PROCESSES ON THE PRECIPICE: SEAFLOOR DYNAMICS ACROSS THE UPPER MALTA-SICILY ESCARPMENT.

A. Micallef [1]*, A. Georgiopoulou [2], T. Le Bas [3], J. Mountjoy [4], V. Huvenne [3] and C. Lo Iacono [3]
[1] University of Malta - aaron.micallef@um.edu.mt
[2] University College Dublin
[3] National Oceanography Centre
[4] National Institute of Water and Atmospheric Research

Abstract
The Malta-Sicily Escarpment (MSE) is a steep, sediment-undersupplied, carbonate escarpment incised by a series of submarine canyons. In this study we present data acquired from the upper MSE during the Eurofleets-funded CUMECS cruise to document a complex seafloor morphology comprising gullies, canyon heads, mass movement scars, channels, contourites and escarpments. The evolution of the upper MSE has been driven by the interaction of fault activity, sedimentary activity related to hemipelagic, pelagic and contouritic sedimentation, and seafloor incision by bottom current activity. Submarine mass movements play a key role in canyon development – they control the extent of lateral and headward extension, facilitate tributary development, remove material from the continental shelf and slope, and feed sediment into the canyons.

Keywords: Canyons, Geomorphology, Sediment transport, South-Central Mediterranean

The Malta-Sicily Escarpment (MSE) is a dominant morphological feature of the central Mediterranean, comprising a steep, 3 km high, NNW-SSE trending carbonate escarpment that extends 250 km southwards from the east coast of Sicily [1-2]. The MSE may be classified as a sediment-undersupplied margin because of the low estimated post-Messinian sedimentation rates in the region (~6 cm ka^{-1} [3-4]), as well as its isolation from terrestrial and coastal sedimentary inputs after the Messinian Salinity Crisis [5]. Studies carried out in the 1980s demonstrated that the MSE is also incised by a series of submarine canyons [2]. In June 2012, the Eurofleets-funded CUMECS cruise acquired multibeam echosounder data, high resolution seismic profiles and gravity cores from across 500 km^2 of seafloor across the upper MSE. These data reveal a complex and diverse seafloor morphology, which comprises: (i) A dense network of gullies and distinct larger and wider channels that extend all the way from the heads of the canyons to the shelf break. (ii) Four channels in the deepest part of the outer Malta Plateau. The longest channel (12 km long) dominates the northern part of the study area and its steeper northern wall is covered by a contourite. (iii) 67 mass movements, ranging from translational slides to debris flows, which affect the outer Malta Plateau and upper MSE. (iv) Elongated escarpments, some of which are colonised by *Antipatharia*, encrusting sponges and hydroids. These observations indicate that the upper MSE has been an active area of seafloor, and that its evolution has been determined by the interaction of: (i) fault activity, (ii) sedimentary activity, driven by hemipelagic, pelagic and contouritic sedimentation, (iii) seafloor incision, related to bottom current activity, and (iv) slope instability. The MSE presents an excellent study area to understand how mass movements and canyon processes may be interrelated. The mass movements are likely triggered by loss of support associated to channel and gully incision, canyon head retreat or retrogressive landslide development. The mass movements control the extent of lateral and headward extension of the canyons across the continental slope and shelf, as well as facilitate tributary development. They also remove material from the continental shelf and slope, feeding sediment and driving its transport down-canyon.

References
1 - Casero, P., Cita, M.B., Croce, M., De Micheli, A., 1984. Tentative di interpretazione evolutiva della scarpata di Malta basata su dati geologici e geofisici. *Memorie della Societa` Geologica Italiana*, 27: 233-253.
2 - Imbrie, J., McIntyre, A., Mix, A.C., 1989. Oceanic response to orbital forcing in the Late Quaternary: Observational and experimental strategies, in: Berger, A., Schneider, S.H., Duplessy, J.C. (Eds.), Climate and Geosciences: A Challenge for Science and Society in the 21st Century. Reidel Publishing Company.
3 - Max, M.D., Kristensen, A., Michelozzi, E., 1993. Small scale Plio-Quaternary sequence stratigraphy and shallow geology of the west-central Malta Plateau, in: Max, M.D., Colantoni, P. (Eds.), UNESCO Technical Reports in Marine Science, Urbino, pp. 117-122.
4 - Osler, J., Algan, O., 1999. A high resolution seismic sequence analysis of the Malta Plateau, Saclantcen Report.
5 - Scandone, P., Patacca, E., Radoicic, R., Ryan, W.B.F., Cita, M.B., Rawson, M., Chezar, H., Miller, E., McKenzie, J., Rossi, S., 1981. Mesozoic and Cenozoic rocks from Malta Escarpment (Central Mediterranean). *American Association of Petroleum Geologists Bulletin*, 65: 1299-1319.