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The use of Ground Penetrating Radar in coastal research, archeaological investigations, lake studies, peat layer measurments and applied research in Estonia

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Ground Penetrating Radar (GPR) is mainly used for scientific research in coastal geology in the Institute of Ecology at Tallinn University. We currently use SIR-3000 radar with 100, 270 , 300 and 500 MHz antennae. Our main targets have been detecting the thickness of soil and sand layers and finding out the layers in coastal sediments which reflect extreme storm events. Our GPR studies in various settings have suggested that the internal structures of the ridge-dune complexes are dominated by numerous layers dipping in various directions. Such information helps us to reconstruct and understand prevailing processes during their formation (e.g. seaward dipping lamination in coastal ridge-dune complexes indicating cross-shore and wave-induced transport of the sediments). Currently, we are trying to elaborate methodology for distinguishing the differences between aeolian and wave transported sediments by using GPR. However, paludified landscapes (often covered by water), very rough surface (numerous bushes and soft surface), moderate micro topography has slowed this process significantly. Moreover, we have been able to use GPR during the winter period (applied on ice or snow) and compare the quality of our results with the measurements taken during the summer period. We have found that smooth surface (in winter) helps detecting very strong signal differences (border between different sediment types – sand, peat, silt, etc.) but reduces the quality of the signal to the level where the detection of sedimentation patterns within one material (e.g. tilted layers in sand) is difficult.

We have carried out several other science-related studies using GPR. These studies include determining the thickness of peat layer in bogs (to calculate the volume of accumulated peat or to find most suitable locations for coring), measuring the thickness of mud and gyttja layer in lakes (to find most suitable locations for coring, reconstructing initial water level of the lake or calculating the volume of stored carbon in the lake).

Additionally, we have done several archaeology-related research including the search of buried city walls and caves (Tallinn old town), buried Viking ship (Saaremaa Island) and several other archaeological objects. We have also done some applied studies including the search of underground power cables, heating pipes, melioration systems, ammunition warehouses (from World War II) and buried ammunition from the military training fields.

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