# Extended Summary

Dugi Otok is the largest island of the Zadar Archipelago, distinguished by its surface (113 km²), coastline (182 km), and overall length (44 km). The island is characterized by exceptional landscape diversity as well as a rich cultural heritage. Its morphological structure is marked by contrasting landforms: on one side, the steep abrasion cliffs within the boundaries of Telašćica Nature Park, and on the other, shallow sandy coves such as Sakarun Bay. Among its hydrological features, marine lake Mir stands out as a semi-enclosed relict basin whose salinity exceeds that of the surrounding Adriatic waters due to restricted water circulation and enhanced evaporation.

The geological structure of Dugi Otok is linked to the evolution of the Adriatic microplate and the subsequent Dinaric orogeny. The island is composed almost entirely of Cretaceous carbonate rocks that have undergone intensive tectonic deformation, uplift, and erosion. The development of numerous exokarstic and endokarstic features, including caves and pits, is associated with the long-term action of karst dissolution processes within the carbonate bedrock. Tectonic zones characterized by increased rock fracturing provided favourable pathways for groundwater circulation. Pleistocene and Holocene sea-level fluctuations played a major role in the formation and evolution of present-day speleological features, many of which developed under subaerial conditions before being partially or completely inundated by the sea. The cliffs of the southwestern coast and the marine Lake Mir constitute particularly significant components of the island's geomorphological diversity.

To date, 52 speleological sites have been documented on Dugi Otok, although their actual number is undoubtedly higher. Most caves and pits are relatively small, with an average length of 36 ± 32 m and an average depth of 14 ± 13 m. The largest known is Veli Badanj, a cave with a pit entrance, having a total length of 169 m and a depth of 63 m. The second-longest cave on the island is Golubinka Cave (near Brbišćica), measuring 140 m in length and partially flooded by seawater. Of all recorded caves and pits, twelve are speleological sites that are either partially or completely inundated by the sea. In addition to the aforementioned Golubinka Cave, notable examples include Y Cave, with a length of 85 m, and Moruzgvača Cave in Južni Vavošćak Cove, with a length of 75 m. In terms of depth, the second-deepest pit is Jamina, a completely vertical shaft currently reaching a depth of 54 m. After a 30 m vertical descent, the explorer enters a water-filled section that is likewise entirely vertical. Hydrologically, Jamina is an anchialine pit: freshwater occurs at the surface and gradually transitions into brackish and ultimately marine water. At present, four anchialine sites are known on Dugi Otok: Bunar Pit near Sakarun, Jama s vodom near the village of Luka, Jamina, and Stržna.

Archaeological investigations confirm that the caves of Dugi Otok served as important locations of human activity throughout various prehistoric and historic periods. The most significant site is Vlakno Cave, one of the key Paleolithic and Mesolithic sites of the eastern Adriatic. Its stratigraphic sequence, nearly five metres thick, preserves a continuous record of human activity spanning approximately the last 20,000 years. Finds of stone and bone artefacts, faunal remains, ornamental objects, and human skeletal remains provide valuable insights into the lifeways of hunter-gatherer communities during the final stages of the last Ice Age and the Early Holocene. Particularly noteworthy are the remains of the Mesolithic individual known as "Šime", the oldest bone harpoons discovered in the wider Adriatic region, and the anthropomorphic bone pendant "Lili", a unique example of symbolic art in Croatia.

The biological significance of the speleologicalsites of Dugi Otok is reflected in its marine and anchialine caves, as well as in its terrestrial subterranean habitats. Marine caves represent distinctive ecosystems characterized by a gradual reduction in light availability, limited food resources, and relatively stable environmental conditions. These habitats support characteristic biological communities composed of sponges, corals, bryozoans, polychaetes, and other specialized groups adapted to conditions of reduced productivity. Anchialine pits are inhabited by stygobiont amphipods of the genus *Niphargus* Schiødte, 1847, as well as by the subterranean shrimp *Troglocaris anophthalmus periadriatica* (Jugovic, Jalžić, Prevorčnik & Sket, 2012). Investigations of the terrestrial subterranean fauna further confirm the island's biological value. Numerous groups of invertebrates have been recorded within the island's caves and pits, including

troglobiont and troglophilic species. Several findings also indicate the possible presence of taxa new to science among pseudoscorpions (Pseudoscorpiones), isopods (Isopoda), myriapods (Myriapoda), and springtails (Collembola).

Bats also represent an important component of the island's fauna. To date, as many as 17 bat species have been confirmed on Dugi Otok, representing half of all bat species recorded in Croatia. Such diversity underscores the importance of the island's caves as roosting, hibernation, and breeding sites for numerous protected bat species.

The synthesis of geological, geographical, archaeological, and biological evidence demonstrates that the speleological features of Dugi Otok constitute both natural and cultural "archives", preserving records of geological history, climatic change, karst evolution, and human activity.

**Key words:** Dugi otok; karst; speleogenesis; caves and pits; speleoarchaeology; marine caves; troglobionts; stygobionts; bats