

SINKHOLE HAZARD IN URBAN AREAS: THE CASE OF CAMAIORE (TUSCANY, ITALY)

D'AMATO AVANZI G., GIANNECCHINI R., PUCCINELLI A. & VERANI M.

Dipartimento di Scienze della Terra - Università di Pisa

In the Camaiore town (Tuscany), a sinkhole suddenly formed in 1995 and caused destruction or heavy damage of several houses. Many people were evacuated.

The geological structure being one of the most important preparing factors of the sinkhole, surface and underground geologic features of the area were investigated, in order to understand the causes of the collapse and its evolution. Such features were reconstructed on the basis of geologic, geomorphic and geognostic surveys: in the sinkhole zone, the bedrock is made up of limestone, densely fractured and intersected by several direct faults. This bedrock is buried by thick alluvial deposits, up to 140 m thick. Basing on surveys and drillings, the bedrock evidences karst cavities, generally filled by breccia and/or alluvial materials.

The sinkhole disaster is attributed to a deep collapse of a cave in the calcareous bedrock. The effects of this collapse were felt at the surface only after a considerable lapse of time, determined by the slow progress of the cavity upwards in the alluvial materials. Actually, it is significant to note that, one week before the collapse, an earthquake with a 50 km far epicentre involved the Camaiore area as well; probably, the earthquake triggered the collapse of the cave roof in the bedrock. In order to individuate other hazardous places, historic-archive researches together with geognostic and geomorphic surveys were also performed, in the urban area and around. These studies highlighted possible deep caves in the underground and traces of past karst collapses, close to and in the Camaiore town; in fact, limestone is widespread in the study area and might be affected by sudden karst phenomena. Furthermore, Camaiore is next a high seismicity region (the Garfagnana-Lunigiana), where very strong earthquakes (> 6 M) occurred. Finally, due to the high sinkhole hazard of the area, it is considered necessary to extend the investigations to the whole Camaiore plain, in order to identify any conditions like those of the 1995 collapse.