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Karst development in different tectonic settings (Middle East, Greece, South China), concept analysis and first findings towards hydrology modeling reconsideration

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As part of the International Geoscience IGCP-715 project, we present the core objective and preliminary analyses on the karst development of the study areas. Our aim is to further characterize the geomorphologic features of the extended karst of Koiliaris Critical Zone Observatory (KCZO), Crete, Greece. Simultaneously to better understand the main drivers of karst development we compare the CKZO karst system with other areas in different tectonic contexts such as Oman (Salma Plateau), the northern UAE and southern China (Guilin karst area).

Hydrological studies and previous geomorphologic analysis of KCZO suggest that 27% of the total water budget is coming from the adjacent watershed in the east where an extensive karst system with two explored super-deep caves is situated (Liontari Cave - 1100 m, Gourgouthakas Cave - 1200 m). The area is build up by a continuous carbonate succession exceeding 5 km in depth, lying on top of the Hellenic subduction zone. Field work and Google Earth mapping show two dominantly striking directions of failures (fault, fracture surfaces), trending E-W to ESE-WNW (90-120°) and N-S to NNE-SSE (0-22.5°). The N-S surfaces are mainly fractures while the E-W ones are mainly thrusts and/or strike-slip faults with obvious large displacements of hundreds of meters. The karst development in a subduction zone with dramatic thrusting on the overriding plate has created super-deep caves which are controlled by the vertical bedding and a series of faults and fractures. The area exhibits two layers with different hydraulic properties, a fast water-transferring zone and a slower one which is consistent and supports the hypothesis of the hydrologic model.

At the Salma Plateau, in Oman, the karstic system is related to rapid uplifted Eocene limestones

that overlay the Semail Ophiolite. There is a large cave (Majilis Al Jinn) at an area of interconnected fractures (and/or faults?). It is the only karstic system presented inhere which has similarities with the karstic system in the KCZO.

At the UAE and northern Oman (Musandam) is an active collision zone between Arabia and Eurasia with 2000-m-thick allochthonous Mesozoic limestones. The area lacks a subsurface karst system, and the only karst has developed in steep wadis.

Finally, the Guilin area in China represents a former passive margin with a Devonian limestone. It features a spectacular karst of conical peaks (fengcong) and tower peaks (fenglin). Caves exhibit mainly a horizontal development and there is no similarities to the KCZO.