

EMSEAC - ELECTROMAGNETIC SEAFLOOR PROFILER FOR ENVIRONMENTAL MAGNETIC RESEARCH IN COASTAL AND SHELF SEAS

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A marine electromagnetic profiler was developed to survey the magnetic and electric signatures of marine near-surface sediments (0-50 cm). The system is devised for coastal and shelf operations of 5 to 500 m water depth, to resolve subtle and gradual variations in silt and clay content, porosity and diagenesis state at sub-meter resolution. A commercial electromagnetic induction (EMI) sensor was modified for submarine operations and mounted into a bottom-towed sledge enabling synchronous in-situ mapping of magnetic susceptibility and electrical conductivity. Magnetic susceptibility is used as a proxy for fine-grained terrigenous clay/silt content, diagenetically forced magnetite depletion, anthropogenic metallic contaminants as well as proneness to trace metal accumulation. Electric conductivity is primarily considered as a measure of porosity and grain-size distribution. The sensor is used to investigate patterns of sediment transport and deposition and to detect fluid seepage and pollution effects. The 3.2 m long non-magnetic and non-conductive sledge, named GEM-SHARK, is towed by small to large size research vessels at a typical speed of 2 to 4 knots. Onboard control and co-registration of seafloor measurements is provided via an up to 10 km long armored coax cable, supported by an autonomous registration, navigation and control system in the bottom-towed sledge. A complementary CTD tracks bathymetry and identifies bottom water characteristics.

During deployments at the Baltic Sea Eckernförde Bight, NW Iberian Shelf and estuaries, and recently at the Argentine Shelf and the Rio de la Plata mouth, the system has successfully covered more than 800 km with sub-meter resolution susceptibility and conductivity profiles. We will present data examples depicting cold seeps, sediment waves, mud belts and glauconite deposits and discuss the scopes and controls of combined electromagnetic in-situ profiling and sampling strategies.

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