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Geological heritage in the Iron Gates Park: structural geology, petrology and mineralogical aspects

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The Iron Gates area, located in south-western Romania, is a distinct presence on the protected area's map. The area includes the most spectacular gorges along the Danube river, hosts the best geological section on the Southern Carpathians, has a unique karst developed on limestones of Danubian cover, an extraordinary biological diversity (more than 1,600 taxa of flora, and 5,200 taxa of fauna), rare plant species and endemic fauna, thermophilic fauna and flora, as well as a rich ethnographic, cultural and historical heritage. Due to all these features, the Iron Gates Park includes an interesting mix of natural (geo and bio) diversity.

The geology of the Iron Gates Natural Park is extremely complex, because it overlaps the orogenic unit of the Carpathian Mountains. Structurally, two major units can be distinguished: the Danubian Autochthon, and the Getic Nappe, both of them having distinct structural and geological characters. The two units are formed by crystalline Mesozoic rocks, with a cover of sedimentary rocks, and intruded by igneous rocks of different ages. In addition, a third distinct structural unit, named Severin Nappe, is formed mostly of flysch formations.

There is a great variety of rocks and lithological complexes: from eclogites and granulites of Getic units, to the gabbro, serpentinites and granites of Danubian units, from micaschists, gneisses, amphibolites, quartzites, crystalline limestones and other metamorphic rocks in the almandine-amphibolite facies, to various types of retromorphites and milonites, formations of tectonic and ophiolitic melange, sedimentary rocks of Severin and Coşuştea nappes (limestones, sandstones and conglomerates, clays and silt). All these formations are locally covered by the recent sediments of the Danube: sand, gravel, silt and clay.

The acid igneous rocks (granite and granodiorite of Ogradena), the ultrabasic rocks (Iuţi and Plavişeviţa gabbro, and Tişoviţa serpentinites) and the reef limestones are a great influence on the landscape. The limestones are Jurassic and Cretaceous in age and are part of the cover of both Getic and Danubian Nappes. They form all types of karst relief. The endokarst is well represented by the caves and potholes, and the exokarst is represented by gorges, dolinas, lapis, uvalas.

The biggest cave in the area is Gura Ponicevei, dug in the limestones which form the Ciucaru Mare Mountain. Another area with karst features is located in the Locvei Mountains sedimentary deposits, formed by carbonate rocks of Mesozoic age. The sedimentary deposits host two other caves: Padina Matei and Gura cu Musca.

All the caves mentioned above contain deposits of fossil bat guano that led to the formation of a large variety of minerals species dominated by phosphates. Using a combination of modern methods, as X-ray powder diffraction, Fourier-transform infrared absorption and electron microscopy, several rare

minerals species were identified, some of them with the only occurrence known so far in Romania, such as hydroxylapatite, taranakite, ardealite, brushite, monetite, francoanellite and leucophosphite. The main ore deposit in the area is the W-Mo andraditic skarn located in the upper basin of Mraconia Valley, developed at the contact of granodiorite bodies of Mesozoic age with marbles of the Nemțu Series of the Danubian Unit.

