



Picos de Europa National and Regional parks (Northern Spain): the karst underground landscape

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Karst caves represent an environmental with a high value from the Geoheritage and Geodiversity points of view given by hidden underground landscape practically reserved to the speleologists. Nevertheless, cave surveys, 3d models of caves and DEMs, and pictures can be used to approach the endokarst geoheritage characterization. The Picos de Europa National and Regional parks include the 14% of World's Deepest Caves (>1 km depth); moreover these parks shows a high environmental value related with seven protection figures: Biosphere Reserve, Special Protection Area, the Site of Community Importance, and four Natural Monument. The aim of this work is to present the Geoheritage values of the underground landscape of the Picos de Europa National and Regional parks. These parks involve several alpine karst massifs up to 700 km² and 2,600 m asl, as the Picos de Europa mountains (declared Global Geosite by its geomorphological interest), the Mampodre Massif, and the Peñas Pintas and Yordas peaks (sited in Riaño dam area). The alpine karst involves a large underground landscape formed by more than 3,700 epigenic caves with 403 km of conduits. The 95 % of the cave conduits are located in the Picos de Europa mountains and correspond to caves up to 18.9 km length and 1.6 km depth; the 5 % of cave conduits are sited in other small karst areas and include caves up to 1.5 km length and 200 m depth. The karst caves present high natural, scientific and cultural values. The natural value corresponds to the singularity and the spectacular vertical development of the caves and a very high Geodiversity of cave features. The karst shows a high concentration of deep caves (81 caves deeper than 500 m) that is twice higher than the concentration of other karst areas, as Arabika Massif (Western Caucasus). The natural value is mainly related to the presence of geomorphological and hydrogeological features, highlighting high vadose canyons and shafts, old phreatic and epiphreatic conduits, few fluvial deposits, some speleothems (dripstone, flowstone), few ice caves, many underground streams, and karst springs. The scientific value corresponds to the cave records related to the regional evolution of the Cantabrian Range. The scientific studies evidence that the caves are originated prior to, at least, the Middle Pleistocene, in relation to mountain uplift, glaciations, fluvial incision, and the erosion of the alpine lithological series that were above the karst. The cultural value is related with the specific uses of the cavities by shepherds and speleologists, and the singularity of cave names. The uses include traditional customs, as the livestock farming, the water collection, the elaboration of five types of cheese with Certificated of Origin, and sport uses by speleologists from many countries of Europe. The educative values are low due to the limitations of access inside the caves, although two caves are touristic and the entrance of some caves can be used to explain vadose shafts, relations between caves and glaciers and rivers or the underground water flow.

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