HIGH RESOLUTION GEOPHYSICAL TECHNIQUES FOR AN INSIGHT TO THE FORMATION OF THE DUNE FIELD OF THE CENTRAL KYPARISSIAKOS GULF, (GREECE).

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Abstract
The scope of the present contribution is to investigate the formation and evolution of the Kyparissiakos coastal dune field, during the last transgression (Holocene), on the basis of geophysical techniques (ERT, VES), detailed morphological mapping and existing geoenvironmental information.

Keywords: Geophysics, Coastal processes, Shoreline evolution, Lagoons, Ionian Sea

Introduction
The Kyparissiakos Gulf is part of the western coast of Peloponnesus (Greece), facing the Ionian Sea and has a total coastline length of approximately 70 km. The coastal zone is composed of sandy or gravelly sandy sediments, backed by coastal dunes and alluvial plains that have formed on a post-Alpine (i.e. Neogene and Quaternary) siliciclastic sequence, which locally exceeds 400 m in thickness [1]. The upper part of this sequence (Upper Pliocene) is composed of alluvial and lacustrine sediments that have accumulated mainly in the central part of the Kyparissiakos Gulf. The transition from Pliocene to Pleistocene occurred without any interruption of sedimentation and, therefore, it is very difficult (in some cases, impossible) to differentiate between the relevant deposits [1].

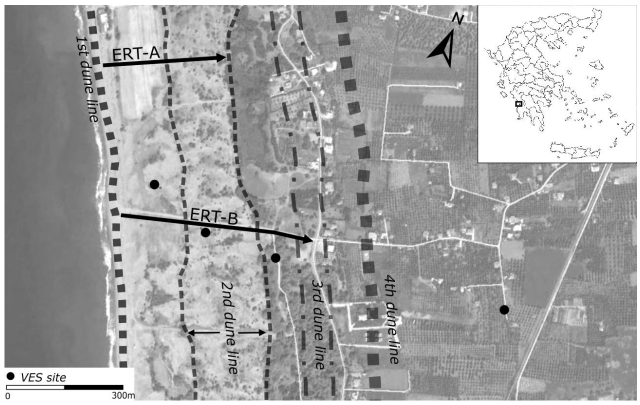

Fig. 1. Satellite image of the study area with annotation showing the dune lines, the geophysical sections and soundings.

The dune field of Kyparissiakos Gulf includes four dune lines (Fig.1) that lie at distances of 650m (4th), 450-470 (3rd), 140-180m (2nd) and 30-40m (1st) from the shoreline. Elevations in the dune field vary between 2 m and 13 m, with the highest corresponding to the 3rd dune line. With the exception of the most recently formed 1st dune line which is a typical foredune, the rest of the dune lines present characteristics similar to those of parabolic dunes, aligned to the prevailing onshore W and SW winds [2], [3].

Methodology
For the needs of the present investigation, a geophysical survey was carried out with the application of geoelectrical methods. Two (2) resistivity sections (ERT) were carried out, perpendicular to the general direction of the dune lines, to provide detailed information of the subsurface resistivity distribution up to 40-50m depth. In addition, four (4) geoelectrical soundings (VES) were carried out, for a deeper investigation of the subsurface lithological structure [4] (for locations see Figure 1).

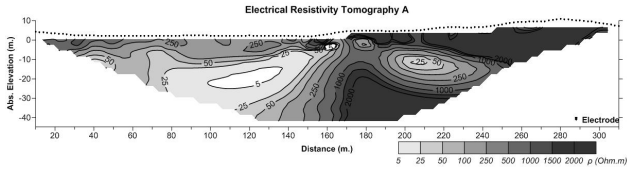

Fig. 2. Electrical Resistivity Tomography A (inversion model)

A detailed morphological map of the dune field was also produced using the technique of high-accuracy real-time kinematic differential GPS.

Discussion
The dune field consists of medium sand, well sorted due to its Aeolian origin [2]. The dune field has developed on the top of an extensive complex of beach barriers incorporating shallow lagoons. These upper Holocene formations, that are regarded as the base on top of which the dune field has been developed, overly an Upper Pleistocene formation of shallow marine/lagoonal deposits; which incorporates layers rich in beach material (i.e. sand, pebbles, gravels) and sandy clay. The geophysical survey indicates that this formation, having an average thickness of 35 m, should have been exposed to subaerial erosion during the last regression of sea level (prior to 21.000 years BP). In addition, this formation, which overlies non-permeable marly Pleistocene deposits, hosts fresh water aquifers that vary in volume seasonally.
The analysis and evaluation of the results of the geophysical survey in the dune field area, has provided information capable of adumbrating these aquifers (5-100 Ohm.m) under the 1st and 2nd dune lines (Fig. 2). As a result, it is concluded that the depicted geophysical structures are equivalent to the previously mentioned lagoonal deposits.
Finally, on the basis of morphological measurements and comparison with previously collected data, it seems that the 1st dune line is under erosion, mainly due to storm wave activity.

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