Natural oil seepage detection using satellite imagery in the Aegean and Marmara seas

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Abstract

This study aims to identify and characterize the natural oil expulsion systems in the Aegean Sea and the Marmara Sea and to compare expelled volumes with anthropogenic sources (degassing) using satellite imaging techniques. this purpose, a large collection of Radar Sentinel-1 satellite data was analysed over the years 2017 to 2019 for the Marmara Sea, while in the Aegean Sea, the whole available satellite image collection was analysed. The satellite images show that the average distribution of the natural/anthropogenic share is 56% / 44%. The natural oil expulsion zones detected in both seas are mostly distributed along the North Anatolian Fault. The presence of this transform fault is associated with a gradually evolving transtensional regime, which generates areas of strong subsidence and creates a series of pull-apart basins (Lemnos and Saros Basins). This subsidence is also responsible for the development of a large area with the characteristics of a still active gravity deformation. The natural expulsion zones are located within a unique geological environment that combines transform fracturing alongwith gravity deformation associated with the formation of the pull-apart basin. In addition, satellite images show the presence of particularly prolific expulsion zones further south, in the vicinity of the Skyros-Edremit basin. These fluid expulsion zones could be located in the extension of the extensional fracturing zones that formed the Skyros-Edremit Trough (Horse tail system). The presence of hydrocarbon expulsions in both the northern domain (North Anatolian Fault) and the southern part (Skyros-Edremit Fault) raises the question of the common origin or not of the source rock, and also the extension of the Upper Eocene-Oligocene rocks of the Thrace Basin.

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