

AN ASSESSMENT OF UXO DUMPSITES IN THE BLACK SEA

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In the decades following World War I and even more so during and after World War II, the major powers disposed of massive quantities of captured, damaged, and obsolete unexploded ordnance (UXO) by dumping them into the oceans.

The former USSR and now-a-days Russia has provided to the international community few records only of its sizable UXO dumping activities. Russian authorities admitted that more than 160,000 tons of chemical weapons may be settled on the seabed of Russian seas, which demonstrate a potentially enormous problem posed by Soviet ocean-dumped chemical weapons material. Similarly, more than 300,000 tons of chemical weapons munitions were left over in Germany and the United Kingdom (UK) after World War II, most of which were eventually dumped in the oceans (Wilkinson et al., 2017).

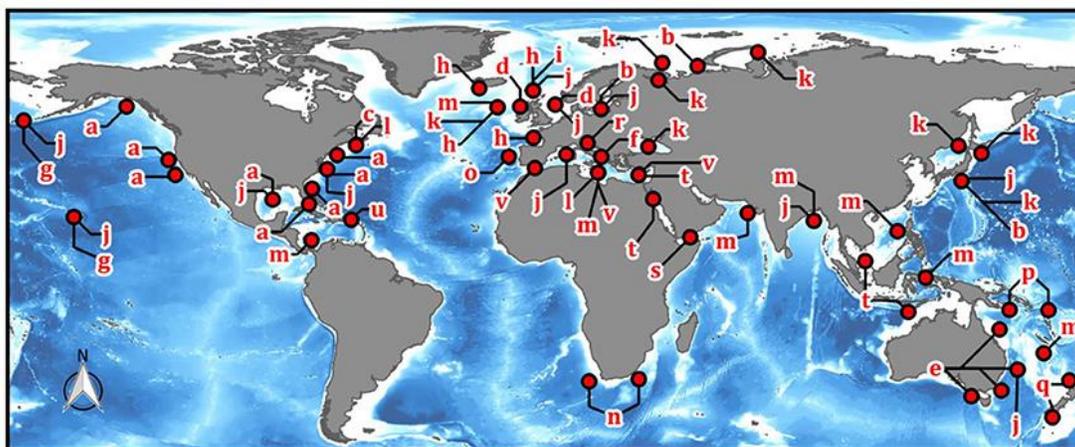


Fig. 1 Global distribution of documented marine sites with munitions present. Letters refer to literature references (see Beck et al., 2018 for more information). The map resolution is coarser than the number of actual munitions dumps

Various projects such as UDEMM, R.E.D C.O.D., HELCOM or CHEMSEA were implemented around the world in order to study and understand the impact of UXO on the marine ecosystems.

The UXO dumpsites have the potential to become a serious public health hazard by negatively impacting different areas of human activities with serious environmental consequences. Due to a continuous increase in shipping traffic, as well as development of offshore oil industry, infrastructures associated with pipelines, wind farms and aquaculture it is required that a greater

urgency is attributed to studying and developing strategies to clean up munitions from the seafloor.

The Black Sea is lacking in information regarding dumping zones of UXO (Fig. 2), this is because following WW I and II records of such activities were poorly kept, incomplete, lost or held as a military secret.



Fig. 2 Map of known UXO sites in the Black Sea. Compilation of chemical weapons dumps by Wilkinson et al. (2017) and information gathered from literature and navigation charts

Recent research projects and contracts implemented by Romanian geoscientists, such as "Submarine Archaeological Heritage on the Western Black Sea Shelf – HERAS" (Caraivan et al., 2015), or "Implementation of a geophysical investigation and monitoring tool of the Romanian maritime space security – MAR-S" (Dimitriu et al., 2019) gathered information that led to a better understanding of the situation of UXO contaminations in the western Black Sea.

Thus, during HERAS project several sunk military vessels, among which the Russian Moskva destroyer (Fig. 3a), the Shchuka-class SC-210, SC-213, the Leninets-class L-24 and the Malyutka-class M-34 submarines must be mentioned, all carrying weapons and ammunition onboard have been identified off the northern Bulgarian and southern Romanian coast. All these shipwrecks are posing a potential risk for the environmental safety of the Black Sea.

In August 2016, a high resolution magnetometric survey carried out in Burgas bay (Dimitriu et al., 2017) led to the identification of numerous sites where UXO-type items were laying on the seabed or were shallowly covered by recent sediments (Fig. 3b). In the aftermath of the survey more than 2000 pieces of UXO-type items were recovered from the seabed prior to the start of dredging operations for Burgas harbour's expansion.

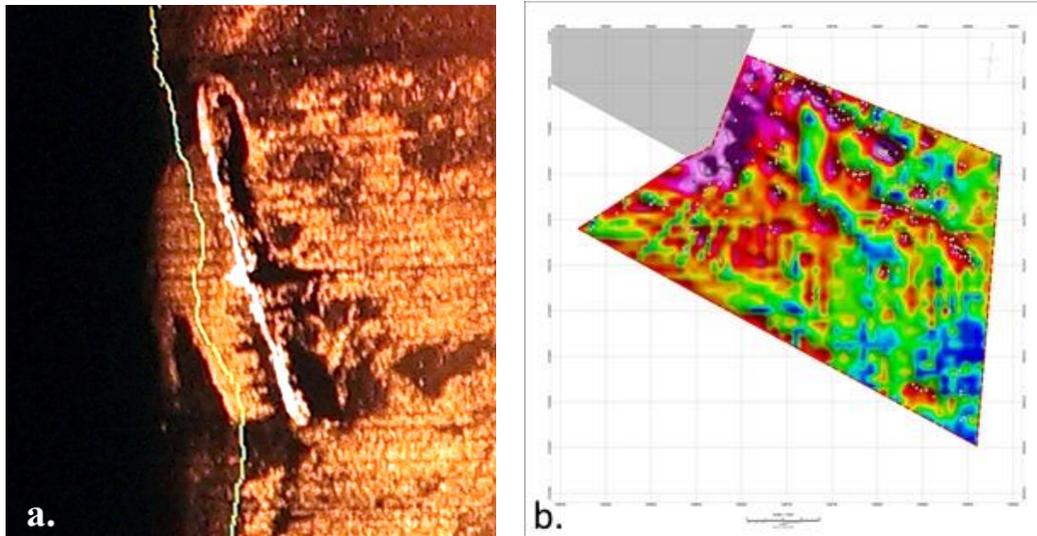


Fig. 3 Geophysical results from NIRD GeoEcoMar projects: (a) Acoustic image of M-34 shipwreck (Caraivan et al., 2015); (b) Location of maritime sites hosting UXO items, highlighted by the careful analysis of the magnetic data (Dimitriu et al., 2017)

The MAR-S project, implemented during 2017-2018 by GeoEcoMar research institute and the Research Center for Navy, aimed to demonstrate the effectiveness of a complex geophysical tool for the assessment of maritime space safety and security. The experimental-demonstrative marine geophysical investigations have been carried out off Constanța and Midia harbours. The geophysical investigation (Fig. 4) in the perimeter off Midia harbour led to the detection of 4 shipwrecks, two identified shipwrecks, one previously detected on magnetometric data and another completely unknown. Also, the investigation showed correlation of magnetic and acoustic targets with sunk marine mine barrages which were deployed in the area during WW II.

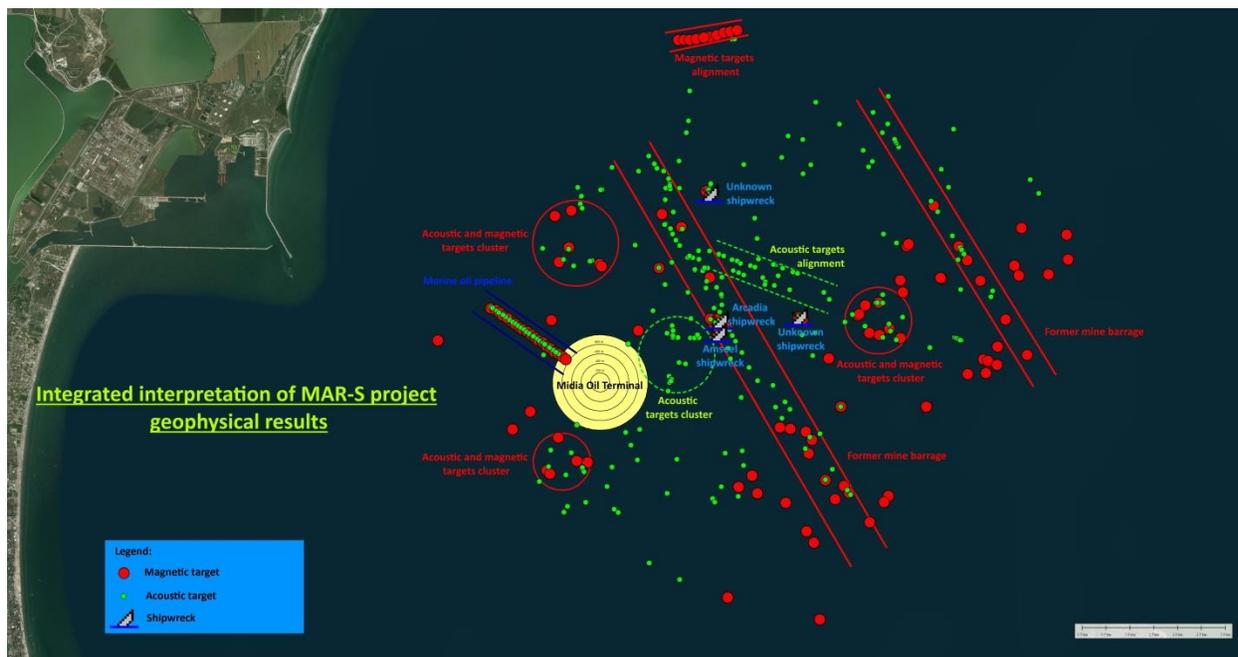


Fig. 4 An integrated interpretation of geophysical results obtained during MAR-S project

During the project an exhaustive assessment of the Romanian waters for shipwrecks was conducted and centralized within a web database. This database provides a platform for identifying shipwrecks that pose potentially serious environmental hazards.

According to Fedorov (1994), the former Soviet Union disposed of large quantities of chemical warfare agents or materials such as mustard gas (yperrite), lewisite, phosgene and adamsite in the Black Sea. Their effect was studied in the Adriatic and Baltic Sea and on dumpsites around Hawaii, and these studies show that depending on their concentration, these chemical agents can lead to a serious environmental impact posing a risk to organisms living in those areas and to humans who come in contact with them.

A thorough assessment for the current situation of UXO dumpsites in the Black Sea basin is important in order to identify and further study the effect of these sites on the environment and look for remediation solutions.

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