

Abstract

Geomorphological features such as buried valleys are pervasive structures documented by many studies across the circum-Mediterranean basins in most cases related to the Messinian salinity crises event (MSC). However, the origin and evolution of these valleys are still not completely resolved. This in most cases arises due to limited availability or accessibility of high-quality geophysical datasets. This research focuses on understanding the origin and development of incised valleys identified from a suite of 2-D seismic reflection data and borehole data acquired in the Northwestern portion of the Sicily channel and offshore of Tunisia in the central Mediterranean Sea. This was achieved by performing a detailed seismic-stratigraphic analysis and interpretation of the Plio-Quaternary succession in the study area located to the North West of the Adventure Plateau. Five large-scale NW-SE and NE-SW trending valleys were identified in the Plio-Quaternary succession in the study area. The morphology and longitudinal profile of these valleys indicate that they generated from the Adventure Plateau (proximal part) and developed in a West, NW direction. They have a width ranging between 14 to 18 Km and depth of between 1.9 to 2.5 Km. In the area of study, the valleys span an area ranging between 574 to 1221 Km², having a sediment infill volume ranging between 340 to 392 km³. They present a V-shape morphology in the proximal part in contrast to a U-shape morphology in the distal portion. The evolution of these valleys mapped arise from an interplay between tectonics and erosion related to: (1) creation of accommodation space at the thrust front during the Alpine compressional phase of the pre-MSC (Mesozoic and Eocene), folding-thrusting of the flysch and rifting; (2) major episode of erosions/incision that took place during the MSC and (3) reflooding of the valleys and syn-tectonic controlled sedimentation in the Plio-Quaternary. Likewise, a remarkable collapse structure is documented in the study area related to fluid flow induced systematic collapse of the overburden. These valleys may hold potential for trapping hydrocarbons based on the presence of structural culmination and possibility for localized stratigraphic traps identified within the valley and at the termination of these incisions which acted as an important sediments pathways during the MSC low stand. The findings from this study shed light on the role of the dramatic events during the MSC, in shaping the architecture of a subaerial landscape which characterized the reliefs, today underwater, which separated the eastern to the western Mediterranean.

Keywords: Incised valley, Plio-Quaternary succession, Messinian salinity crisis, Seismic Interpretation, Seismic Geomorphology, Mediterranean Sea, offshore Sicily, offshore Tunisia, tectonic.