Central Algarve tufa platforms, Southern Portugal. Geomorphological characterization and genesis

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Introduction

The water-air interaction leads to the saturation of water $CaCO_3$ and precipitation of carbonates, that could be inorganically or biologically induced. The tufa facies presented in this work, follow Pedley (1990), Arenas-Abad *et* al. (2010), Arenas *et al.* (2014) and the accumulation models follow Pedley (2009) and Arenas *et al.* (2014).

Algarve is the southernmost Portuguese with some tufa deposits developed over some limestone formations of the Meso-Cenozoic, locally known as *Barrocal*. (Fig. 1)

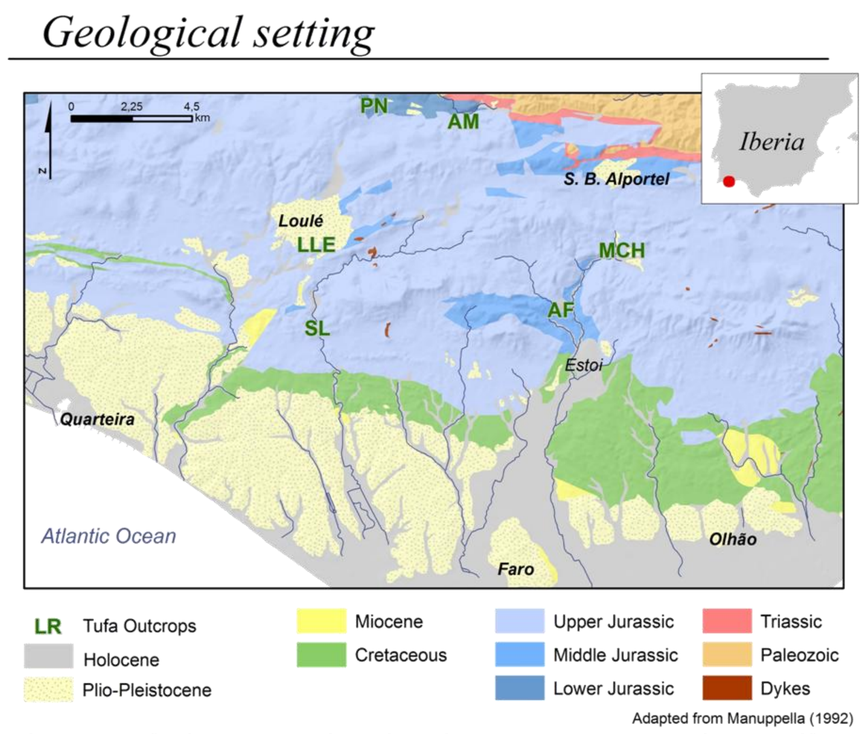

Fig. 1 – Carbonate tufa deposits and geology location map. *Legend*: AF – Alface; AM – Amendoeira; LLE – Loulé; MCH – Machados; PN – Porto Nobre; SL – São Lourenço

Geomorphology and Hydrology

The Algarve has three main geomorphological domains: the Paleozoic mountains carved on turbidic deposits, the Meso-cenozoic karst hills and the littoral Plio-Pleistocene detrital platform. In close association to the Eurasian-Nubian plate-boundary, the whole system was deformed by extensional and compressive tectonic events, which gave rise to a complex groundwater system.

Neotectonical activity has been reported in many workers.

The Algibre flexure is the main geomorphological feature in the area. The highest hills are bare and soddy karst and lower surfaces have low gradient valleys with some dolines and sinks which inhibits surficial drainage.

Discharge areas are located in different settings. Northern discharge is controlled by aquitard lithologies along high gradient slopes. In the South, the discharge occurs along low gradient streams. All springs are intermittent and discharge is linked to the Mediterranean climate wet season.

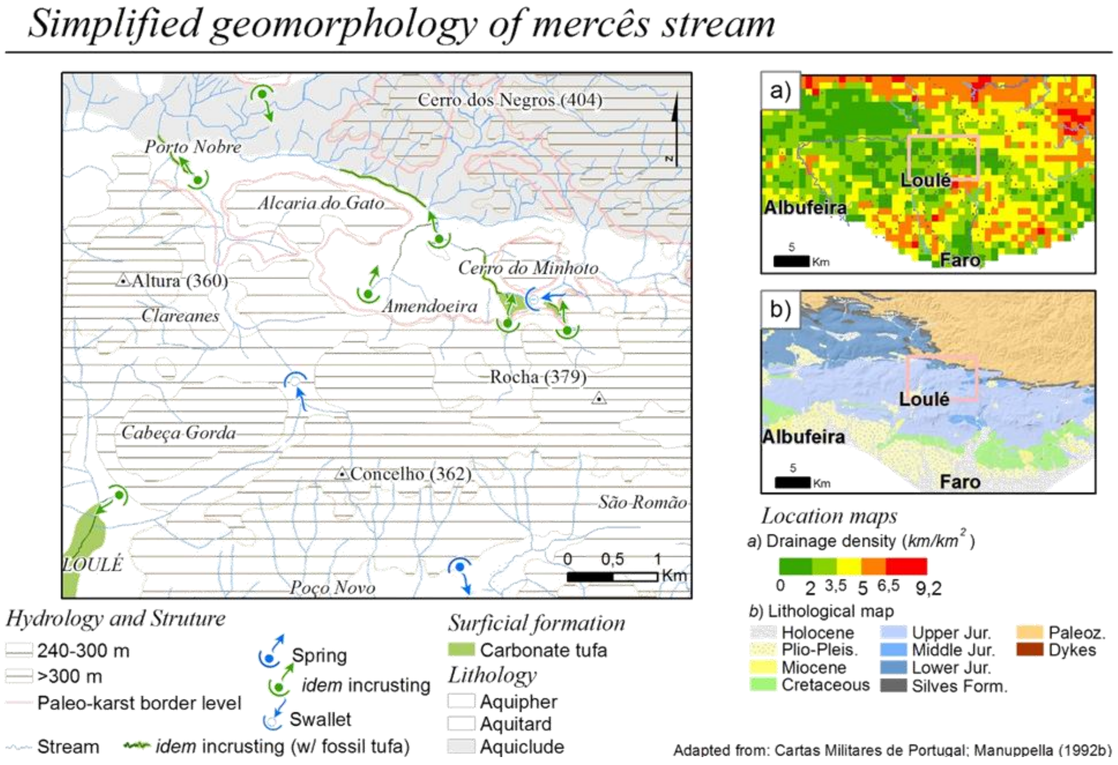

Fig. 2 – Simplified geomorphology of the Mercês stream

Carbonate Tufa Geomorphological Setting

The largest tufa platforms lie in unconformity with the current drainage system, where outcrops are dominated by low gradient facies, *v. g.* detrital bedded lime muds. These outcrops lie down on larger areas in Loulé and Alface, at altitudes between 160-200 m and 120-150 m respectively. (Figs. 1 and 2)

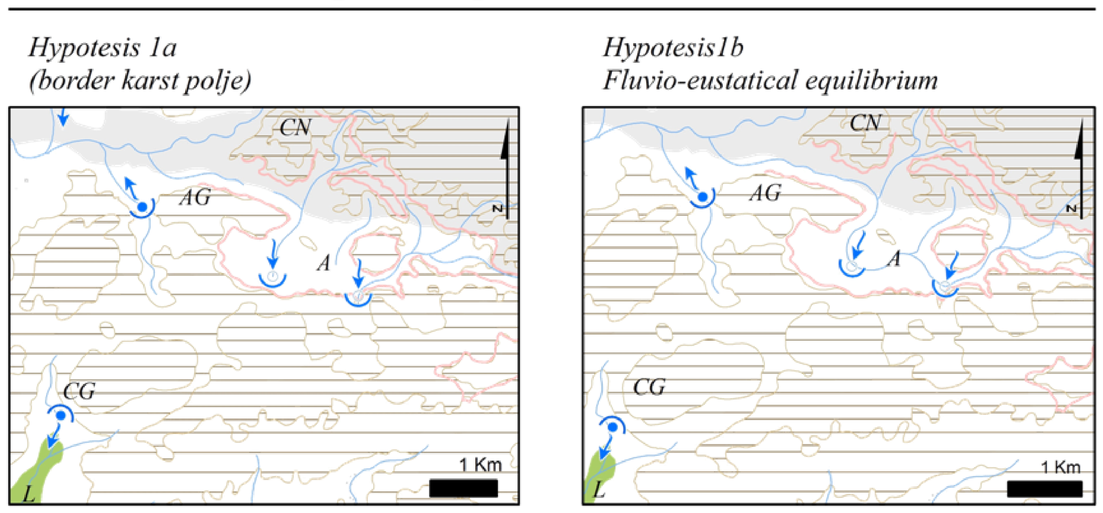

Fig. 3 – Geomorphological evolution on the Mercês stream border karst.
Legend: same as Fig. 2

Environmentally conformal tufas occupy some sectors of the modern Cadouço, Rio Seco, São Lourenço and Mercês streams. Modern tufa range from spring dominated mounds in Alface and Mercês streams and barrier and low gradient fluvial dominated tufas (*v. g.* São Lourenço and Loulé) (Mercês stream case study on figs. 3 and 4).

The ocean proximity and local perched aquifers enable the formation of eustatic platforms and karst surfaces, which provided substratum for tufa accumulations.

Vertical movements and lowstands promoted fluvial incision and degradation of previous structures, later covered by tufa deposits in the modern streams.

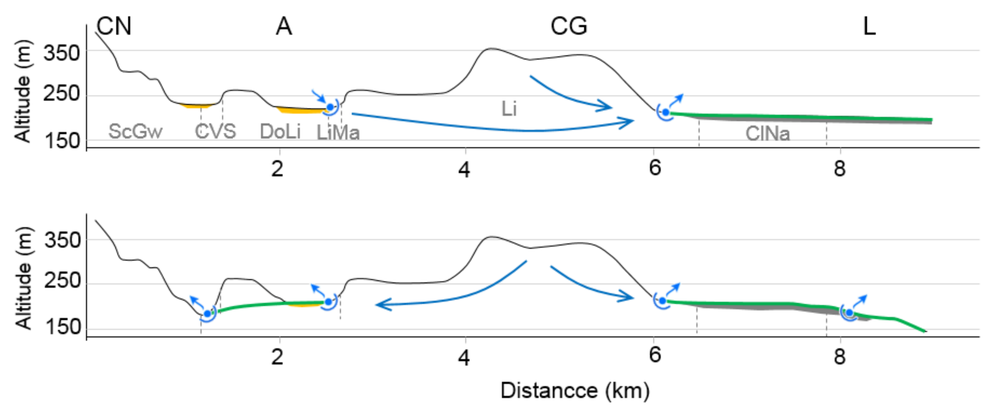

Fig. 4 – Hydrogeological evolution on the Mercês stream border karst. Legend: CN – Cerro dos Negros; A – Amendoeira; CG – Cabeça Gorda; L – Loulé; ScGW – schists and greywackes; CVS – volcano-sedimentary rocks; DoLi – Dolostones and dolomitic limestone; LiMa – marly limestones ans marls; Li – limestone; ClNa - halite

Conclusion

Algibre flexure create distinct conditions for tufa structures, especially when considering slopes gradient. Perched springline models are predominant in high gradient slopes. In low gradient streams, fluvial deposits with waterfalls along the streams can occur, however we don't know lacustrine deposits.

The distribution of tufa outcrops and their facies association infer the environment on its deposition, and that way the geomorphological evolution of the Central Algarve Area.

The Mercês stream tufa models and geomorphology should be linked to the southern low gradient outcrops. After incision, border karst features and were eroded and tufa outcrops developed on the new drainage system.

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Universidade de Coimbra

FCT Fundação para a Ciência e a Tecnologia

COMPETE

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