Geophysical Research Abstracts, Vol. 8, 04700, 2006
SRef-ID: 1607-7962/gra/EGU06-A-04700

Coastline evolution controlled by development of sinkholes, and likely effects on the anthropogenic environment

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Evolution of coastlines in karst areas is strongly controlled by dissolution processes which favour the development and later enlargement of surface and subsurface landforms, including caves, produced by the intensive action of solution due to the mixing between fresh and brackish water. Formation of inlets, often connected to cave systems, seem to be governed by the combined action of tectonics (that originated the development of discontinuities in the carbonate rock mass), hydrogeology and karst. Due to the subtle character of the phenomena, the so-produced karst landforms may interfere with the anthropogenic environment, and cause damage to man's activities. Appraisal of the local geological and morphological conditions should therefore be mandatory to any programme of land use planning in karst coastal areas. To highlight the often underestimated importance of karst phenomena in coastal areas, we have analyzed a 10-km long stretch of Apulia, in southern Italy. The Apulia region (the heel of the Italian boot) is geologically characterized by carbonate rocks, Mesozoic to Quaternary in age, which makes the karst processes extremely widespread all over the regional territory. The latter can be subdivided into three main karst districts: Gargano, Murge, and Salento. The Salento Peninsula, the southernmost Apulian karst district, can be defined as a carbonate lowland (maximum elevation about 200 m above sea level), facing the Adriatic Sea to the north-east and the Ionian Sea to the south-west. In Salento, the coastal areas are strongly exposed to dissolution: groundwater are in fact made aggressive because of the mixing phenomena with sea water, and are thus responsible for "hyperkarst" processes, notoriously more effective and faster than the normal karst reactions. This setting favours the formation of surficial

caves, partly flooded and with a predominant horizontal development. These caves and conduits, when developed in areas where urban settlements and infrastructures are present, might create adverse consequences, as testified by damage related to the numerous sinkholes registered in the last decades. Choice of the selected area, situated along the Adriatic coast at the boundary between the provinces of Lecce and Taranto, was dictated by the presence of several interesting karst landforms (locally known as “spunnulate”, a term used to describe collapse sinkholes), that are generally connected to underground caves. Furthermore, the area is of high naturalistic importance, and hosts significant remnants of the cultural heritage. The sinkholes were identified through field surveys, integrated by interpretation of multi-year aerial-photographs (dating back to the 40s) and archival research; some tens of sinkholes, many of which were produced because of the presence of underground cavities, have been thus identified, mapped, and a morphometric analyses has been performed. The latter, besides showing the main parameters of the sinkholes (in terms of area, length, width, and depth), was also aimed at checking the control exerted by the main discontinuity systems in the area in the development of sinkholes, and of coastal inlets as well. Some considerations on the interaction between man and these special landforms of the karst landscape are eventually presented.