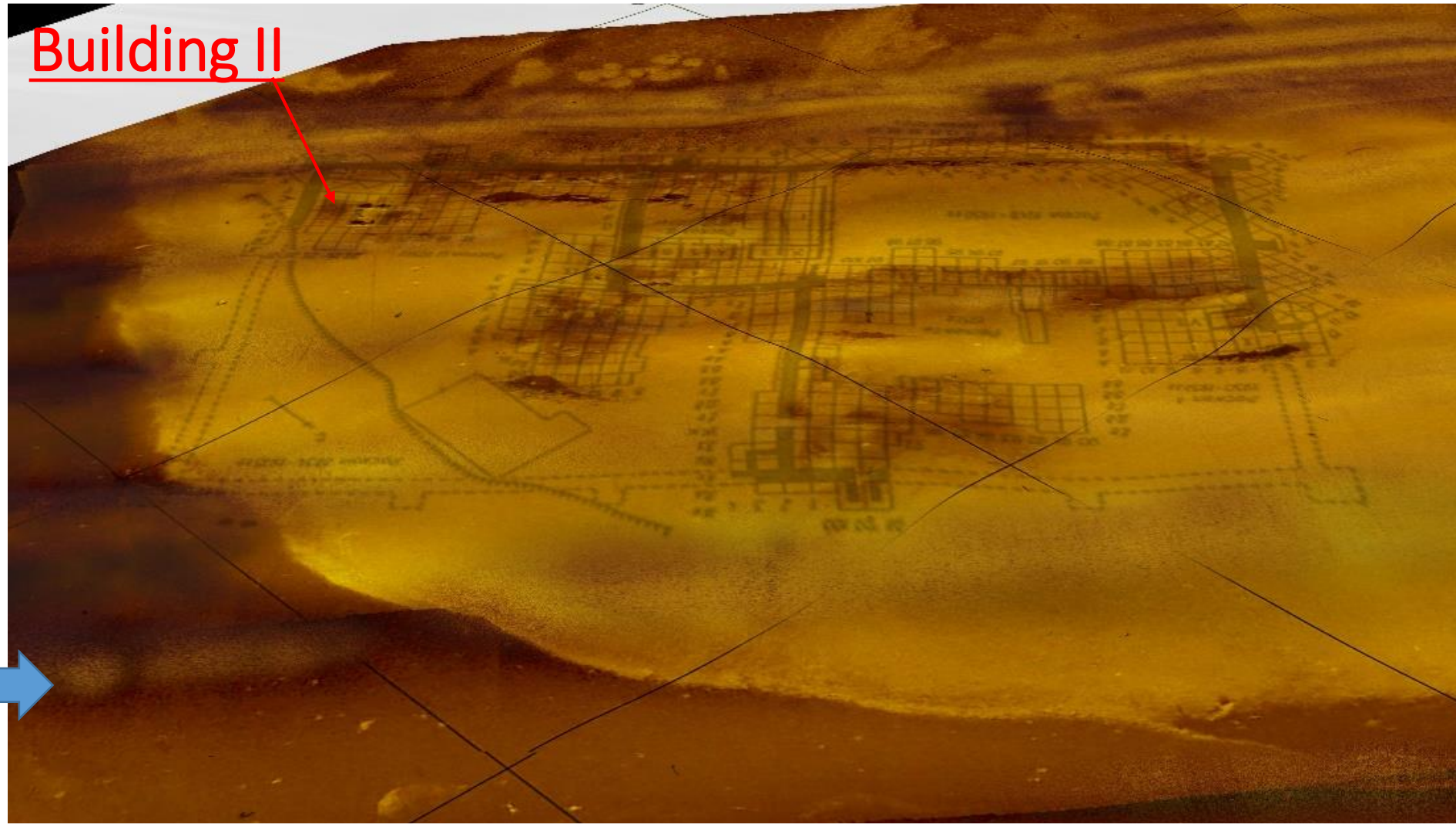


Comparison of aerial photography in 1951 with a 3D model made on the basis of bathymetry and SSS mosaic









Building II

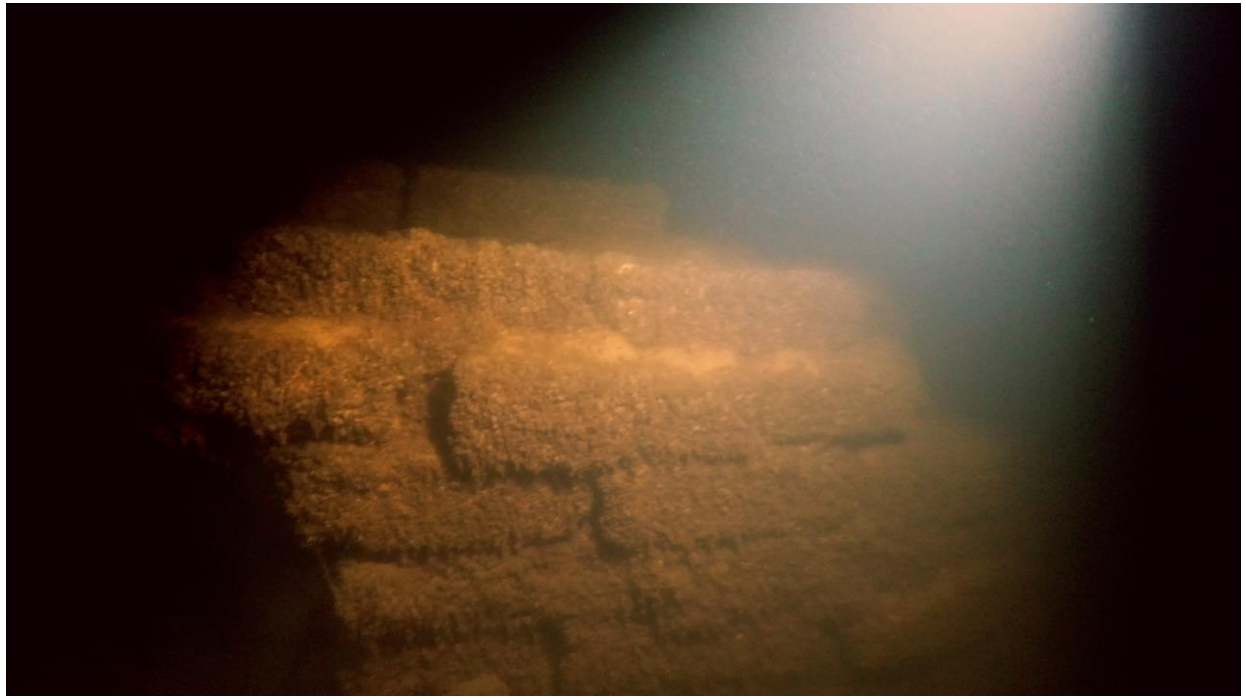
Dives were made on the archeological site and a visual inspection was carried out and surface material was collected from the bottom.

As a result of diving operations, the remains of buildings excavated by the expedition of M. Artamonov were discovered.

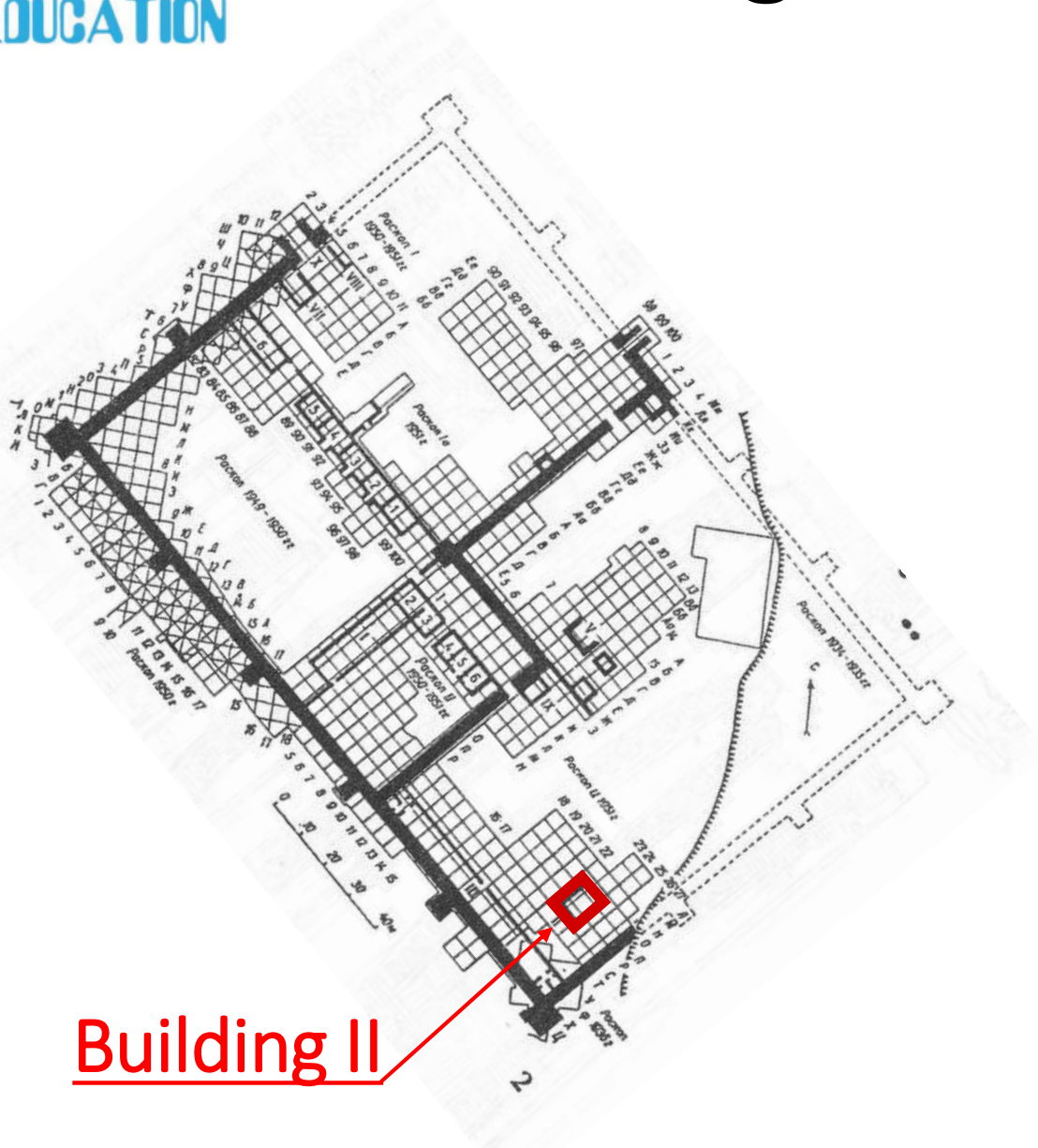
One of which was identified as Building II according to M. Artamonov's excavation reports.

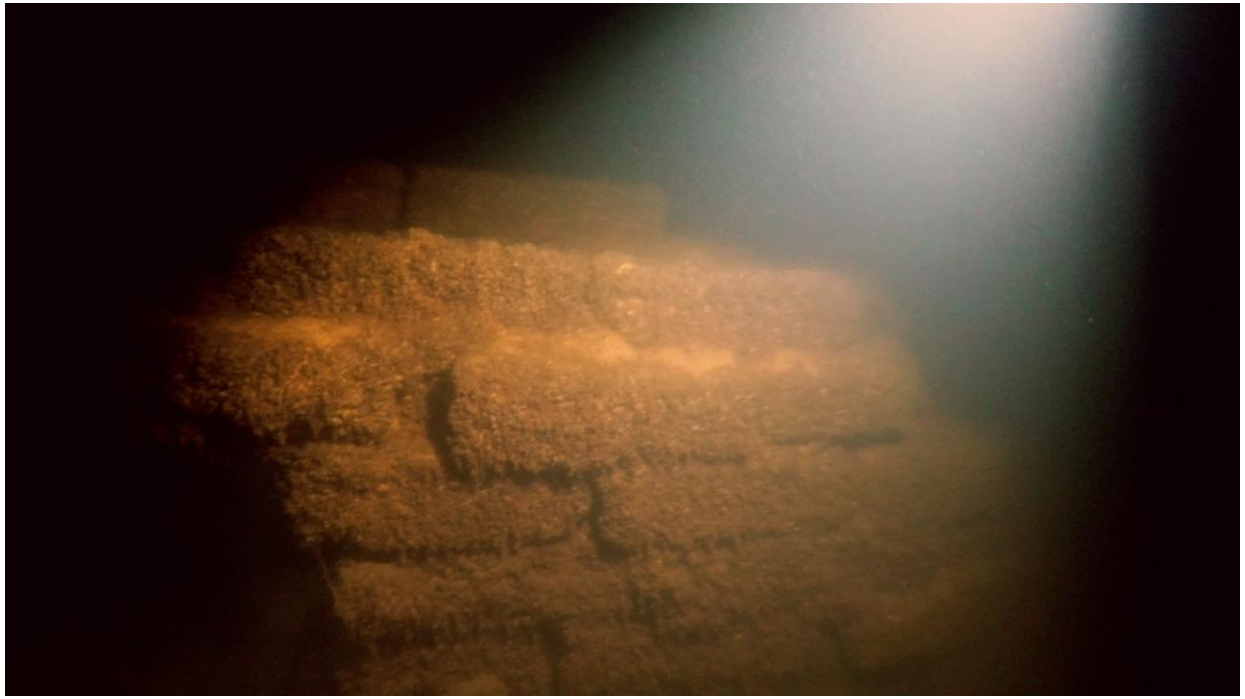
The walls of the building rise above the bottom to a height of up to 70 cm . During visual inspection and probing, it was found out that the lowlands at the excavation sites were filled with silt to a depth of at least 70 cm.

Despite the complete darkness and poor visibility, it was possible to build a 3D model of this area using photogrammetry methods.



Building II





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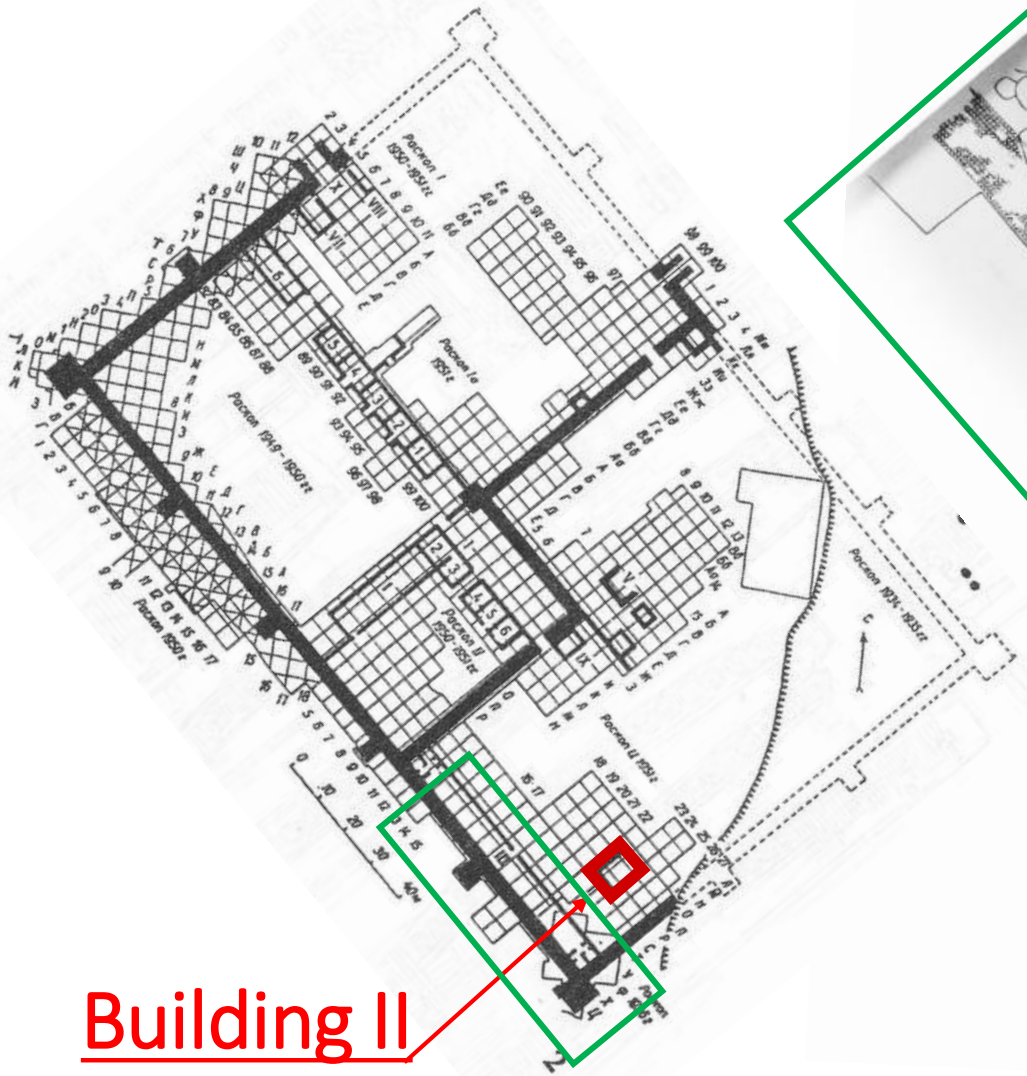
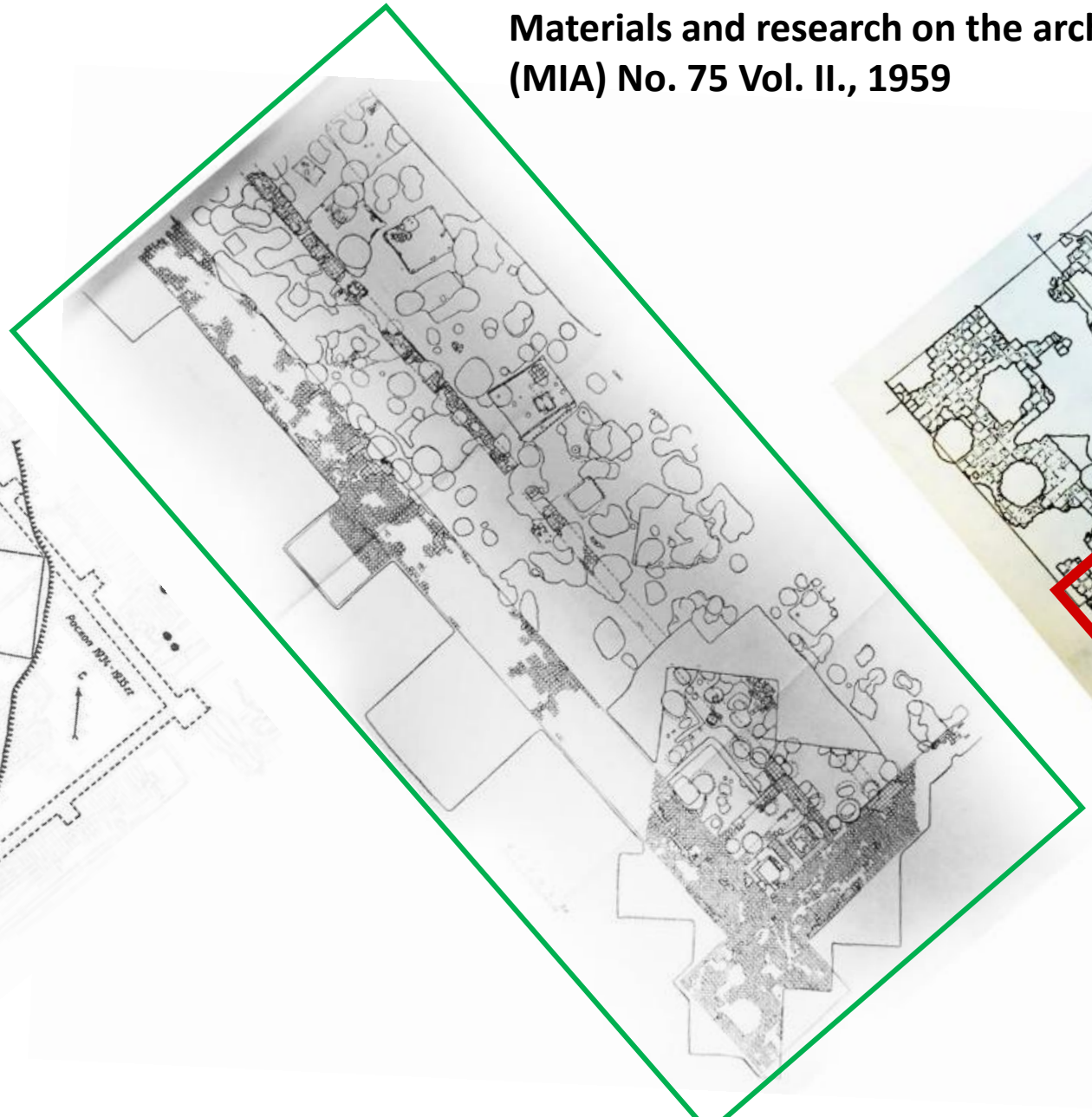
3D model of part of Building II made using photogrammetry method.

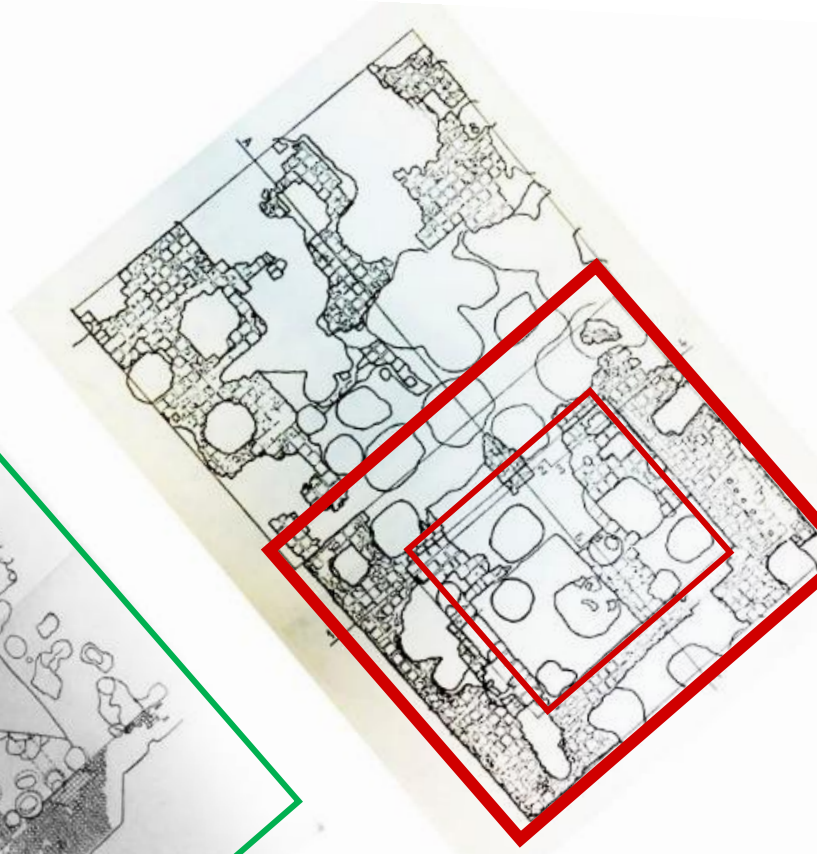
Building II and the South tower

Materials and research on the archaeology of the USSR (MIA) No. 75 Vol. II., 1959

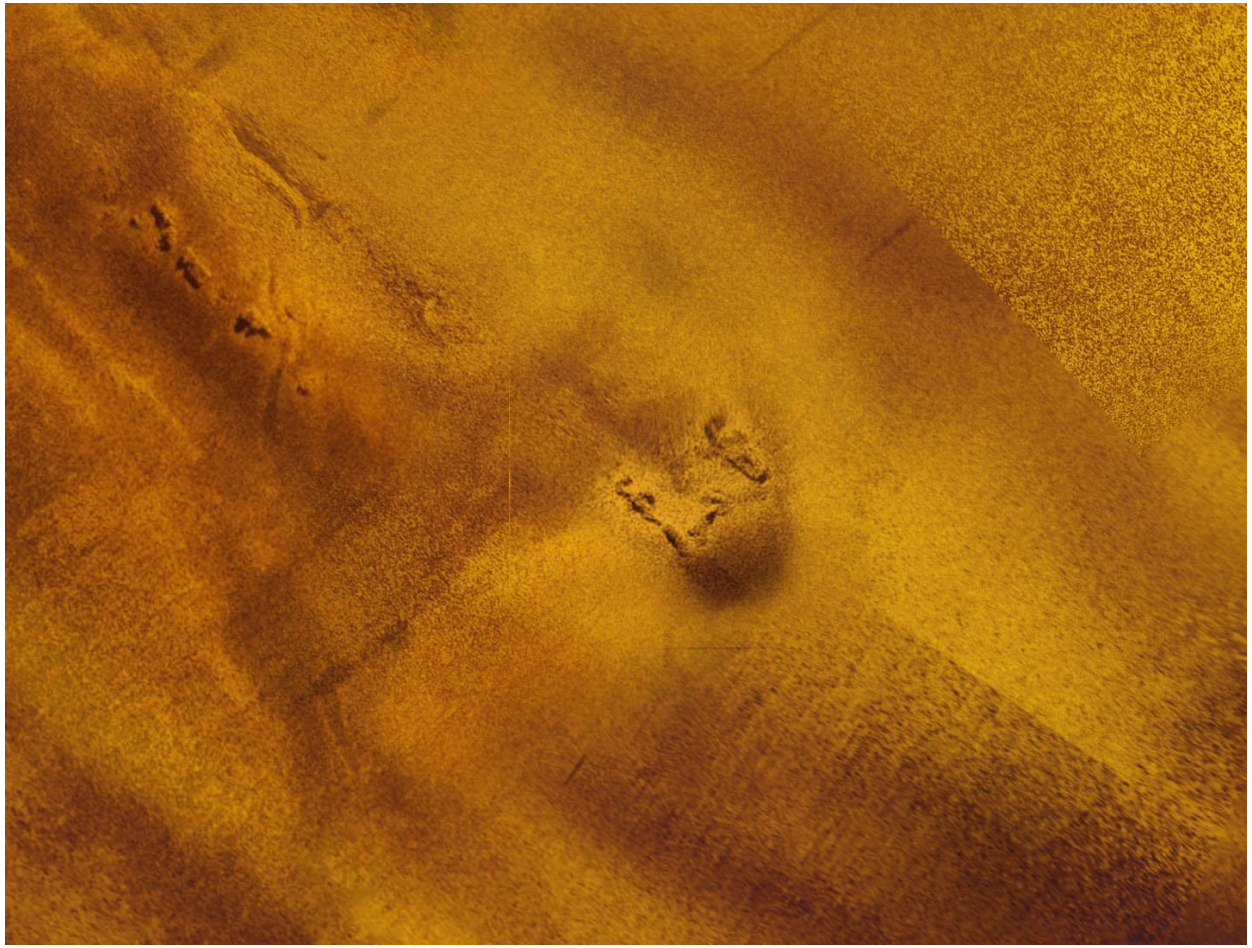


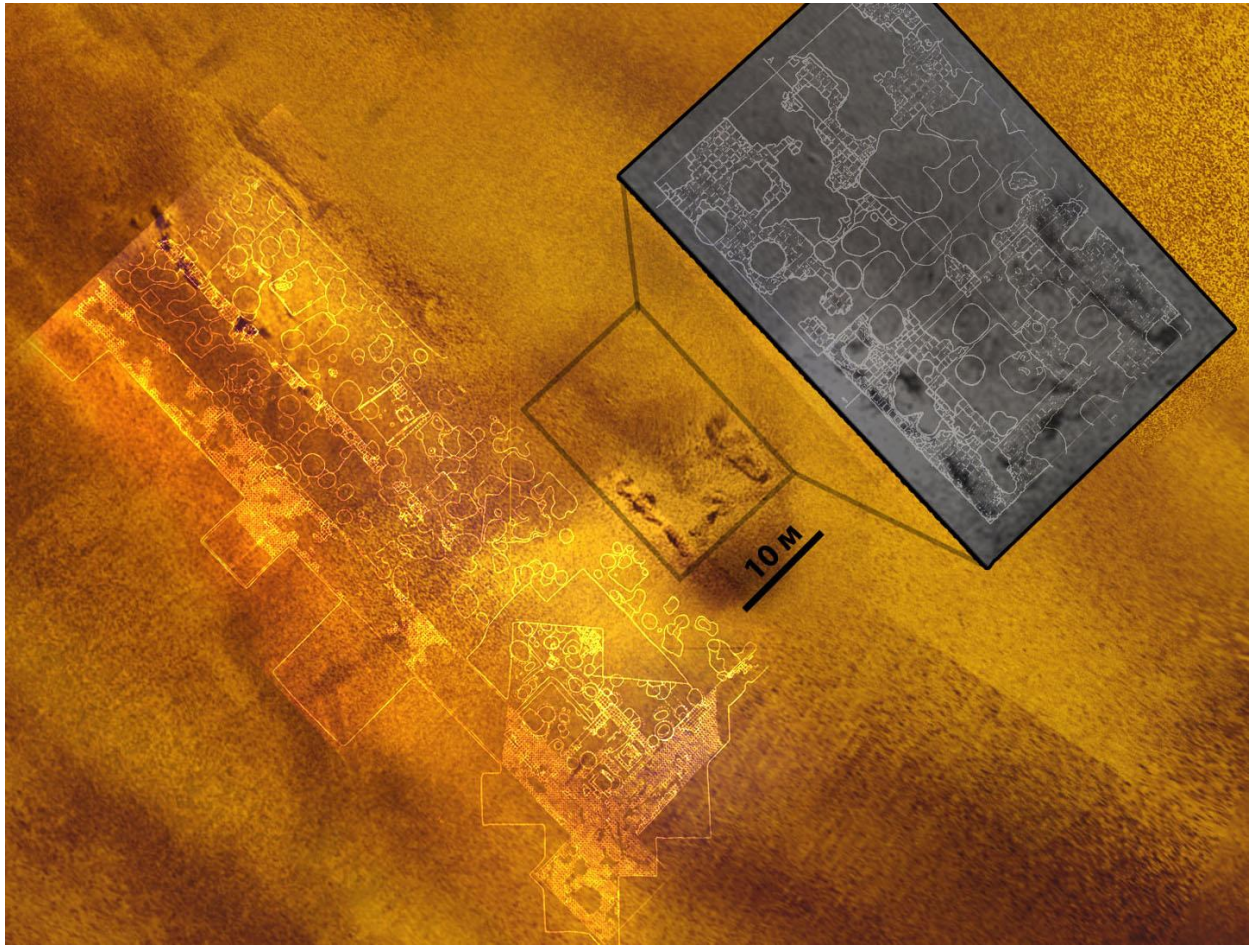
Building II





SSS survey of the South tower area and Building II with matching excavation plans





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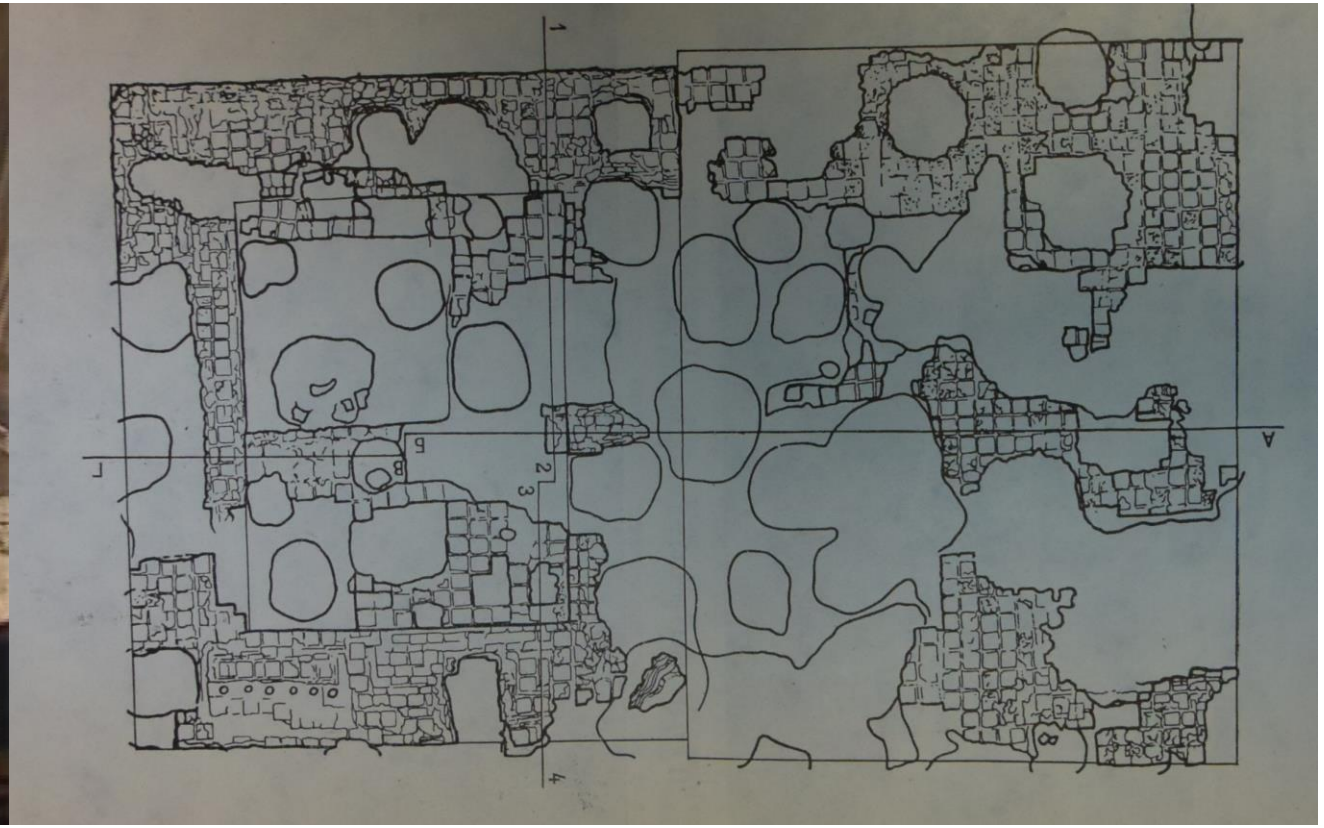
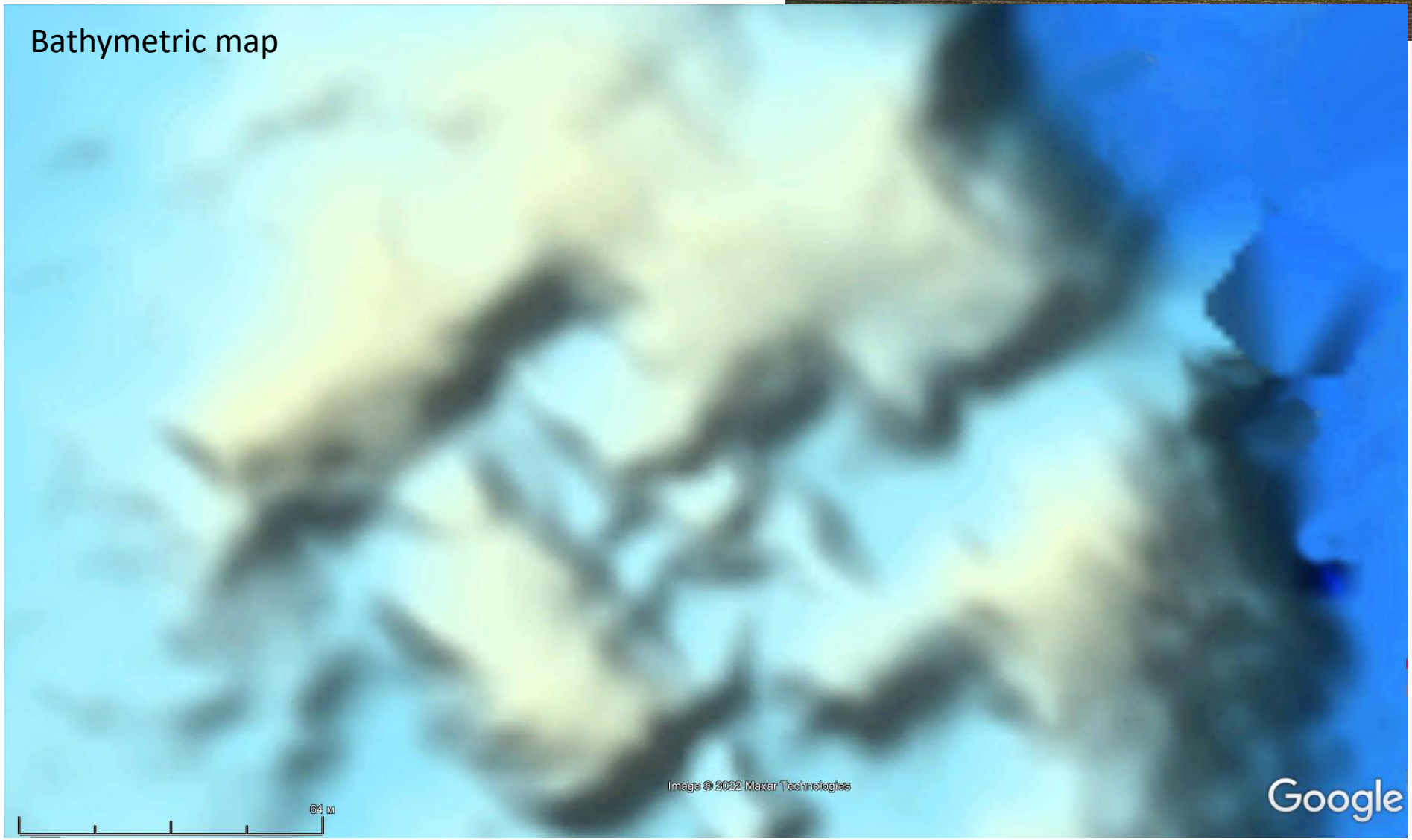
The model of building II in the funds of the Hermitage Museum and the excavation plan of this building (MIA) No. 75 Vol. II., 1959



Magnetometry

A magnetometric survey was carried out in the immediate vicinity of the bottom surface.

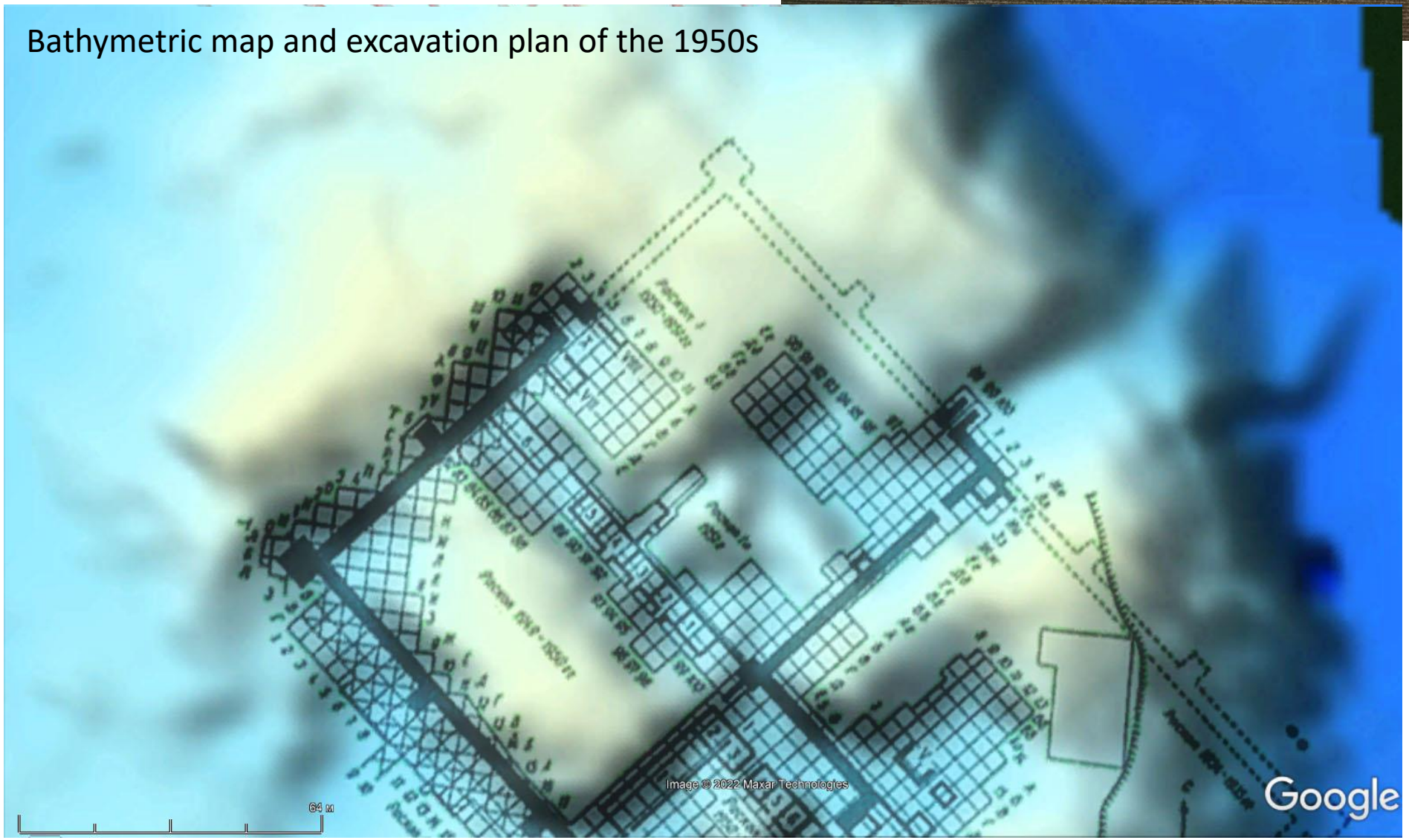
Bathymetric map



Magnetometry

A magnetometric survey was carried out in the immediate vicinity of the bottom surface.

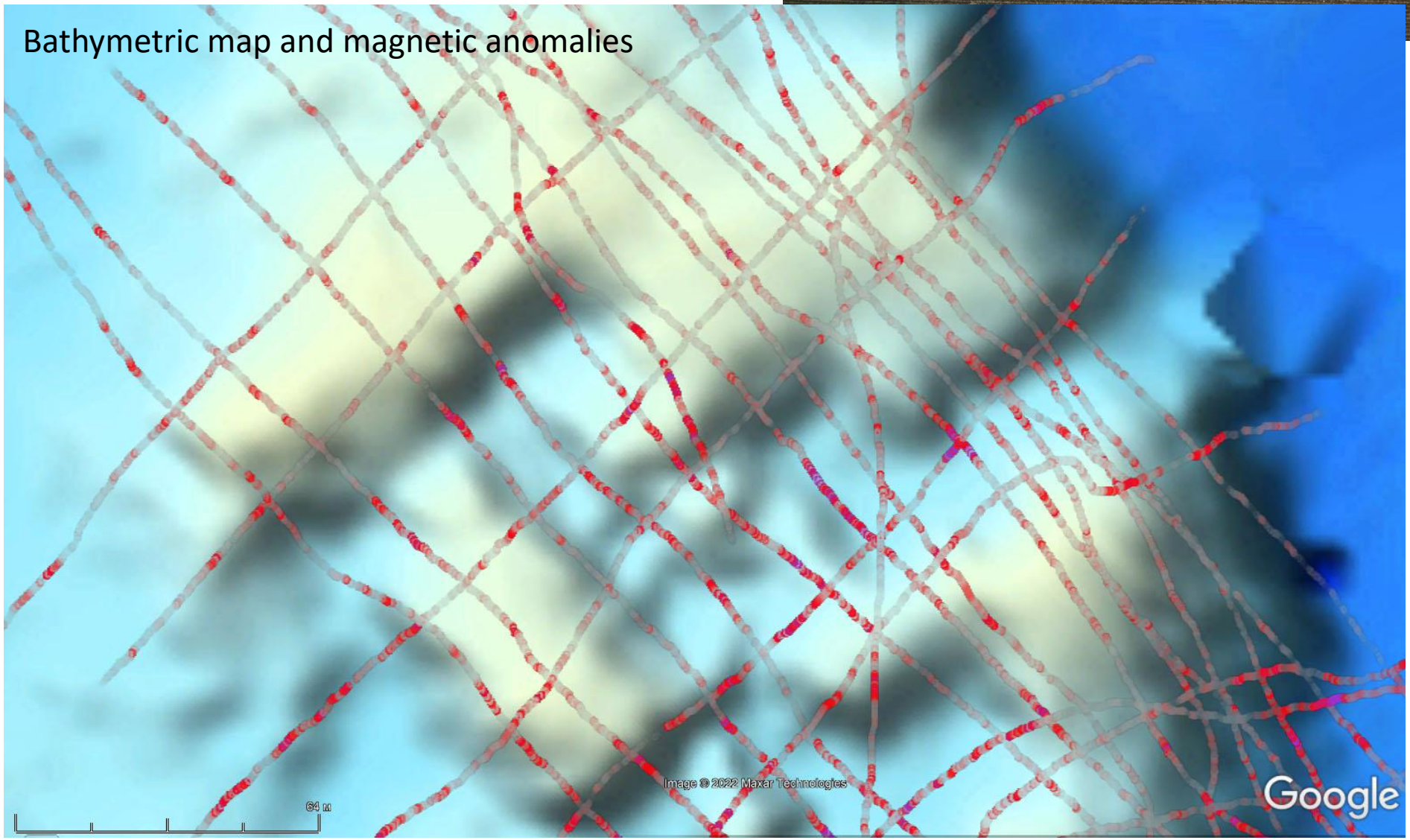
Bathymetric map and excavation plan of the 1950s



Magnetometry

A magnetometric survey was carried out in the immediate vicinity of the bottom surface.

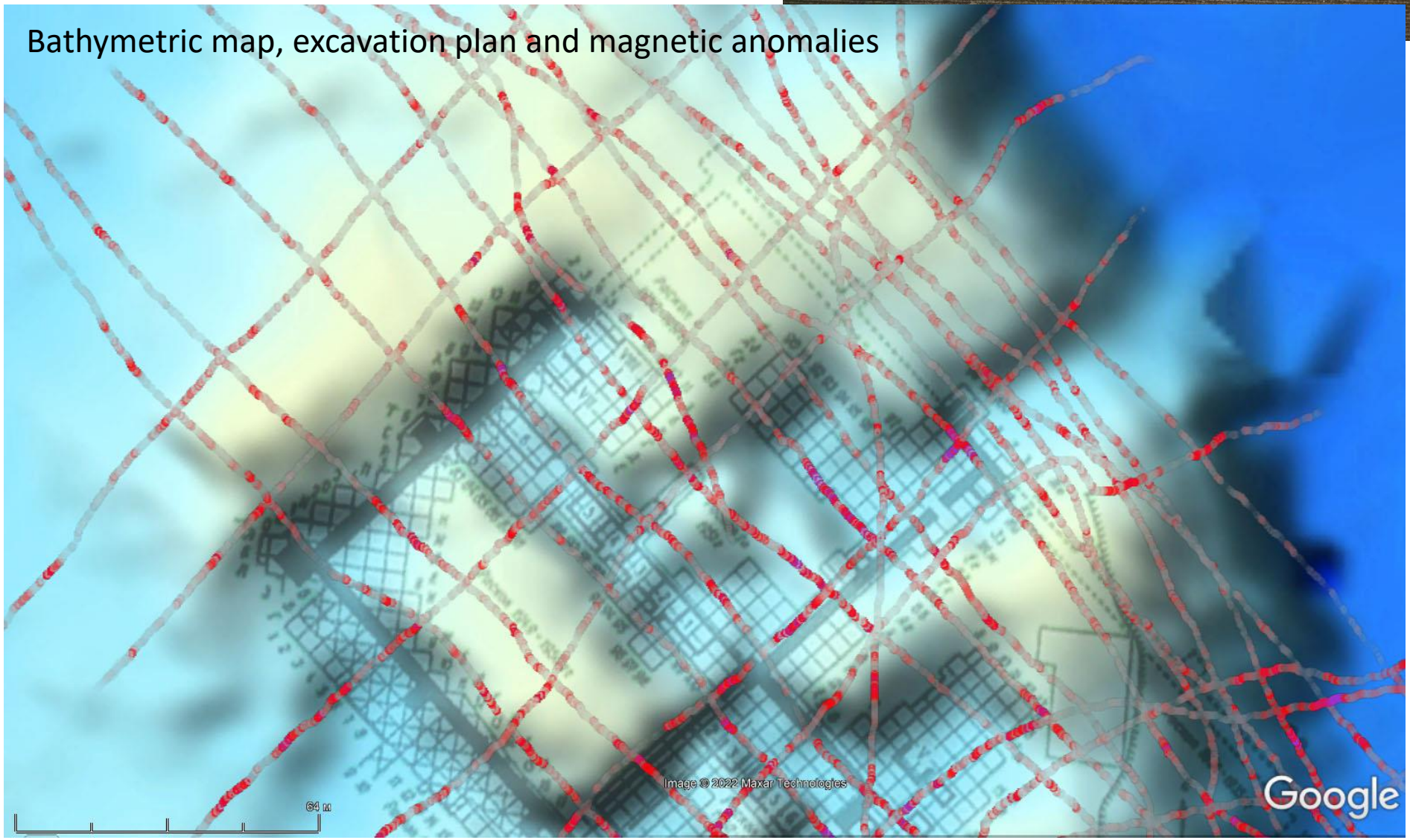
Bathymetric map and magnetic anomalies



Magnetometry

A magnetometric survey was carried out in the immediate vicinity of the bottom surface.

Bathymetric map, excavation plan and magnetic anomalies



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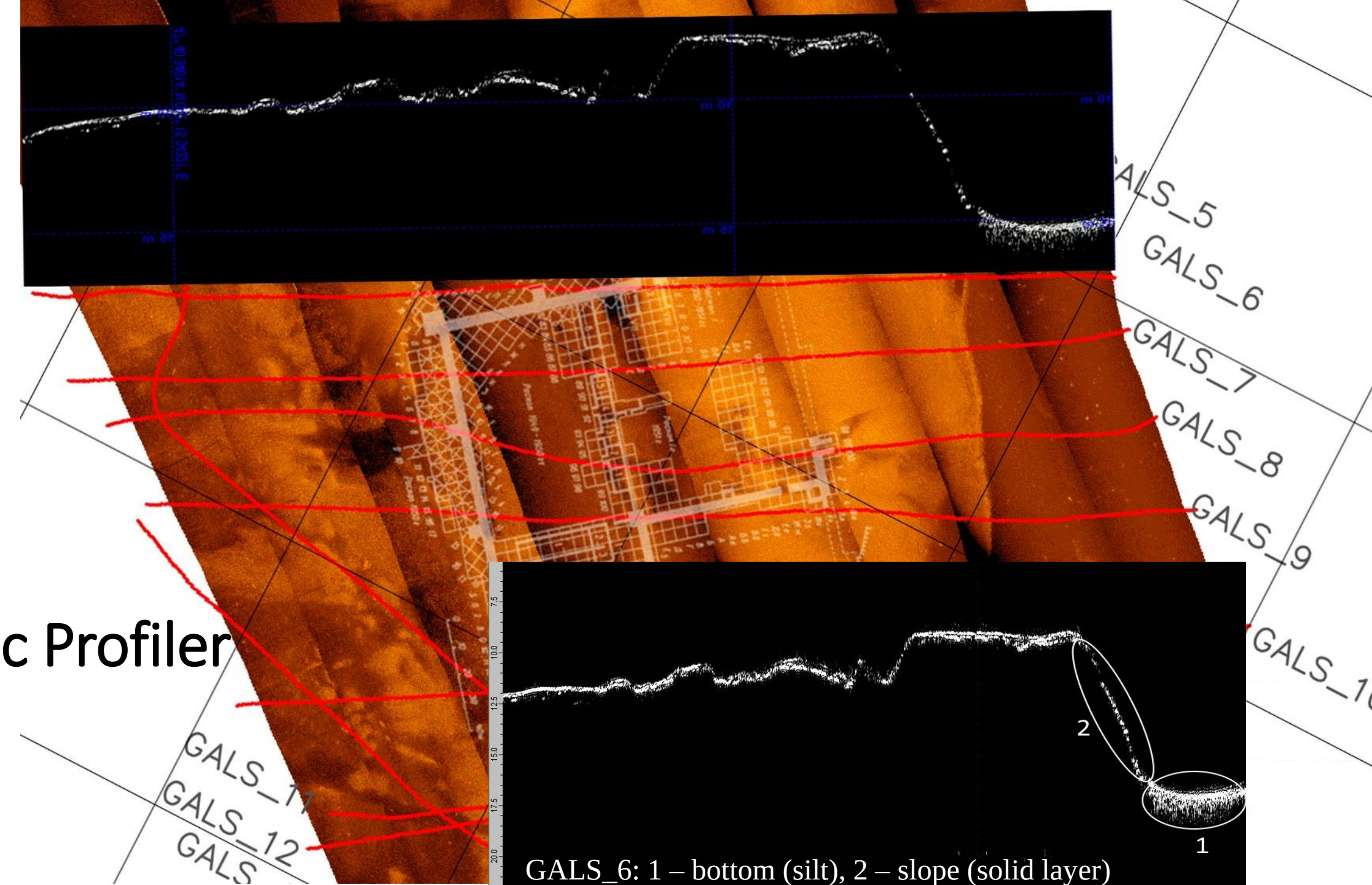
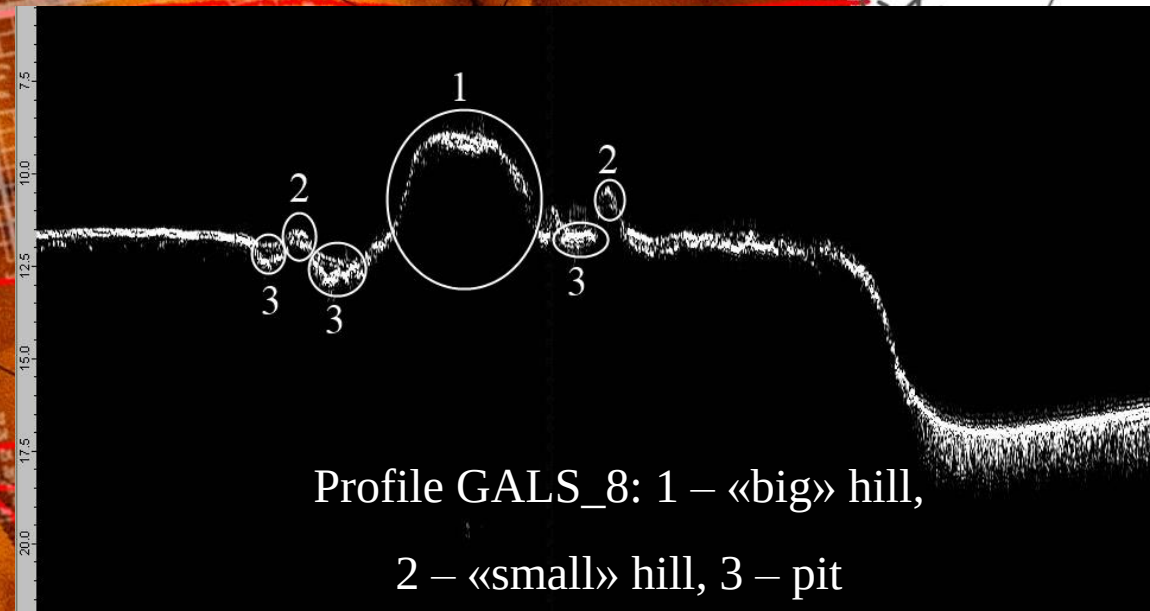
Bottom scanning with Acoustic Profiler Tack diagram

Acoustic Profiler Gals 6



GALS_6: 1 – bottom (silt), 2 – slope (solid layer)

Acoustic Profiler Gals 8



Profile GALS_8: 1 – «big» hill,

2 – «small» hill, 3 – pit

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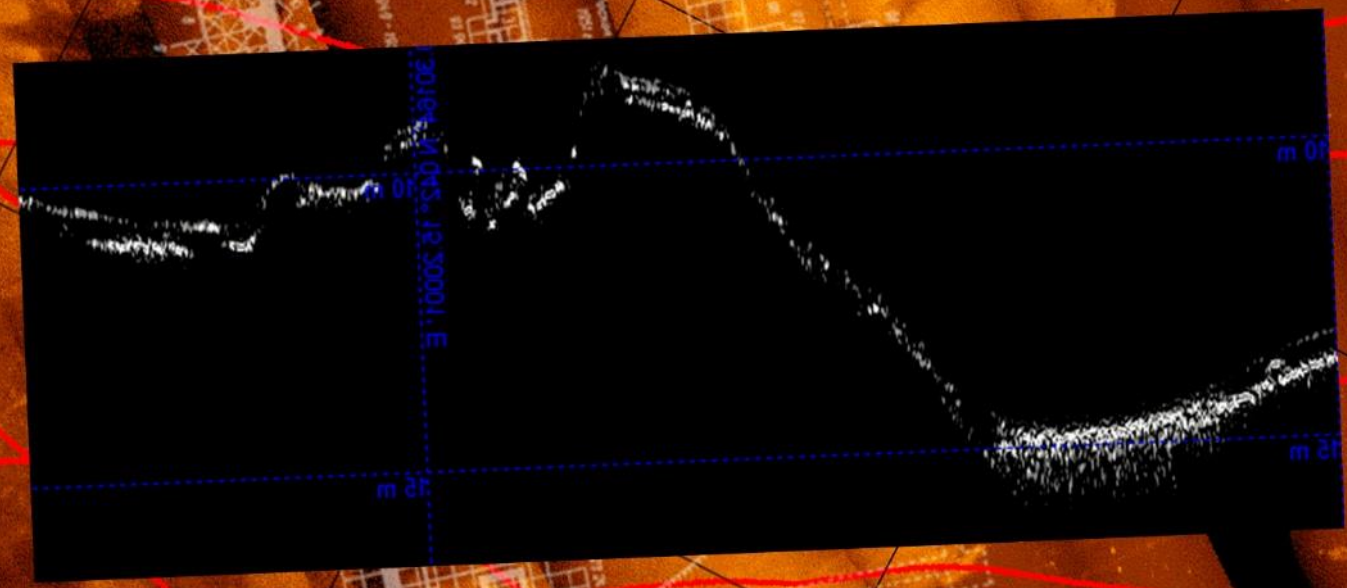
Acoustic Profiler Gals 11

Profile GALS_11: 1 – «big» hill,

2 – «small» hill, 3 – pit



GALS_8

GALS_9

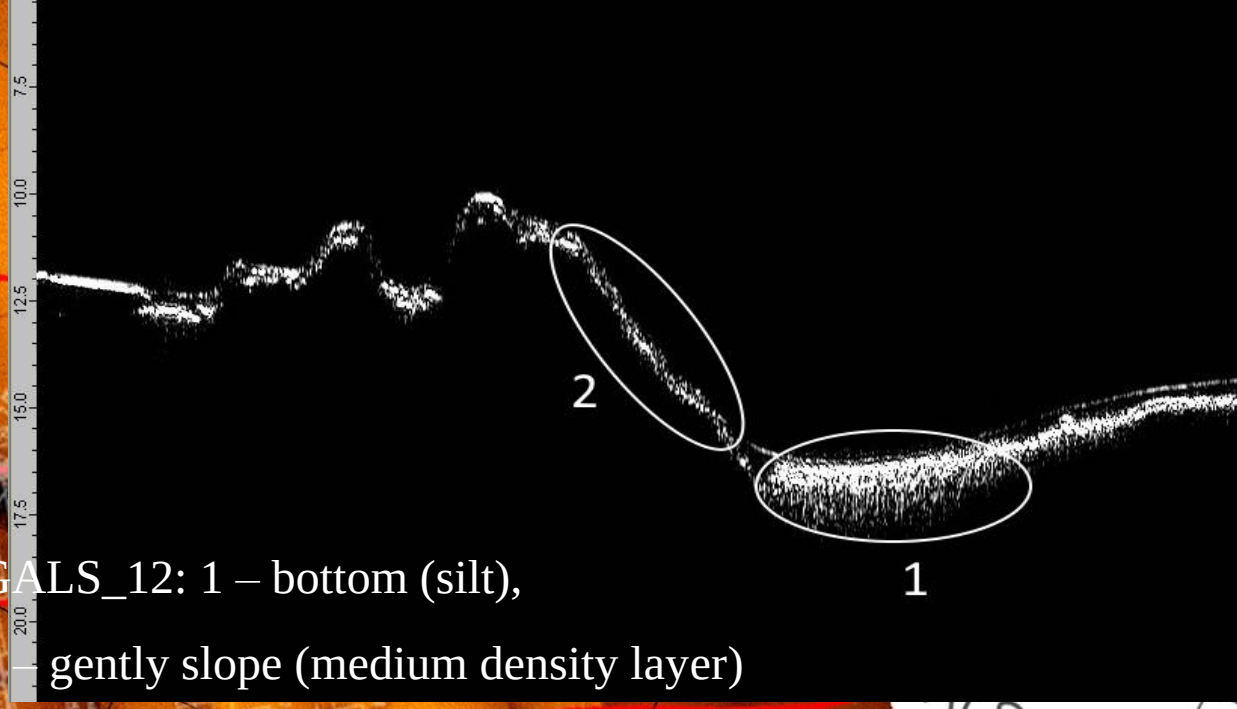
GALS_1

GALS_11

GALS_12

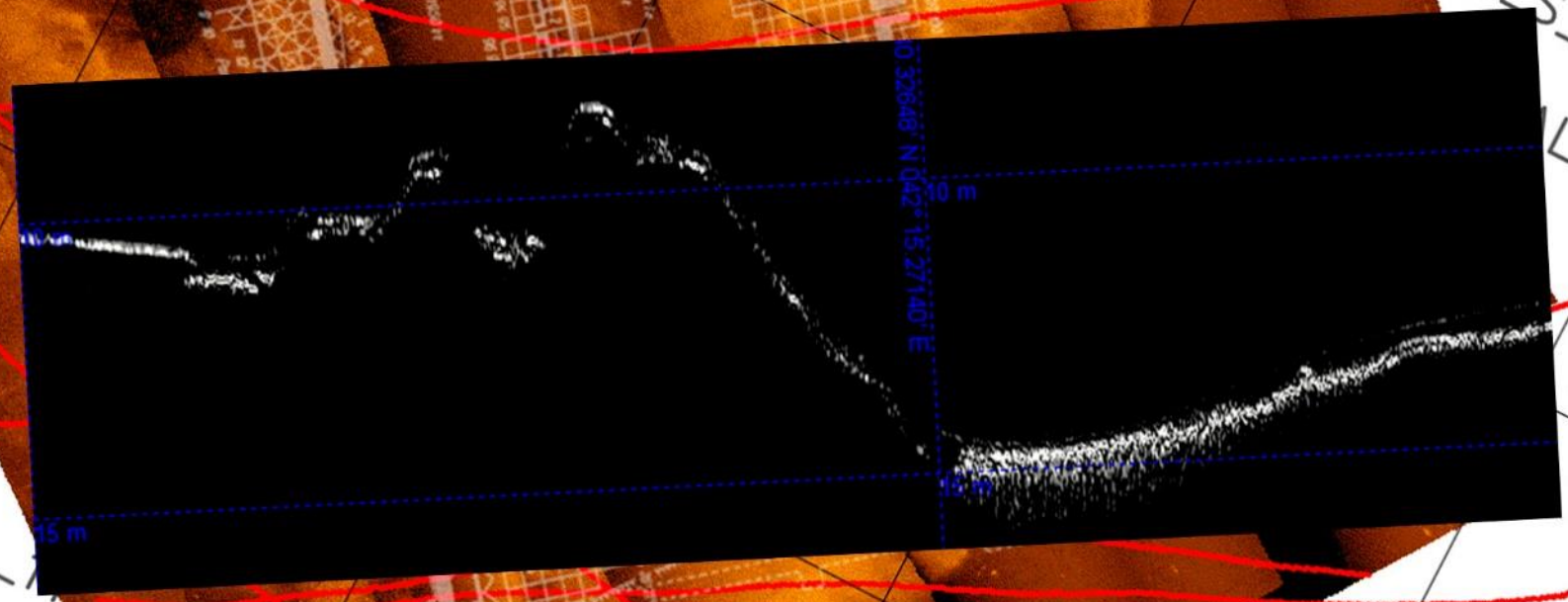
GALS

Acoustic Profiler Gals 12



GALS_12: 1 – bottom (silt),

2 – gently slope (medium density layer)



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