Side-scan sonar

Principle: Side-scan sonars emit conical or fan-shaped pulses across a wide angle perpendicular to the path of their towed sensors ('towfish'). The received signals create a detailed image of the reflectivity of the sea floor ("sonograph") and its anomalies within the swath (coverage width) of the beam. The reflectivity of the seafloor depends on its roughness and the nature of the topmost material: coarse-grain sediments display higher reflectivity than fine-grain deposits, rocky outcrops reflect higher than sediments, etc.

Basic features: Side-scan sonars are very useful for mapping archaeological features that are visible on or above the bottom (wrecks, exposed pole and rock structures, etc.) They are unable to penetrate the sediments and can therefore only provide information about the exposed surface of the sea floor. Normally frequencies between 100 and 1000 kHz are used.

Resolution and horizontal precision: Higher frequencies yield better across track resolution (perpendicular to the direction of movement) but involve a narrower swath. Depending on the frequency of the emitting signal, a resolution of up to a few centimetres can be achieved. Along track resolution (parallel to the direction of movement) depends on the cruising speed and the triggering rate of the emitted signal. Slow cruising speed and high triggering rates enable higher resolution along track.

Platforms: Side-scan sonars can be operated from small vessels in water depths down to about 2 m. The fish can either be towed behind the ship or fixated at the bow. The latter has the advantage that it is out of the bubbles of the propeller and the GPS antenna can be placed directly above it, which can provide better recordings with more precise positioning.

Advantages:
- High resolving detail
- Can be operated from very small vessels
- Can be used in very shallow water
- Small objects (dm range) can be detected

Disadvantages:
- No penetration below the seabed
- No precise geo-referencing
- Not suited for detection of most Stone Age sites
- No 3D bathymetry

Literature:
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Quinn, R. et al. 2005: Backscatter responses and resolution considerations in archaeological side scan sonar surveys: a control experiment. Journal of Archaeological Science, 32. 1252-1264.

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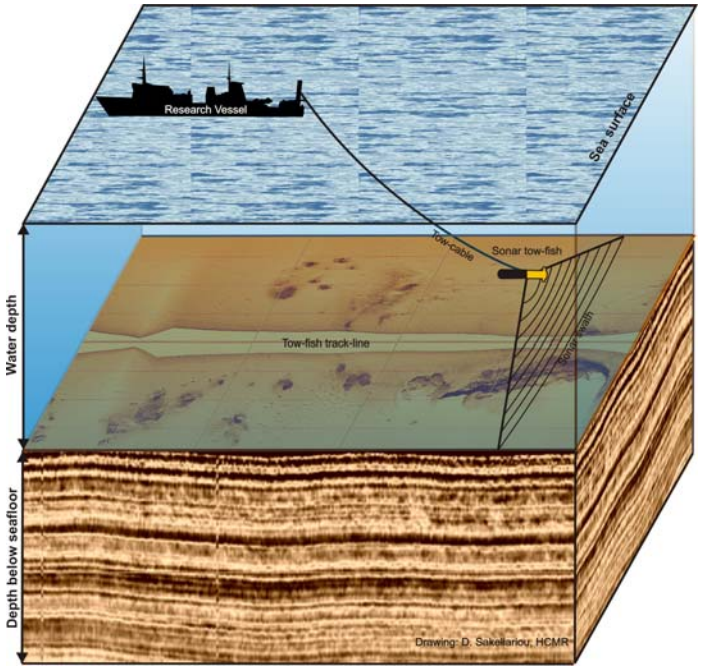

Fig. 1 Schematic showing a side-scan sonar towed behind the survey vessel. Drawing by D. Sakellariou

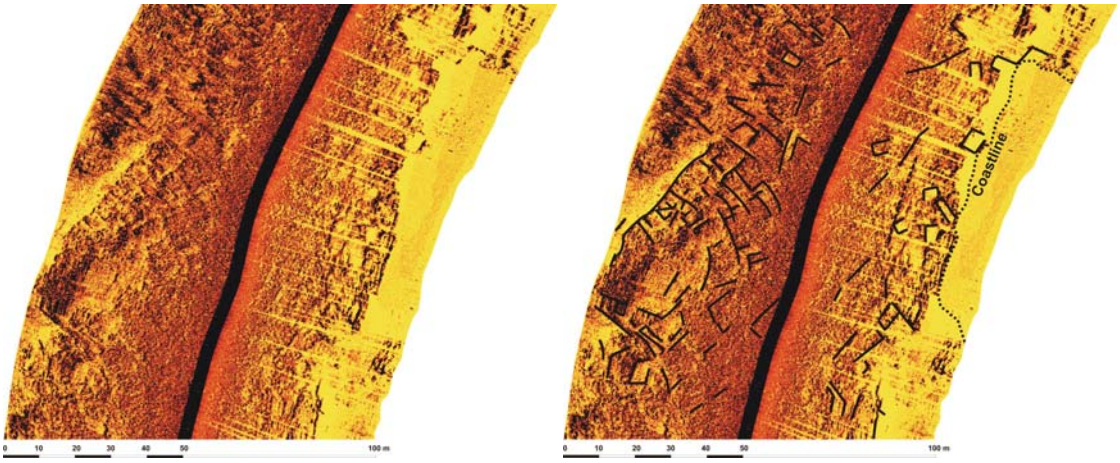

Fig. 2 Side-scan sonar image of the ruins of the submerged town of Pavlopetri, Peloponese, Greece. Left: raw image, Right: line drawing of the ruins.

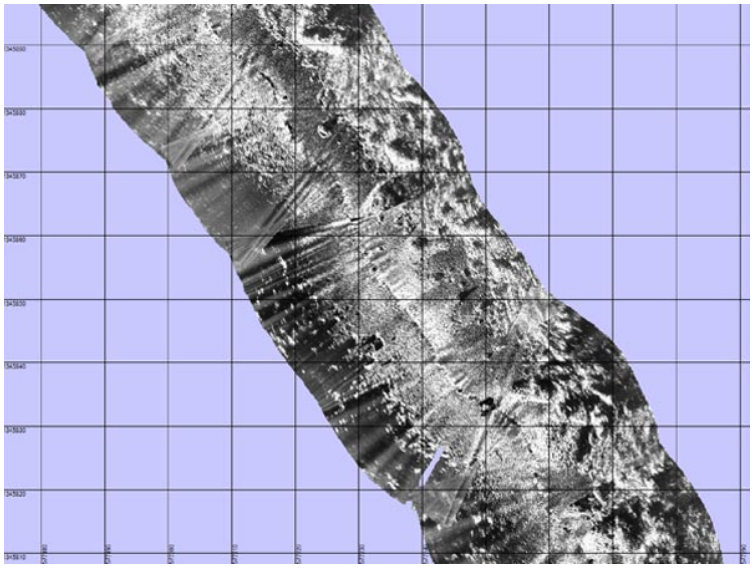

Fig. 3 High-resolution side-scan sonar mosaic. Bright areas indicate high return energy associated with coral fragments or scattered rocks, dark patches represent shadow zones or patches of soft sand and/or mud that absorb more sound than rocks or corals.(© NOAA)

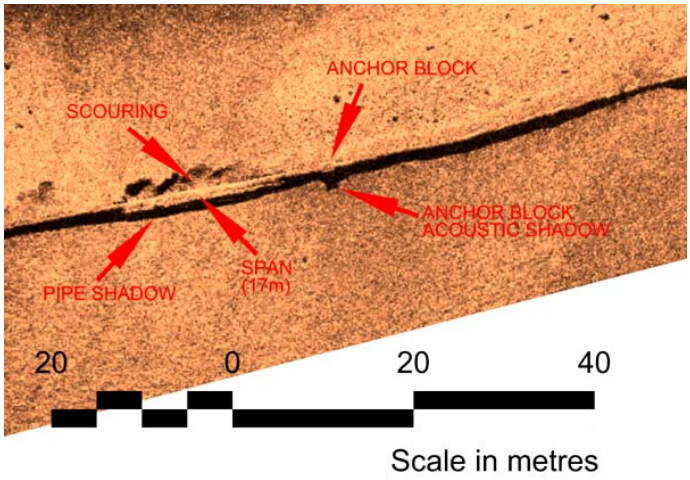

Fig. 4 Side-scan image of a pipeline and associated anchor blocks(© Terramote)