Archaeological methodology and deep water archaeological surveys: challenges and perspectives

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We present an overview of the well developed and commonly followed standard methodologies in underwater archaeological research along with recent technological progress in deep water surveys. Our aim is to identify challenges posed by the state of the art marine engineering achievements and to explore perspectives towards an interdisciplinary methodology and concept for the benefit of underwater archaeological research and in the frame of the archaeological deontology.

Remote sensing marine geological-geophysical techniques enable quite high resolution mapping of the seafloor at almost any depth. Underwater vehicles, manned or unmanned, autonomous or remotely operated, equipped with highly sophisticated scientific devices extend the limits of underwater archaeology to include almost full ocean depths.

Mutual understanding and close collaboration between archaeologists, marine scientists and engineers is a prerequisite for the best use of technology and experiences for the benefit of deep water archaeology.

Morphotectonic analysis along the neotectonic faults of Geras Gulf of Lesvos Island (NE Aegean, Greece)

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The tectonic structure of Lesvos is characterized mainly by an extensional regime acting from Neogene to recent while it is also under the influence of the westward migration of the southern branches of the North Anatolian Fault and the North Aegean Trench (NAT). Some of the main active faults of Lesvos Island are extended along the Geras gulf, which form an area of particular importance due to its proximity to the town of Mytilene. At a primal study of faults, a rift zone was found by neotectonic mapping, with deep-slip to oblique-slip normal faults of general direction NW - SE and W – E, respectively. Afterwards, based on rural measurements, the stress pattern of the area was studied as the main directions of the strain-stress field trends (σ_1, σ_2, σ_3) were calculated. In some specific sites of fault surfaces overlapping generations of slickenside striae were observed, meaning that more than one field tectonic trends acted in the same position in different time periods. The results include two main distinct tectonic phases; the oldest one with extensional axis directed NE-SW and the newest trending NNW - SSE. The tectonic analysis and the interpretation of digital relief model (DEM), as well as the use of satellite imagery of the study area, have contributed significantly to the quantitative and qualitative analysis of morphotectonic characteristics of the faults. On the basis of the digital relief model, morphological sections were constructed perpendicular to the faults in order to extract information on the morphology of the slope. Moreover, profiles of morphological slope gradients were constructed along faults, based on the slip map of the digital relief model, with mean gradient ranging from 14° to 16° for most of the faults. These values seem to be related to the lithology of the rising block and the uplift rate. Shaded relief maps and three-dimensional imaging helped identifying faults. The determination of the effect of the tectonic geomorphological phenomena can be defined and quantified with morphotectonics indicators. In the present study five (5) morphotectonics indicators were applied: Stream Length – Gradient Index (SL), Drainage Basin Asymmetry Factor (AF), Hypsometric Integral (HI), Ratio of Valley – Floor Width to Valley Height (Vf), Mountain – front Sinuosity (S). The calculation of morphotectonic indicators in the regional faults confirmed the activity, and the recent action,

which gave rise to the tectonic structures observed today. The high values of the SL index are found in morphological slope of the faults. The AF index shows a river spin, possibly due to the influence of faults, which either lift or humiliate the respective pieces of the rift zone. The index Vf exhibits relatively low values indicating a strong, deep erosion of the streams rising in the piece. The estimates of Mountain – front Sinuosity index are ranging from 1.1 to 1.6 and characterize active faults, though not associated with any known historical earthquake. Finally using empirical magnitude - fault length relationships, for the Gera's Gulf area, the maximum expected magnitude earthquake for each fault or fault zone is calculated to Ms = 5.7 – 6.3.

Investigation of drinking water quality in Isparta, SW Turkey

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The studied area is located in the western part of the Tauride carbonate axis forming a north pointing cusp, so-called Isparta Angle, in SW Turkey. Autochthonous carbonates and flysch type sedimentary rocks form the basement of the area and are tectonically overlain by ophiolitic melange of the Lycian nappes. All these units are cut in some places by the Plio-Quaternary Gölcük volcanics and covered by Quaternary pyroclastic tuffs and alluvial deposits. Additionally, the rest of Isparta area is made up of sedimentary rocks (Jurassic to Oligocene) and Pliocene-Quaternary (6.75 Ma-24,000 year) volcanic rocks. Hydrogeologically, the rocks in the area are classified as permeable, semipermeable, slightly permeable, and impermeable. Among these hydrogeological units, the alluvium, volcanic tuffs, and limestones are considered as aquifers in the area. The groundwater flow direction in the Isparta plain is generally from SW to NE comparable with the gently slope of pyroclastic fall deposits extending from Gölcük caldera in the SW to province capital of Isparta.

The water is one of the most important basic resources for the human life. The drinking water must be of drinkable quality corresponding to drinking water standards. Therefore, the quality control of drinking water is very important. In this study, to determine the distribution of water in drinking water system, 46 samples were collected from town of Isparta and its surroundings accompanying with the *in situ* measurements of temperature, pH, electrical conductivity, total dissolved solids, redox potential, dissolved oxygen, alkalinity and acidity tests. 46 water samples have been analysed for their anions, cations and some trace element contents by Inductively Coupled Plasma Optical Emission Spectromety (ICP-OES) and Ion Chromatography (IC). It was concluded that the results are comparable with national (Turkish Standards Institution – TS 266 2005) and international (World Health Organisation – WHO 2006, United States-Environmental Protection Agency – US EPA 2002 and European Union – EU 1998) drinking water standards. The waters in the studied area can be considered as Ca-Mg-HCO_3 and Ca-HCO_3 type exchange-waters. Until 1995, the drinking water for the people from the capital of Isparta have been supplied by water springs of Andık and Gölcük lake. Since 1995 due to increasing water requirements, drinking water system are ensured by Eğirdir lake waters. The results of hydrogechemical analyses show that the Eğirdir Lake water dominates in drinking water system of Isparta. Nowadays, the high fluoride contents in drinking waters from Isparta and its surroundings are reduced by mixing process with the waters of Eğirdir Lake which reach sometimes standard fluoride values and lie under standard fluorine values (<0.5 mg/l). F-contents in waters below the standard value (<0.5 mg/l) may give rise to dental and medicine problems. Therefore, mixing operations for the drinking waters used in town of Isparta must be carried out very carefully.