

MAURO SOLDATI (*), CHIARA TONELLI (*) & JORGE PEDRO GALVE (*)

GEOMORPHOLOGICAL EVOLUTION OF PALAEO-SINKHOLE FEATURES IN THE MALTESE ARCHIPELAGO (MEDITERRANEAN SEA)

ABSTRACT: SOLDATI M., TONELLI C. & GALVE J.P., *Geomorphological evolution of palaeosinkhole features in the Maltese archipelago (Mediterranean Sea)*. (IT ISSN 0391-9838, 2013).

Palaeosinkhole features characterise the Maltese islands, some of them reaching relevant dimensions, especially in the Island of Gozo. They show varied morphostructures: sub-circular bays, large depressions and rounded buttes or mesas (due to relief inversion) are the resulting geomorphic expressions. A detailed geological and geomorphological study of the palaeosinkholes located in the NW sector of the Island of Gozo has been carried out with the aim of investigating the evolution of the associated landforms. A field survey and a mapping campaign at a 1:5000-scale, coupled with aerial-photo interpretation, has been carried out and a spatial database has been implemented within a GIS software. Existing evolutionary models have been critically analysed and new models proposed. Thanks to the detailed exploration of the collapse palaeosinkholes, it has been deduced that at a certain stage, selective erosion has become the main factor influencing their geomorphological evolution. Positive reliefs (rounded buttes or mesas) were formed where more resistant terrains were located inside the sinkholes; conversely, depressions and sub-circular bays developed where the sinkholes infill was surrounded by more resistant rocks. Collapse structures do not seem to be active at present and their activity probably ceased during the Miocene, suggesting that karst subsidence processes are not the only responsible for the final shaping of the above-mentioned sub-circular depressions and bays. The Gozitan rounded bays related to the palaeosinkholes have been compared with similar sub-circular coastal landforms located along the southern coast of the Island of Malta. The investigation showed that the latter are not caused or influenced by karst processes, but linked to the attitude of strata and to their different resistance to erosion. The bays analysed in Gozo and Malta are morphologically similar but genetically different, representing a relevant example of equifinality. The Gozitan sinkhole-related landforms have also been compared with those of the Island of Malta, generally much smaller in size, which allowed their different geomorphological evolution to be pointed out.

KEY WORDS: Palaeosinkholes, Karst, Selective erosion, Malta, Mediterranean Sea.

(*) Dipartimento di Scienze Chimiche e Geologiche, Università degli Studi di Modena e Reggio Emilia, Largo S. Eufemia, 19, 41121 Modena, Italy. E-mail: mauro.soldati@unimore.it

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INTRODUCTION

The Maltese archipelago is characterised by the presence of outstanding palaeosinkholes that may reach a few hundreds of metres in diameter and stratigraphic throw, being comparable in size to the largest sinkholes of the World. They display different landforms depending on the lithologies that crop out inside and outside the subsidence structures. Sub-circular bays, large depressions and rounded buttes are the resulting geomorphic expressions. Despite their large size and impressive associated landforms, these collapse palaeosinkholes have never been referred to in the specialised karst literature and have received scarce attention from the geomorphological perspective. Previous authors provided very detailed sedimentological studies of the units filling the palaeosinkholes and proposed a genetic model (Trechman, 1938; Pedley, 1974; Illies, 1980; Pedley & alii, 2002), but they did not analyse in detail the evolution of the current landforms controlled by these structures. Other papers have dealt with these morphostructures from the geomorphological point of view. Paskoff & Sanlaville (1978), based on a study on the coasts of the Maltese archipelago, described the rounded bays related to palaeosinkholes. Alexander (1988) focused on the tectonic aspects of the Maltese palaeosinkholes and suggested to investigate the relations between surface hydrology and vertical tectonics to better understand their mechanism of formation. Coratza & alii (2012) have recently analysed the Maltese sinkholes aiming at their recognition and assessment as geosites.

Within this frame, during recent surveys carried out in the Maltese archipelago, a detailed geological and geomorphological study of the palaeosinkholes has been carried out, with the aim of investigating the evolution of the associated landforms. A preliminary analysis of the palaeosinkholes depicted in the geological map of the Maltese islands (Oil Exploration Directorate, 1993) has been carried out and then the western sector of the Island of Gozo has been