



SCIENCE

Central Algarve karst system tufa-related dynamics, Portugal

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ABSTRACT

Geomorphological mapping is a powerful instrument improving the geomorphological interpretation and understanding of the processes and forms used in landscape studies, with the ability of organizing different thematic layers in the same map. The presented map provide relevant information about the different geomorphological units of the central Algarve (i.e. the Carboniferous flysch mountains; the Barrocal, with marly and karstified subunits), where a karst system is prominent. Solution karst morphologies and large dry areas are common in the elevated areas of the Barrocal, suggesting deep circulation of groundwater. These recharge areas feed the perched aquifers of the area, where discharge is controlled by the impervious lithologies (clay-rich strata of the turbidites, marls and argillites) in the valley bottoms or other leaks in dammed aquifers. In springs related to the main aquifers tufa are actively being formed and, close coupled to spring location, different tufa depositional systems develop.

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1. Introduction

Geomorphological mapping aims to present a balanced representation of Earth surface processes, with information arranged by relevance according to the generally accepted graphic semiology that enhances the analyzed processes. Geographic information systems (GIS) significantly aid the process of data processing and management (Griffiths, Smith, & Paron, 2011).

This map aims to represent the main geomorphological elements of the central Algarve, relevant to the interpretation of the karst of the *Barrocal* (Portuguese noun formed from *barro* – mud – and *cal* – lime). The karst geomorphology is exposed under the geological, hydrological and geomorphological constraints, expressing the distribution and patterns of the studied landforms (Cunha, 1988; Ford & Williams, 2007; Guerreiro, 2015).

Karst landscape is characterized by deep groundwater circulation, developed as a consequence of the solution of limestone, dolomitic limestone and evaporitic terrains (Cunha, 1988; Ford & Williams, 2007). Consequently, in these areas the epikarst is dry and characterized by the development of solution morphologies that promote an extensive and fast infiltration of the meteoric water in the form of karren, dolines, polja, swallow holes and caves – these promote effective deep circulation. In contrast, lower borders of karst terrains and areas of high phreatic level present discharge points – karst springs and ponor – often related to the precipitation of carbonate tufa due to epiphreatic CO₂ losses (Guerreiro, 2015).

Geomorphological information is important for hydrogeomorphological research in karst areas, since the karst geomorphology is central to understanding the hydrogeological systems. It can contribute to a determination of the presence of lithologies and their landscape settings, that control the recharge (e.g. soluble lithologies in high areas), flow (e.g. confined aquifers, tectono-karst corridors) and discharge areas (e.g. valleys intersecting soluble lithologies and carbonate tufa deposits) of the karst aquifers.

This technique is a useful tool not only for geomorphological and hydrogeological research but also for land planning and land use management (e.g. preventing aquifer contamination and overexploitation).

The main objectives of the map *Geomorphology of the Central Algarve (Main Map), Portugal* are to: (1) define the diversity and extent of the geomorphology; (2) locate carbonate tufas and the recharge/discharge areas of the hydrogeomorphological system; (3) identify the relationship between lithologies and the distribution of karst morphology; (4) establish the main denudation surfaces of the Central Algarve and (5) recognize the structural morphology and the influence of neotectonic activity.

2. Methods

Geomorphological map production requires the combination of different methods and data sources, that can be summarized by the following steps: (i) interpretation of stereoscopic aerial-photos at the scale of 1:15 000