

Is Kissamos Bay in NW Crete, Greece worth to be exploited as a marine aggregates deposit? An integrated approach

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This study uses an integrated approach to investigate the offshore area of Kissamos Bay, NW Crete Island, Greece, as a prospective marine aggregate (MA) deposit. Non-fuel marine minerals and especially marine aggregates (sand and gravel) are reviewed from the perspective of resources during the last decades. The possible MA deposit of Kissamos Bay was explored during the implementation of the research project THALES-MARE, considering existing information of previous extraction activities in the wider area. Kissamos Bay is located at the inner continental shelf off NW Crete. The onshore basement rocks are composed of Mesozoic to Eocene limestones, shale and sandstone units, along with Neogene sediments such as marls, sandstones and claystones, which locally host Messinian gypsum layers.

Sixteen sea-bottom sediment samples were collected with a Smith-McIntyretype grab along four transects, vertical to the shoreline, at water depths of 11 to 44m. A sub-bottom acoustic profiler survey was conducted in order to quantitatively determine the deposit (dimensions and structure). Mineralogical, geochemical, sedimentological and benthic analyses of the samples were carried out, in order to determine the quality of the reservoir and the environmental impact of a potential exploitation.

Mineralogical results indicated that the bulk samples consist predominantly of quartz, while calcite occurs as a second significant phase. Chemical analysis of major and trace elements revealed that the average SiO_2 content is around 55% with samples closer to the beach (depths <15m) reaching 70%. SO_3 content, attributed to the presence of gypsum, is lower than 1%. The Cl- content of the unwashed material reflected mainly the presence of halite and is approximately 0.2%. The results of the benthic analysis indicated that no pressure will occur at the local ecosystem due to a potential exploitation of the deposit. Granulometric analysis of the sediments indicated that the main particle size composition is sand with extended spots of coarser material (gravel) in the western part of the bay, while the finer fraction (mud) increases in greater depths (~40m). After the analysis of the seismic profiles, it was estimated that the surface area of the deposit is approximately 12.25 km² and the volume of the sand and gravels is about 0.4 km³, whereas the average specific weight of the sediments in the study area is 2.5-3 g/cm³.

The aforementioned results support the idea that Kissamos Bay can be a promising area for marine aggregate exploitation, regarding beach replenishment and the wider construction industry. However, with respect to silica content, a better quality (quartz sand) is required for cement applications.

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