APPLICATION OF CAESIUM-137 TECHNIQUE FOR STUDYING ENVIRONMENTAL SENSITIVE AREAS

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The Caesium-137 (\(^{137}\)Cs) is an artificial radioactive isotope, a common fission product with an extended half-life (30.2 years). Huge amounts of \(^{137}\)Cs were released and distributed in most places all over the Europe during Chernobyl nuclear power plant accident (1986). \(^{137}\)Cs emits a characteristic high energy radiation (662 keV) that is detected with gamma ray spectrometry. \(^{137}\)Cs depth profile has been widely applied for studying upslope soil erosion and sediment deposition [1]. In the present work the possibility of \(^{137}\)Cs technique application for identification of anthropogenic interferences was examined. As a case study Omalos Mediterranean Temporary Pond (MTP), Chanea, Greece was used [2] but the same technique can be applied in many other cases (e.g. determination of illegal archaeological excavation etc.).

An alleged illegal excavation took place at Omalos pond in 2006 but its extend was not recorded at time. According to anecdotal evidence, surface material from the ponds’ bed was removed by means of a small excavator, in order to enhance the ponds water capacity, which is also used as a livestock watering reservoir. In order to identify whether the excavation affected the ponds bed and its extend, the \(^{137}\)Cs technique was utilized. 72 surface sediment, virtually undisturbed, soil cores were acquired using a 4 cm diameter metallic hand corer soil sampler. Each core was sectioned in 2 cm intervals and as air dried, as to remove the water content, resulting in a total of 282 samples. Representative undisturbed \(^{137}\)Cs samples were obtained from a nearby field. Activity concentration (Bq/kg) of \(^{137}\)Cs was measured by means of a high purity germanium detector of 70% relative efficiency, placed into a lead shielding of 10 cm thickness. Detector calibration was performed using NIST 4357 SRM, while the uncertainties are given. The \(^{137}\)Cs technique was potential to identify the excavation area giving its characteristic profile. Additionally, the historical water level of Omalos MTP could be estimated, when the fallout from the Chernobyl accident reached this area (May of 1986). Therefore, the \(^{137}\)Cs technique proved useful for studying a fragile environmental system. Applications can also include the verification and validation of hydrological models.

KEYWORDS: Caesium-137, gamma ray spectrometry, environmental analysis, soil erosion

REFERENCES: