ACOUSTIC BACKSCATTER AT 95 KHZ FROM THE SEAFLOOR OFF NORTHERN ISRAEL

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Abstract

A new poster shows the acoustic backscatter as determined by innovative analysis of the returns from high resolution multibeam mapping of the Mediterranean continental shelf and slope off northern Israel. The backscatter received by a Simrad EM1002 sonar system was reanalyzed using the new Geocoder software developed at the Center for Coastal and Ocean Mapping (CCOM) at the University of New Hampshire in the USA. The poster is at 1:50,000 scale on a UTM projection. This poster appears on the backside of a laminated poster showing the bathymetric results.

Keywords : Acoustics, Swath Mapping, Continental Margin, Levantine Basin, Bathymetry.

A new poster prepared for mass distribution presents an image of the acoustic backscatter of the Mediterranean continental shelf and slope off northern Israel.

Technical Details

Offshore: This grayscale image of the seafloor is based upon the acoustic backscatter at 95 kHz obtained with a Kongsberg-Simrad EM1002 multibeam sonar system. On each swath, the EM1002 measures around 4,000 samples of the backscattered acoustic energy returning from the 111 2 degree beams impinging on the seafloor. Thus the 840 million soundings in the bathymetric survey represent about 7.5 million swaths, with over 40 billion backscatter samples.

The Geocoder software package (Fonseca and Calder, 2006), introduced at a two-day workshop (23-24 August 2006) at the Center for Coastal and Ocean Mapping at the University of New Hampshire (CCOM-UNH) in Durham, NH, USA, was used to process these measurements to produce a uniform representation of the acoustic backscatter in reproducible decibels (db).

Geocoder corrects the original backscatter time series registered by the sonar for angle, varying gains, and beam pattern. It filters out speckle and corrects for slant range. Every backscatter sample is geocoded using several algorithms, which apply anti-aliasing, mosaicking, and blending between swaths. The final mosaic exhibits low noise, few artifacts, reduced seams between parallel acquisition lines and reduced clutter in the near-nadir region, while still preserving regional data continuity and local seafloor features. The mosaic resolution here is 5 m, tied to the underlying bathymetric grid. Resolutions as high as 25 cm are possible inshore. Lighter regions represent higher backscatter. The original mosaic image has been contrast-stretched using Adobe PhotoShop, but this is reflected in the accompanying decibel scale.

Land: The Survey of Israel's 1:50,000 scale topocadastral map sheets are reproduced on land in Hebrew. They are texturized with the Survey's 4 m digital terrain model (DTM) using Global Mapper software with the sun in the northwest (N315E) at 45 degrees altitude and a vertical exaggeration of 2.

Map Projection: The image is at scale 1:50,000 on the Universal Transverse Mercator (UTM) Projection (Zone 36), on the WGS-84 datum.

Acoustic Characterization of the Offshore:

Kurkar ridges: The kurkar ridges show the higher backscatter. This is a result of their relative hardness, as well as the roughness of the biological growth that blankets them. Of note are the meanders and inter ridge areas with lower backscatter, representing channel bed deposits, softer sediments, and generally smoother seafloor.

Sedimentary facies: Areas of higher backscatter in deeper waters beyond the kurkar ridges on the shelf south and west of the Carmel may be related to the higher percentage of coarser sand within the sediments. Opposite the Zebulun Valley and beyond the ridges within Haifa Bay the backscatter is lower, likely related to the finer silt and mud fraction. Farther north, higher backscatter appears to be related to the slightly uplifted platform.

Dune-like bedforms on the outer shelf: The areas of dune-like bedforms and the northernmost Shaal Ridge have slightly higher backscatter, possibly related to induration and roughness.

Brittle Sheet Area: Within the so-called broken 'Brittle Sheet' area 8 km NNW of the Carmel Cape, high backscatter is associated with the lows, and low with the upraised blocks. The topography here is around 2-3 m. Note the distinct NNE trending demarcation between high backscatter on the west and lower backscatter on the east.

Bulls' Eyes: Northwest of the Brittle Sheet area, within a triangular zone, more than 100 circles of high backscatter are visible. These are from 30 to 120 m in diameter; a few are associated with a subdued crater-like topography. These may be areas of gas or fluid seepage.

Man's activities: Opposite Haifa Port at depths of 10-12 m, just south of the kurkar ridges, brighter areas stand out. These are likely dumpsites of material dredged from the port. East of the Brittle Sheet area, a mottled zone may show much older material dumped during major port expansions. Parallel low contrast brush-like strokes farther to the west may indicate the marks of fisherman's bottom trawls.

Reference

Fonseca, L. and Calder, B., 2006. Geocoder: An Efficient Backscatter Map Constructor. Center for Coastal and Ocean Mapping, University of New Hampshire. Available at www.thsoa.org/hy05/08_3.pdf.