UNDERWATER ARCHAEOLOGICAL SURVEYS

Application of geophysical prospecting methods for the purposes of underwater archaeological research in the Black Sea

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Durankulak Like and shallow sea Bathymetry.

South Stream
Bathymetry Multi-beam, Magnetic/Gradient, Side Scan, Sub-Bottom and Electrical survey.

Pomorie 2 areas.
Bathymetry Multi-beam, Side Scan, Sub-Bottom and Electrical survey.

Chernomoretz
Bathymetry Multi-beam, Side Scan, Sub-Bottom and Electrical survey.

Sozopol
Bathymetry Multi-beam, Side Scan, Sub-Bottom and Electrical survey.

Ropotamo–Primorsko–Kiten–Oazis
Bathymetrical, LiDAR, side scan and sub-bottom.

Ahtopol – Silistar
Bathymetrical, side scan.

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RESEARCH METHODOLOGY

The systematic remote-sensing investigation conducted by CUA on several sites was designed to provide accurate location and reliable identification of potentially significant targets, as well as assessment, and documentation of submerged cultural resources in the study areas.

Considering the limitations of each single geophysical prospecting method, a set of magnetic, acoustic and electric remote-sensing equipment was employed for the purposes of the survey.
EQUIPMENT USED:

1. **Side scan sonar** as an imaging system for acquisition of data about the character of the sea bottom and for locating sites/objects of potential cultural value;

2. **Single-beam echo sounder** – as a back-up control system for depth measurement, as well as for data acquisition in areas, where other methods cannot be applied;

3. **Multi-Beam echo sounder** – for the development of Digital Terrain Models;

4. **Sub-bottom profiler** – for obtaining vertical sections of sediment layers;

5. **Four DGPS systems** – for heading and positioning;

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6. **Marine acquisition 10 channels resistivity-meter** of a “dipole-dipole array” type; with a tow cable with 5 m electrode spacing, and a symmetrical Schlumberger scheme with maximal electrode spacing of 100 m for land measurements;

7. **Magnetometer/gradiometer** for conducting of magnetic and magnetic gradient survey for locating magnetic anomalies caused by metal objects of different size;

8. **Supporting computer systems with the relevant software** for data acquisition and post-processing.

9. **Metal detector** with different coils;

10. **Video and camera equipment** (tow & drop camera, ROV, still camera);

11. **Diving equipment** – surface supply and scuba.
Side scan sonar as an imaging system for acquisition of data about the character of the sea bottom and for locating sites/objects of potential cultural value.
Multi-beam echo sounder – for the development of Bathymetric Charts and Digital Terrain Models;
Single-beam echo sounder – as a back-up control system for depth measurement, as well as for data acquisition in areas, where other methods cannot be applied.
**Sub-Bottom Profiler** – for receiving a vertical section of the sea bottom.

SUB BOTTOM PROFILER SES-2000, INNOMAR TECHNOLOGIE GMBH

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Marine acquisition of a "dipole-dipole array" type; scheme with maximal electrode spacing of 100 m for land measurements with a tow cable with 5 m electrode spacing, and a symmetrical Schlumberger type; marine acquisition 10 channels resistivity-meter of a "dipole-dipole array" type;
Magnetometer/gradiometer for conducting of magnetic and magnetic gradient survey for locating magnetic anomalies caused by metal objects of different size

G-882TVG CESIUM MAGNETOMETER & TRANSVERSE GRADIOMETER

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Up to four DGPS systems – for heading and positioning
8. Supporting computer systems with the relevant software for data acquisition and post-processing

Principal block scheme of the device connections
SENSOR INSTALLATION
9. Metal detector with different coils

Pulse 8X
Video and camera equipment (tow & drop camera, ROV, still camera)

TOV-1 Camera

Video Recorder and Monitor
11. Diving equipment – surface supply and scuba
Diving equipment – surface supply and scuba

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MOMENTS IN ACTION

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SIDE SCAN SONAR SURVEY

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SIDE SCAN SONAR SURVEY - TARGETS

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SIDE SCAN SONAR SURVEY - TARGETS

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SIDE SCAN & MULTIBEAM SURVEY

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MULTIBEAM SURVEY – Pasha Dere@Varna / 3D Digital Terrain Model

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MULTIBEAM SURVEY – Pomorie #01

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SUB-BOTTOM SURVEY – Sozopol

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SUB-BOTTOM SURVEY – Sozopol / reconstruction of the palaeo-terrain by sub-bottom data

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Complex interpretation Electrical & Sub-Bottom data – Pasha Dere @ Varna

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Magnetic & Magnetic Gradient Survey – Pasha Dere @ Varna

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THANK YOU!

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